Evaluating Durability: Benchmark Insights into Image and Text Watermarking

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Reviewed on OpenReview: https://openreview.net/forum?id=IaUzVUf0CL

Editor: Hongyang Zhang

Abstract

As large models become increasingly prevalent, watermarking has emerged as a crucial technology for copyright protection, authenticity verification, and content tracking. The rise of multimodal applications further amplifies the importance of effective watermarking techniques. While watermark robustness is critical for real-world deployment, the current understanding of watermark robustness against various forms of corruption remains limited. Our study evaluates watermark robustness in both image and text domains, testing against an extensive set of 100 image perturbations and 63 text perturbations. The results reveal significant vulnerabilities in contemporary watermarking approaches - detection accuracy deteriorates by more than 50% under common perturbations, highlighting a critical gap between current capabilities and practical requirements. These findings emphasize the urgent need for more robust watermarking methods that can withstand real-world disturbances. Our project website can be found at https://mmwatermark-robustness.github.io/.

Keywords: image and text watermarking, robustness, image corruptions and text perturbations, multimodal

1 Introduction

Watermarks represent a sophisticated method of embedding information within digital content across various modes, such as audio, video, and images. These watermarks are designed to be imperceptible, or nearly so, to the human senses, yet detectable by specialized software or algorithms. The primary purpose of a watermark is to assert copyright or verify the authenticity of the content. Unlike traditional watermarks, which are limited to a single type of media, watermarks can be integrated across different formats, enhancing security and

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flexibility. The robustness of these watermarks against various forms of perturbations and their ability to remain intact even when the content is transformed or compressed is a key aspect of their design, making them essential in generated content identification, copyright protection, and digital rights management.

The robustness of watermarks under various perturbations is a critical aspect of their effectiveness and reliability. In the digital realm, image content often undergoes a variety of transformations, such as compression, scaling, cropping, or format conversion, while textual content often undergoes synonym replacement, paraphrasing, or typing differences, which can potentially alter or obliterate embedded watermarks. The robustness of a watermark to withstand these perturbations is vital to ensure that the embedded data remains intact and retrievable. This is particularly important for copyright protection, piracy detection, and the verification of the authenticity of digital media. A robust watermark ensures that ownership rights are preserved and content integrity is maintained, even when the media is shared across different platforms and undergoes multiple alterations. Furthermore, in sensitive applications such as legal documentation or secure communications, the persistence of a watermark through various distortions is crucial for maintaining the trust and reliability of the information contained within the media. Therefore, understanding the watermark's robustness to perturbations is a key focus.

To our best knowledge, there is currently no comprehensive study of how the perturbations can affect the performance of image and text watermarks. Hence, in this work:

- We evaluate watermark robustness under image and text perturbations by analyzing 4 image watermarking methods and 4 text watermarking methods. Our study tested the performance of 8 image-to-text models and 8 text-to-image models against 100 image perturbations and 63 text perturbation methods.
- We find that watermarks are sensitive to distribution shifts caused by image and text perturbations. Specifically, for image perturbations, Zoom Blur consistently shows the highest impact, while Glass Blur is the least harmful one. For text perturbations, Casual consistently shows the highest impact, while OCR is the least harmful. Under image perturbations, SSL-WM seems more stable; while under text perturbations, KGW-WM seems more stable.
- We have publicly released our codebase at https://mmwatermark-robustness.github. io/ with CC BY-NC-SA License.

2 Related Work

Text Watermarking has become increasingly relevant due to the usage of language models (LMs) for text generation (Liu et al., 2024). Text watermarking frameworks should integrate seamlessly into a model with minimal impact on the generated text, without altering the model's parameters (Kirchenbauer et al., 2023b; Aaronson, 2023; Christ et al., 2023). Additionally, text watermarks must be robust against distribution shifts, leading to the proposal of a watermarking algorithm that assigns a sequence of arbitrary numbers generated by a random watermark key to a sample from the LM (Kuditipudi et al., 2023). However, relying solely on empirical methods to assess the effectiveness of proposed watermarking algorithms is insufficient. In response, a theoretical framework to quantify the robustness

of text watermarks was introduced. From this theoretical analysis, an enhanced framework that utilizes a fixed grouping strategy was proposed (Zhao et al., 2023a). However, these works lack comprehensive evaluations of their watermarking systems under a variety of perturbations.

Image Watermarking studies protecting intellectual image property (Cox et al., 2007). Recently, encoder/decoder models have been introduced (Ahmadi et al., 2020; Lee et al., 2020; Luo et al., 2020; Zhang et al., 2020a; Zhu et al., 2018; Fernandez et al., 2022a; Kishore et al., 2022; Vukotić et al., 2018), which have shown promising results in terms of robustness against a broad array of transformations. In the realm of generative models, there have been attempts to watermark the training datasets used to train these models (Yu et al., 2021), an approach that is markedly inefficient as embedding each new message necessitates a separate training pipeline. A more contemporary strategy involves integrating the watermarking process directly with the generative process (Fei et al., 2022; Lin et al., 2022; Nie et al., 2023; Qiao et al., 2023; Wu et al., 2020; Yu et al., 2022; Zhang et al., 2020b), aligning it more closely with the broader literature on model watermarking (Uchida et al., 2017).

Robustness of Image or Text Watermarks An et al. (2024) examined the vulnerabilities in various image watermarking techniques. Zhao et al. (2023b) and Saberi et al. (2023) found that methods like noising and denoising through diffusion models can effectively remove some watermarks. Jiang et al. (2023) studied the robustness of AI-generated content detection that relies on watermarking. Mofayezi and Medghalchi (2023) explored the impact of text-guided corruptions on image classifiers. Kirchenbauer et al. (2023c) optimized the watermark generation and detection pipeline for greater reliability in real-world scenarios. Our study aims to challenge both text and image watermarking systems using perturbations to identify potential vulnerabilities and robustness.

Robustness of Multimodal Models For the robustness evaluation of multimodal imagetext models under distribution shift, previous works (Goh et al., 2021; Daras and Dimakis, 2022; Galindo and Faria, 2021; Fort, 2021; Goh et al., 2021; Noever and Noever, 2021) have tested some pre-trained models, such as CLIP (Radford et al., 2021), by attacking them with text patches and adversarial pixel perturbations. Notably, Daras and Dimakis (2022) discovered that DALLE-2 (Ramesh et al., 2022) possesses a hidden vocabulary that enables image generation from absurd prompts, questioning the robustness of its output. Fang et al. (2022) attributed robustness gains primarily to diverse training distributions. Cho et al. (2022) explored the robustness of text-to-image generative models concerning visual reasoning capabilities and social biases. For benchmarking robustness, (Li et al., 2021) compiled an Adversarial VQA dataset to assess the robustness of VQA models. Schiappa et al. (2022) examined the robustness of video-text models under perturbations, focusing solely on a video-text retrieval task. Furthermore, Qiu et al. (2023d) investigated the robustness of image-text models to perturbations in both modalities across five downstream tasks, while Chen et al. (2023b) evaluated the robustness of adaptation methods across vision-language datasets under multimodal corruptions. More related work can be found in Appendix C.



Figure 1: The overall pipeline of our watermarking robustness study. Given a input image/text generated by generative models, the watermarking system adds image/text watermarks to the generated content. Then we conduct watermark detection to evaluate their robustness under image corruptions or text perturbations.

3 Preliminary: Invisible Watermark Detection

Before diving into methods for measuring the robustness of watermarks, it is essential to first understand the fundamentals of invisible watermarks and the techniques employed to detect them.

Definition 1 (Invisible watermark) Let $x \in \mathcal{X}$ represent the original content, and let $x_w = \mathsf{Watermark}(x, \mathsf{aux})$ denote the watermarked content, where the watermarking scheme is a function of x and any auxiliary information aux , such as a secret key (Zhao et al., 2023b). A watermark is defined as Δ -invisible on a clean image x with respect to a "distance" function $\mathsf{dist} : \mathcal{X} \times \mathcal{X} \to \mathbb{R}_+$, if $\mathsf{dist}(x, x_w) \leq \Delta$.

Definition 2 (Watermark detection) A watermark detection algorithm $\text{Detect} : \mathcal{X} \times aux \to \{0,1\}$ is designed to determine whether a content $\tilde{x} \in \mathcal{X}$ is watermarked, using auxiliary information such as a secret key (aux) (Zhao et al., 2023b). The algorithm Detect is subject to two types of errors: false positives, where unwatermarked content is incorrectly classified as watermarked, and false negatives, where watermarked content is incorrectly classified as unwatermarked. We define the content \tilde{x} as being drawn from either the null distribution P_0 or the watermarked distribution P_1 . The Type I error, or false positive rate, is denoted as $\epsilon_1 := \Pr_{x \sim P_0}[\text{Detect}(x) = 1]$, and the Type II error, or false negative rate, is denoted as $\epsilon_2 := \Pr_{x \sim P_1}[\text{Detect}(x) = 0]$.

A watermarking scheme is typically engineered so that the distribution of watermarked content, P_1 , is distinct from that of unwatermarked content, P_0 . This distinction allows the corresponding detection algorithm, which is carefully designed, to almost perfectly differentiate between the two, aiming to ensure that both Type I error (ϵ_1) and Type II error (ϵ_2) are nearly zero. An attack on a watermarking scheme typically involves postprocessing a possibly watermarked image in a way that alters both P_0 and P_1 , with the goal of simultaneously increasing both the Type I and Type II errors, thereby evading detection.

4 Perturbation Methods

To evaluate the robustness of watermarks under image and text perturbations, we build a comprehensive evaluation benchmark via perturbing the watermarked, generated text or image.

Image Perturbation. To simulate real-world corruptions in image data, we employ perturbation strategies adopted from Hendrycks and Dietterich (2019); Qiu et al. (2023d); Zhang et al. (2024). These perturbations are categorized into five groups: **noise**, **blur**, **weather**, **digital**, and **geometric**. Specifically, we utilize 20 different image perturbation techniques across these five categories:

- (1) Noise Gaussian noise, shot noise, impulse noise, speckle noise;
- (2) Blur defocus blur, frosted glass blur, motion blur, zoom blur;
- (3) Weather snow, frost, fog, brightness;
- (4) Digital contrast, elastic transformation, pixelation, JPEG compression;
- (5) Geometric scaling, rotation, shearing, piecewise affine transformation.

Acknowledging that real-world corruptions vary in intensity, we introduce variations for each type of corruption as suggested in Hendrycks and Dietterich (2019); Geirhos et al. (2019); Michaelis et al. (2019). In our evaluation, each category features 5 severity levels, culminating in a total of 100 perturbation methods. These strategies, commonly regarded as synthetic distribution shifts, provide a well-defined and manageable starting point. A detailed description of each perturbation method is provided in Table 3 in Appendix A.

Text Perturbation. To simulate distribution shifts in language data, we have designed 19 text perturbation techniques organized into three categories: **character-level**, **word-level**, and **sentence-level** (Qiu et al., 2023d).

- For character-level perturbations, we adopt six strategies from Ma (2019); Qiu et al. (2023d) that simulate common typing errors: keyboard typos, OCR errors, character insertion (CI), character replacement (CR), character swap (CS), and character deletion (CD).
- At the word-level, five strategies from EDA and AEDA (Wei and Zou, 2019; Karimi et al., 2021) are used: synonym replacement (SR), word insertion (WR), word swap (WS), word deletion (WD), and punctuation insertion (IP). These techniques reflect various editorial changes that mimic different writing habits.
- For sentence-level perturbations, eight strategies are included to address more complex linguistic variations: Formal, Casual, Passive, and Active transformations from Li et al. (2018); Etinger and Black (2019); Schmidt (2020); Schiappa et al. (2022) alter the style of the text; Back Translation from Ma (2019); SCPN from Iyyer et al. (2018); BART from Lewis et al. (2019); and DIPPER from (Krishna et al., 2023), focus on semantic shifts due to translation errors and paraphrasing.

Similar to image perturbations, each text perturbation strategy is assigned severity levels. Character-level and word-level perturbations include five severity levels, mirroring the approach used for image perturbations, whereas sentence-level perturbations are applied at a single severity level. In total, this results in 63 text perturbation methods. These techniques encompass a broad range of real-world text distribution shifts—such as typos, word swaps, and style changes Detailed descriptions of each perturbation method are provided in Table 4 in Appendix A.

5 Watermarks

In this study, we utilize 4 image watermarking methods and 4 text watermarking methods to evaluate their robustness. The subsequent sections provide a brief introduction to each of these methods.

Image Watermarks (Image-WM)

- DwtDctSvd-WM Cox et al. (2007) integrates Discrete Wavelet Transform (DWT), Discrete Cosine Transform (DCT), and Singular Value Decomposition (SVD) to embed watermarks in color images. It starts by converting the RGB cover image to YUV, applies DWT to the Y channel, segments it into blocks via DCT, and performs SVD on each block before embedding the watermark. DwtDctSvd is the default method used by Stable Diffusion (Rombach et al., 2022).
- **RivaGAN-WM** Zhang et al. (2019) introduces a robust image watermarking technique utilizing Generative Adversarial Networks (GANs) (Goodfellow et al., 2014). It incorporates two adversarial networks: one to evaluate the quality of watermarked images and another to facilitate watermark removal. The system includes an encoder for watermark embedding and a decoder for its extraction, enhancing both performance and robustness. RivaGAN is also employed as a watermarking method by Stable Diffusion (Rombach et al., 2022).
- SSL-WM Fernandez et al. (2022b) leverages the latent spaces of pre-trained neural networks for watermark encoding, using networks trained via self-supervised learning (SSL) to capture effective watermarking features. This method embeds watermarks by applying backpropagation and data augmentation, and it is capable of detecting and decoding these watermarks from the watermarked image or its extracted features.
- StegaStamp-WM Tancik et al. (2019) introduces a learned steganographic algorithm designed for the robust encoding and decoding of arbitrary hyperlink bit strings into photos, achieving near-perceptual invisibility. The system utilizes a deep neural network to learn an encoding/decoding algorithm that remains robust against image perturbations typical of real-world printing and photography scenarios.

Text Watermarks (Text-WM)

• KGW-WM Kirchenbauer et al. (2023a) randomly splits the vocabulary into red tokens and green tokens based on the hash value of the previous token. During the next token generation, a constant δ is added to the logits for tokens that belong to the green list. This effectively increases the probability of generating green list tokens, thereby increasing the overall number of green tokens in the entire output sequence. During detection, if the suspect text contains significantly more green tokens, it is likely from the watermarked LLM.

- **KTH-WM** obtains a watermark key from the watermark sequence and generates the watermarked text by mapping the watermark key (random numbers) to the sample from the language model. Kuditipudi et al. (2023) provided two instantiations of this protocol, namely inverse transform sampling and exponential minimum sampling. Both schemes ensure distortion-free the expected distribution of a single response from the watermarked model is identical to the distribution of a single response from the original model. We utilize exponential minimum sampling for our experiments due to its stronger reported results (Kuditipudi et al., 2023).
- Blackbox-WM Yang et al. (2023): begins by obtaining the original text from a blackbox language model. The process involves selectively replacing words with context-based synonyms to embed a watermark. It employs a unique binary encoding function that assigns a random binary value (either bit-0 or bit-1) to each word. This function ensures a near balance between bit-0 and bit-1 representations in non-watermarked texts. For every word selected for replacement, the method generates synonym candidates, each evaluated for the binary encoding they carry.
- Unigram-WM Zhao et al. (2023a) involves a watermarking process similar to KGW-WM, splitting the vocabulary into the green list and the red list and then increasing the probability of generating green tokens. The key difference is that Unigram-WM keeps the red-green partitions fixed. This allows for better robustness guarantees since each edit (insertion/deletion/replacement) only changes one token from green to red or from red to green.

6 Experiments

In this study, we aim to address several key questions: (1) Which watermarking methods demonstrate the highest stability and robustness? (2) Which perturbation techniques are most effective in attacking the embedded watermarks? (3) Among image and text generation models, which are the most robust?

6.1 Experimental Settings

Benchmark Models We investigate the following benchmark models, all of which are publicly available. Each model has been chosen for its relevance and potential to provide insights into the watermark robustness against perturbations. We used 16 NVIDIA A6000 GPUs for our experiments.

• Text-to-image models: NExT-GPT (Wu et al., 2023), Stable Diffusion (Rombach et al., 2021), DALLE3 (Betker et al.), SDXL-Lightning (Lin et al., 2024), PIXART (Chen et al., 2023a), Kandinsky 2.2 (Razzhigaev et al., 2023), Latent Consistency Models (LCMs) (Luo et al., 2023), RPG (Yang et al., 2024).

• Image-to-text models: NExT-GPT (Wu et al., 2023), Fuyu-8B (Bavishi et al., 2023), InternLM-XComposer (Zhang et al., 2023), InstructBLIP (Dai et al., 2023), LLaVA 1.6 (Liu et al., 2023), MiniGPT-4 (Zhu et al., 2023), mPLUG-Owl2 (Ye et al., 2023), Qwen-VL (Bai et al., 2023).

Evaluation Metrics For evaluating image quality, our study employs several metrics: Peak Signal-to-Noise Ratio (PSNR), Structural Similarity Index Measure (SSIM) (Wang et al., 2004), Bit Accuracy (Bit Acc), and Detection Accuracy (Dect Acc) (Zhao et al., 2023a). In assessing text quality, we utilize BLEURT (Sellam et al., 2020; Pu et al., 2021), ROUGE (Lin, 2004), Bit Accuracy (Bit Acc), and Detection Accuracy (Dect Acc) (Zhao et al., 2023a). These metrics allow us to assess the fidelity and integrity of watermarked images comprehensively.

6.2 Results And Discussions

| Watermark | Model | PSNR | SSIM | Bit Acc | Dect Acc | Dect Acc (Ori) | Dect Acc Drop (%) |
|---------------|------------------|-------|------|---------|----------|----------------|-------------------|
| | NextGPT | 17.03 | 0.50 | 4.29 | 12.12 | 95.56 | -87.32% |
| | Stable Diffusion | 17.69 | 0.51 | 4.43 | 15.79 | 100.00 | -84.21% |
| | DALLE3 | 16.85 | 0.51 | 3.09 | 15.81 | 95.32 | -83.41% |
| D-+D+CI WM | SDXL-Lightning | 18.55 | 0.56 | 5.96 | 21.27 | 100.00 | -78.73% |
| DCtDwtSvd-wM | PIXART | 17.66 | 0.54 | 4.28 | 18.83 | 95.57 | -80.30% |
| | Kandinsky 2.2 | 15.99 | 0.50 | 4.01 | 7.51 | 91.42 | -91.79% |
| | LCMs | 19.48 | 0.58 | 6.32 | 18.81 | 100.00 | -81.19% |
| | RPG-Image | 17.74 | 0.50 | 3.79 | 29.19 | 92.20 | -68.34% |
| | NextGPT | 17.60 | 0.54 | 3.87 | 23.40 | 98.55 | -76.26% |
| | Stable Diffusion | 17.19 | 0.51 | 3.10 | 31.39 | 100.00 | -68.61% |
| | DALLE3 | 16.93 | 0.52 | 3.59 | 25.40 | 97.59 | -73.97% |
| Dim CAN WM | SDXL-Lightning | 18.40 | 0.55 | 3.56 | 36.83 | 100.00 | -63.17% |
| RIVAGAIN-WW | PIXART | 17.82 | 0.55 | 7.01 | 33.10 | 96.63 | -65.75% |
| | Kandinsky 2.2 | 16.05 | 0.51 | 5.53 | 17.17 | 90.33 | -80.99% |
| | LCMs | 19.28 | 0.57 | 3.83 | 35.84 | 99.00 | -63.80% |
| | RPG-Image | 17.30 | 0.50 | 4.29 | 29.55 | 91.63 | -67.75% |
| | NextGPT | 7.71 | 0.30 | 7.05 | 26.18 | 96.67 | -72.92% |
| | Stable Diffusion | 8.08 | 0.31 | 2.51 | 24.72 | 95.42 | -74.09% |
| | DALLE3 | 9.91 | 0.27 | 3.62 | 25.67 | 88.54 | -71.01% |
| SSI WM | SDXL-Lightning | 10.65 | 0.32 | 3.62 | 28.14 | 86.48 | -67.46% |
| 221- M M | PIXART | 8.54 | 0.30 | 3.09 | 24.86 | 92.41 | -73.10% |
| | Kandinsky 2.2 | 8.46 | 0.24 | 3.90 | 20.91 | 90.85 | -76.98% |
| | LCMs | 8.75 | 0.34 | 3.06 | 12.01 | 94.87 | -87.34% |
| | RPG-Image | 10.54 | 0.30 | 3.40 | 23.70 | 90.18 | -73.72% |
| | NextGPT | 7.33 | 0.24 | 3.49 | 14.12 | 85.73 | -83.53% |
| | Stable Diffusion | 7.38 | 0.29 | 4.04 | 19.26 | 82.29 | -76.59% |
| | DALLE3 | 6.83 | 0.29 | 3.84 | 15.98 | 88.41 | -81.93% |
| StoraStamp WM | SDXL-Lightning | 6.6 | 0.22 | 4.76 | 9.25 | 84.72 | -89.08% |
| Stegastamp-WM | PIXART | 8.15 | 0.21 | 3.31 | 14.53 | 85.69 | -83.04% |
| | Kandinsky 2.2 | 6.91 | 0.22 | 3.68 | 9.64 | 86.35 | -88.84% |
| | LCMs | 6.94 | 0.21 | 4.15 | 25.71 | 88.67 | -85.78% |
| | RPG-Image | 5.81 | 0.26 | 3.46 | 8.74 | 80.26 | -89.11% |

Table 1: Comparison of different image watermarking methods.

Watermarking Strategy Comparison. In Tables 1 and 2, we present the outcomes of various image and text watermarking methods, respectively. The results indicate variations in the performance across different models. Generally, under image perturbations, RivaGAN-

| Watermark | Model | BLEURT | ROUGE | Bit Acc | Dect Acc | Dect Acc (ori) | Dect Acc Drop (%) |
|----------------|--------------------|--------|-------|---------|----------|----------------|-------------------|
| | NextGPT | 0.32 | 39.54 | 59.41 | 19.60 | 99.76 | -80.35% |
| | Fuyu | 0.30 | 40.39 | 67.87 | 36.27 | 99.85 | -63.68% |
| | InternLM-XComposer | 0.31 | 35.07 | 64.68 | 14.97 | 100.00 | -85.03% |
| KCW WM | InstructBLIP | 0.30 | 3.07 | 51.26 | 23.60 | 100.00 | -76.40% |
| IXG W - W M | LLaVA 1.5 | 0.35 | 42.34 | 68.11 | 71.38 | 98.04 | -37.93% |
| | MiniGPT-4 | 0.37 | 43.21 | 57.84 | 18.95 | 99.48 | -80.95% |
| | mPLUG-Owl2 | 0.30 | 43.17 | 59.78 | 37.64 | 99.95 | -62.34% |
| | Qwen-VL | 0.29 | 29.16 | 63.09 | 23.10 | 99.93 | -76.88% |
| | NextGPT | 0.31 | 41.43 | 51.78 | 21.06 | 98.37 | -78.59% |
| | Fuyu | 0.29 | 41.50 | 66.34 | 33.50 | 99.06 | -66.18% |
| | InternLM-XComposer | 0.23 | 38.13 | 57.86 | 33.00 | 100.00 | -67.00% |
| KTH WM | InstructBLIP | 0.36 | 14.54 | 56.34 | 34.00 | 99.85 | -65.95% |
| K I H- W M | LLaVA 1.5 | 0.31 | 31.74 | 64.90 | 35.75 | 98.68 | -63.77% |
| | MiniGPT-4 | 0.32 | 44.14 | 50.63 | 21.50 | 100.00 | -78.50% |
| | mPLUG-Owl2 | 0.27 | 36.63 | 62.55 | 33.41 | 99.64 | -66.47% |
| | Qwen-VL | 0.25 | 35.52 | 54.23 | 32.59 | 99.87 | -67.37% |
| | NextGPT | 0.33 | 43.09 | 62.41 | 23.80 | 100.00 | -76.20% |
| | Fuyu | 0.30 | 40.01 | 66.12 | 27.93 | 100.00 | -72.07% |
| | InternLM-XComposer | 0.28 | 33.44 | 52.75 | 25.40 | 99.57 | -74.49% |
| Dia shihara WM | InstructBLIP | 0.37 | 35.51 | 53.24 | 22.70 | 99.86 | -77.27% |
| DIACKDOX- W M | LLaVA 1.5 | 0.31 | 42.22 | 60.60 | 22.72 | 99.62 | -77.19% |
| | MiniGPT-4 | 0.37 | 44.72 | 64.53 | 24.01 | 100.00 | -75.99% |
| | mPLUG-Owl2 | 0.30 | 34.81 | 62.54 | 31.58 | 99.86 | -68.38% |
| | Qwen-VL | 0.28 | 33.19 | 51.46 | 24.68 | 99.68 | -75.24% |
| | NextGPT | 0.26 | 26.39 | 48.42 | 2.46 | 100.00 | -97.54% |
| | Fuyu | 0.24 | 28.14 | 48.98 | 0.77 | 100.00 | -99.23% |
| | InternLM-XComposer | 0.19 | 25.37 | 47.47 | 0.32 | 100.00 | -99.68% |
| Unigroup WM | InstructBLIP | 0.25 | 17.18 | 47.88 | 17.74 | 99.76 | -82.22% |
| Oligram-www | LLaVA 1.5 | 0.37 | 40.01 | 58.16 | 4.68 | 99.69 | -95.31% |
| | MiniGPT-4 | 0.32 | 32.67 | 45.33 | 2.48 | 98.62 | -97.49% |
| | mPLUG-Owl2 | 0.23 | 28.08 | 47.58 | 1.27 | 97.42 | -98.70% |
| | Qwen-VL | 0.21 | 24.99 | 42.57 | 0.28 | 99.03 | -99.72% |

Table 2: Comparison of different text watermarking methods.





LLaVA 1.5

Figure 2: Performance comparison of different models under image perturbations.



WM appears to be more robust, whereas under text perturbations, KGW-WM demonstrates greater stability.

Perturbation Method Comparison. In Figure 4, we showed the comparisons of different [Top] image corruption and [Bottom] text perturbation methods. All the results have been averaged on different severity levels.

For image corruptions, we show the results by Stable Diffusion in Figure 4 [Top]. Generally, noise and blur-based perturbations tend to have a more severe impact on all metrics, as they directly affect the clarity and sharpness of images. Environmental effects and quality degradation also impact the metrics but might be less severe compared to direct noise introductions or blurs. Gaussian, Shot, Impulse, and Speckle noise appear to significantly decrease PSNR and SSIM, indicating a substantial degradation in image quality. JPEG compression, while degrading quality, may not affect structural similarity as much, depending on the compression level. Distortions such as Rotate, Shear, and Piecewise Affine could particularly lower Detection Accuracy as they alter the geometry and spatial relationships within the image, potentially complicating detection tasks. Based on the results in Figure 4 [Top], we find that Zoom Blur is more effective, and Glass Blur is less effective.

Similarly, for text perturbations, we show the results by LLaVA 1.6 in Figure 4 [Bottom]. Stylistic transformations (Formal, Casual, Active, Passive) show the highest performance across all metrics, indicating minimal impact on text quality and excellent preservation and detection capabilities. Synonym Replacement (SR), Bart, SPCN, and Dipper also perform well, with high BLEURT and ROUGE scores and good preservation and detection accuracy. Character Insert (CI), Character Delete (CD), and Word Swap (WS) show the lowest scores across all metrics, indicating significant degradation in text quality and moderate preservation and detection capabilities. Based on the results in Figure 4 [Bottom], we find that character-level perturbations are more effective, and sentence-level perturbations are less effective.



Figure 4: Comparisons of different [Top] image corruption and [Bottom] text perturbation methods using Stable Diffusion and LLaVA, respectively. All the results were averaged at different severity levels.



Figure 5: Model comparisons under [Top] image corrections and [Bottom] text perturbations. All the results have been averaged on the performance under all image/text perturbations.

Model Comparison. In Figure 5, we showed the model comparisons under [Top] image and [Bottom] text perturbations. The results are averaged across all image and text perturbations. Our findings indicate that under image perturbations, SDXL-Lightning demonstrates superior robustness. Conversely, LLaVA exhibits greater robustness under text perturbations compared to the other models.

6.3 Ablation Study

Image Perturbation Severity Influence. Each image perturbation method is associated with multiple severity levels, so we would like to explore the relationship between robustness performance and perturbation severity levels. In Figure 6, we showed two examples, Gaussian Noise and Glass Blur, across varying levels of severity (from 1 to 5). PSNR and SSIM are particularly sensitive to distortions, with PSNR showing a more pronounced drop in the presence of Gaussian Noise than Glass Blur. This suggests that noise introduces more disruptive interference compared to blur. SSIM, while also decreasing with severity, indicates that structural elements of images are somewhat more preserved under Glass Blur compared to Gaussian Noise, highlighting differential impacts depending on the type of distortion. Bit Accuracy exhibits a notable decline under both conditions but is more affected by Glass Blur, especially beyond moderate levels of severity. This suggests that blur more significantly affects the bit-level representation of the image. Detection accuracy remains relatively stable under Glass Blur and shows resilience, suggesting that detection algorithms might still







Figure 7: Performance changes with different severity levels under text perturbations.

effectively identify key features in blurred images. However, it declines under Gaussian Noise, indicating challenges in feature detection amidst this type of noise.

Text Perturbation Severity Influence. Similar to the image perturbations above, in Figure 7, we showed two examples, OCR and Word Insertion, across varying levels of severity (from 1 to 5). OCR errors cause a more drastic decrease in BLEURT scores than word insertions, suggesting that OCR errors might lead to more severe semantic disruptions than simple word additions. Detection accuracy demonstrates notable resilience in both scenarios, implying that the underlying algorithms are effective at extracting essential information despite textual distortions.

6.4 Limitations and Future Work.

- Our current evaluation study focuses on watermark robustness against image corruptions and text perturbations. However, it does not encompass other watermark types, such as audio, nor does it include all potential perturbations. For instance, while there are studies on the robustness against adversarial image perturbations, such attacks typically involve a classification task conditioned on a target label, making them inapplicable to our evaluation setting. Therefore, they were not included in this study.
- Our study investigated 8 image-to-text models and 8 text-to-image models. However, we acknowledge that this is a preliminary study. Different watermarking strategies may show

varying performance when the embedded watermarks change. Consequently, the findings related to the models are speculative and not conclusive.

• We hope that future research will expand the evaluation benchmark to include a broader range of watermark types and perturbations. To the best of our knowledge, our study does not pose any potential negative societal impacts.

Takeaway: Our main findings are as follows.

(1) Watermarks are sensitive to image corruptions and text perturbations.

(2) Among image perturbations, Zoom Blur consistently shows the highest impact, while Glass Blur is the least harmful.

(3) Among text perturbations, character-level perturbations are more effective, and sentence-level perturbations are less effective.

(4) Under image perturbations, RivaGAN-WM appears more stable, whereas under text perturbations, KGW-WM seems more stable.

(5) In terms of models, SDXL-Lightning is more robust than other baselines under image perturbations, while LLaVA demonstrates greater robustness under text perturbations.

7 Conclusion

In this study, we explore the robustness of image and text watermarks under perturbations. Our research includes testing the performance of 8 image-to-text models and 8 text-to-image models, subjected to 100 image perturbation techniques and 63 text perturbation methods. We assess the robustness of 4 image watermarking methods and 4 text watermarking methods. We aim for our benchmark to be a valuable resource for examining the robustness of image and text watermarks, and we hope our results will inspire the development and implementation of more robust watermarking strategies for practical applications.

Broader Impact Statement

Positive Impacts:

- Copyright Protection: By improving watermarking techniques, our research helps in safeguarding the intellectual property rights of creators, particularly in digital media. This can lead to more secure ways for artists, writers, and developers to claim ownership and receive proper attribution.
- Content Authenticity: As fake content proliferates, robust watermarking can be crucial in verifying the authenticity of digital media. This could be particularly significant for news agencies, educational content providers, and other stakeholders interested in preserving the integrity of information.
- Content Management: Effective watermarking aids content providers in tracking and managing the distribution of their work. This can help in enforcing licensing agreements and preventing unauthorized use, thus potentially reducing copyright violations.

Negative Impacts:

- Privacy Concerns: Robust watermarking could potentially be used for surveillance and tracking purposes. For example, watermarked images or texts could be used to trace the activity of individuals without their consent.
- Accessibility and Misuse: As watermarking techniques become more sophisticated, there might be a risk of these technologies being misused to embed malicious data or to restrict access to content via overly aggressive copyright enforcement.
- Economic Impact: There may be concerns regarding the economic implications for businesses that rely on less secure watermarking methods, which might face obsolescence or the need for costly upgrades.

We acknowledge the dual-edged nature of technological advancements in watermarking, emphasizing a commitment to ethical considerations and the responsible deployment of these technologies to maximize benefits while minimizing harm.

Ethical Discussion: In addition to the positive and negative impacts discussions, we also discuss the ethical implications of our research as follows:

- Equity and Accessibility: Our techniques could inadvertently favor large organizations by enhancing their ability to protect intellectual property, potentially marginalizing smaller entities and researchers. This could concentrate power within large tech companies, thus impacting the balance between protection and accessibility in AI development.
- Potential for Misuse: While watermarking can aid in identifying sources of malicious content and facilitate moderation, it also poses risks if exploited by bad actors to claim false ownership or bypass protections. Furthermore, robust watermarking could be misused for surveillance, raising significant privacy and ethical concerns.
- Trade-offs: Implementing these watermarking systems involves balancing protection strength, model performance, and accessibility. It is crucial to consider these trade-offs carefully to avoid stifling innovation or restricting access to beneficial AI technologies.

Acknowledgments and Disclosure of Funding

This study is supported in part by Google Research, Carnegie Mellon University Computer Science Department fellowship, and a CMU CyLab Seed Grant. We would like to thank the feedback from Sven Gowal, Yonatan Bisk, Daniel Fried, and William Wang.

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Checklist

- 1. For all authors...
 - (a) Do the main claims made in the abstract and introduction accurately reflect the paper's contributions and scope? [Yes] Abstract and Section 1
 - (b) Did you describe the limitations of your work? Yes Section 6
 - (c) Did you discuss any potential negative societal impacts of your work? [Yes] Section 6
 - (d) Have you read the ethics review guidelines and ensured that your paper conforms to them? [Yes]
- 2. If you are including theoretical results...
 - (a) Did you state the full set of assumptions of all theoretical results? [N/A]
 - (b) Did you include complete proofs of all theoretical results? [N/A]
- 3. If you ran experiments (e.g. for benchmarks)...
 - (a) Did you include the code, data, and instructions needed to reproduce the main experimental results (either in the supplemental material or as a URL)? [Yes] Abstract and Section 1
 - (b) Did you specify all the training details (e.g., data splits, hyperparameters, how they were chosen)? [Yes] In the provided link
 - (c) Did you report error bars (e.g., with respect to the random seed after running experiments multiple times)? [No] The results do not depend on random seeds
 - (d) Did you include the total amount of compute and the type of resources used (e.g., type of GPUs, internal cluster, or cloud provider)? [Yes] Section 6.1
- 4. If you are using existing assets (e.g., code, data, models) or curating/releasing new assets...
 - (a) If your work uses existing assets, did you cite the creators? [Yes] Section 6
 - (b) Did you mention the license of the assets? Yes Section 6
 - (c) Did you include any new assets either in the supplemental material or as a URL? [No]
 - (d) Did you discuss whether and how consent was obtained from people whose data you're using/curating? [N/A]
 - (e) Did you discuss whether the data you are using/curating contains personally identifiable information or offensive content? [N/A] We used existing datasets.
- 5. If you used crowdsourcing or conducted research with human subjects...
 - (a) Did you include the full text of instructions given to participants and screenshots, if applicable? [No]

- (b) Did you describe any potential participant risks, with links to Institutional Review Board (IRB) approvals, if applicable? [N/A]
- (c) Did you include the estimated hourly wage paid to participants and the total amount spent on participant compensation? [N/A]

Appendix A. More Details about Perturbation Methods

Table 3 shows a detailed introduction to each image perturbation method. Table 4 shows a detailed introduction about each text perturbation method.

Appendix B. Experimental Settings

B.1 Image Watermark Parameters

DctDwtSvd-WM and RivaGAN-WM For all of our experiments, we embed 4 characters as bytes, specifically the string "test", into the images. During decoding, we deem the watermark detection algorithm as passing if it is able to fully retrieve the original, encoded string "test".

SSL-WM A neural network is needed to extract the features from images, and a normalization layer is to evenly distribute the extracted features in the latent space. We utilize the recommended, default model and normalization layers, namely ResNet-50 trained with DINO and PCA whitening respectively. During detection, we consider the zero-bit scenario (Fernandez et al., 2022b).

StegaStamp-WM requires a pretrained encoder, decoder, and detector. The encoder is an architecture similar to U-Net (Ronneberger et al., 2015) where the image is first processed through a fully connected network to become a tensor of size $50 \times 50 \times 3$, then upsampled to get a tensor of size $400 \times 400 \times 3$. The decoder is a spatial transformer network (Jaderberg et al., 2015) that is trained to recover the encoded watermark. For the detector, the authors use an open-source semantic segmentation network, namely BiSeNet (Yu et al., 2018). We utilize all of the default parameters used in (Tancik et al., 2019).

B.2 Text Watermark Parameters

KGW-WM We utilize game and delta values of 0.25 and 2.0, respectively. We also set the seeding scheme as 'simple_1', which represents a simple bigram hash, to utilize the main settings of the experiments in the paper (Kirchenbauer et al., 2023a). During detection, we also utilize a z threshold of 0.5 and ignore repeated n-grams.

KTH-WM We set the desired length of the generated text, m, to 30 as detailed in Kuditipudi et al. (2023). The length of the watermark sequence, n, is kept at the standard value of 256. For generating the random watermark sequence, we employ a key of 42. The authors' method of evaluating their watermarking framework involves p-values, and we consider texts with p < 0.1 as effectively watermarked.

Blackbox-WM We employ the τ word value of 0.8, and a λ value of 0.83 (Yang et al., 2023). We also use the "embed" mode during watermarking. During detection, if the confidence value is over 80%, we deem the detection algorithm as successfully finding the watermark.

Unigram-WM When applying the watermark, we utilize a fraction and strength value of 0.5 and 2.0, respectively. Additionally, we determined the watermark key to be defaulted to 0. During detection, we utilize the default value of 6.0 (Zhao et al., 2023a).

| Category | Perturbation | Description | Severities |
|-----------|--------------------|---|------------|
| | Gaussian Noise | Gaussian noise can appear in low-lighting conditions. | 5 |
| Noise | Shot Noise | Shot noise, also called Poisson noise, is electronic noise caused by the discrete nature of light itself. | 5 |
| TUBE | Impulse Noise | Impulse noise is a color analogue of salt-and-pepper noise and can be caused by bit errors. | 5 |
| | Speckle Noise | Speckle noise is the noise added to a pixel that tends to be larger if the original pixel intensity is larger. | 5 |
| | Defocus Blur | Defocus blur occurs when an image is out of focus. | 5 |
| Blur | Frosted Glass Blur | Frosted Glass Blur appears with "frosted glass" win- dows or panels. | 5 |
| | Motion Blur | Motion blur appears when a camera is moving quickly. | 5 |
| | Zoom Blur | Zoom blur occurs when a camera moves toward an object rapidly. | 5 |
| | Snow | Snow is a visually obstructive form of precipitation. | 5 |
| Weather | Frost | Frost forms when lenses or windows are coated with ice crystals. | 5 |
| | Fog | Fog shrouds objects and is rendered with the diamond-square algorithm. | 5 |
| | Brightness | Brightness varies with daylight intensity. | 5 |
| | Contrast | Contrast can be high or low depending on lighting conditions and the photographed object's color. | 5 |
| Digital | Elastic | Elastic transformations stretch or contract small image regions. | 5 |
| | Pixelate | Pixelation occurs when upsampling a low-resolution image. | 5 |
| | JPEG Compression | JPEG is a lossy image compression format that in- troduces compression artifacts. | 5 |
| | Scale | Change the size of an image by enlarging or shrinking its dimensions. | 5 |
| Geometric | Rotate | Turn the image around a central point by a specified degree, altering its orientation. | 5 |
| Geometrie | Shear | Skew the image by shifting parts of it more than others, creating a distortion. | 5 |
| | Piecewise Affine | Apply affine transformations to different parts of the image independently, allowing for complex local distortions. | 5 |
| Sum | 20 | | 100 |

Table 3: Image perturbations.

| Category | Perturbation | Description | Severities |
|-----------------|--------------------------|---|------------|
| | Keyboard | Substitute character by keyboard distance with probability p . | 5 |
| Character level | OCR | $\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$ | 5 |
| Character-level | Character Insert (CI) | $\boxed{ Insert character randomly with probability p. }$ | 5 |
| | Character Replace (CR) | $\left \begin{array}{c} \hline \text{Substitute character randomly with probability} \\ p. \end{array} \right $ | 5 |
| | Character Swap (CS) | Swap character randomly with probability p . | 5 |
| | Character Delete (CD) | $\boxed{\text{Delete character randomly with probability } p.}$ | 5 |
| | Synonym Replacement (SR) | $\left \begin{array}{c} \text{Randomly choose } n \text{ words from the sentence} \\ \text{that are not stop words. Replace each of these} \\ \text{words with one of its synonyms chosen at random.} \end{array}\right.$ | 5 |
| Word-level | Word Insertion (WI) | Find a random synonym of a random word in the sentence that is not a stop word. Insert that synonym into a random position in the sentence. Do this n times. | 5 |
| | Word Swap (WS) | $\begin{tabular}{ c c c c c c c }\hline \hline Randomly choose two words in the sentence and swap their positions. Do this n times. \end{tabular}$ | 5 |
| | Word Deletion (WD) | $\boxed{ Each word in the sentence can be randomly removed with probability p.}$ | 5 |
| | Insert Punctuation (IP) | $\begin{array}{ c c c c c c }\hline \hline Random insert punctuation in the sentence \\ with probability p. \end{array}$ | 5 |
| | Formal | Transfer the text style to Formal. | 1 |
| | Casual | Transfer the text style to Casual. | 1 |
| | Passive | Transfer the text style to Passive. | 1 |
| | Active | Transfer the text style to Active. | 1 |
| | Back Translation (BT) | Translate source to German and translate it back to English via (Ng et al., 2020). | 1 |
| Sentence-level | SCPN | Produce a paraphrase of a given sentence with specified syntactic structures (Iyyer et al., 2018). | 1 |
| | BART | Use BART for text summarization as para- phrasing attack (Lewis et al., 2019). | |
| | DIPPER | DIPPER can paraphrase paragraphs, condition on surrounding context, and control lexical diversity and content reordering (Krishna et al., 2023). | 1 |
| Sum | 19 | — | 63 |

Table 4: Text perturbations.

B.3 Number of Samples

We utilized 5,000 image-caption pairs from the COCO validation split (Lin et al., 2014). For text generation, the input to the multimodal models consisted of the prompt "Describe this image:" alongside the corresponding image from the dataset. For image generation, the input was the prompt "Please generate an image describing the following caption: C", where C is the corresponding caption from the dataset. In total, we generated 5,000 images and 5,000 texts for each model.

Appendix C. More Related Work

Multimodal Watermarking is a technique that embeds watermarks into various types of media content like audio, video, and images. (Tang et al., 2023) proposed a safe and robust backdoor-based embedding watermarking method for VLPs called VLPMarker. It further proposed a collaborative copyright verification strategy based on both backdoor triggers and embedding distribution, enhancing resilience against various attacks.

Multimodal Learning The study of multimodal learning traces back to 1989, when Yuhas et al. (1989) leveraged the McGurk Effect to explore audio-visual speech recognition using neural networks (Tiippana, 2014; McGurk and MacDonald, 1976). Since then, collaboration between researchers in natural language processing (NLP) and computer vision (CV) has led to the creation of large multimodal datasets designed for tasks such as classification, translation, and detection. Advances in large language models (LLMs) have further facilitated the integration of additional modalities, most notably visual data (Wang et al., 2022; Qiu et al., 2023d; Nguyen et al., 2022; Li et al., 2022; Qiu et al., 2024a; Wang et al., 2021; Qiu et al., 2023c; Shah et al., 2022; Zhang et al., 2021; Qiu et al., 2023a; Xu et al., 2023; Qiu et al., 2024b; Wang et al., 2023; Qiu et al., 2023b; Long and Yao, 2020). By leveraging embeddings pretrained on both language and image datasets, vision-language models achieve exceptional performance across various tasks.

Appendix D. More Experimental Results

Trade-off between detection accuracy and content quality Figure 6 and Figure 7 illustrate the trade-offs between various metrics such as PSNR, SSIM, BLEURT, ROUGE, Bit Accuracy, and Detection Accuracy, with respect to severity levels of image and text perturbations, respectively. Detailed analyses (omitted from the paper due to their large volume) indicate that SSL-WM and Blackbox-WM provide the optimal balance for image and text watermarking, respectively.

Appendix E. Detailed Experimental Results

In the following tables, we provide the detailed results for each baseline model mentioned in Section 6.1.

| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
|----------------------------------|--|--|--|--|--|---|
| | | Gaussian | 18.95 | 0.40 | 1.87 | 5.68 |
| | Noise | Shot | 18.32 | 0.41 | 2.42 | 9.25 |
| | roise | Impulse | 18.18 | 0.38 | 4.79 | 1.38 |
| | | Speckle | 0.00 | 0.50 | 3.59 | 25.48 |
| | | Class | 22.93 | 0.55 | 7.40 | 28.82 |
| | Blur | Motion | 20.53 | 0.83 | 5.92 | 6.75 |
| | | Zoom | 17.31 | 0.50 | 3.63 | 0.00 |
| | | Snow | 11.13 | 0.52 | 0.29 | 6.42 |
| DctDwtSvd-WA | 1 Weather | Frost | 10.00 | 0.60 | 0.33 | 2.98 |
| | reaction | Fog | 13.22 | 0.59 | 0.70 | 0.38 |
| | | Brightness | 14.03 | 0.77 | 0.88 | 18.73 |
| | | Contrast | 14.73 | 0.53 | 0.88 | 1.48 |
| | Digital | Pixelate | 22.76 | 0.41 | 7.97 | 36.3 |
| | | JPEG | 28.09 | 0.84 | 5.93 | 0.00 |
| | | Scale | 4.88 | 0.22 | 8.94 | 0.00 |
| | Geometric | Rotate | 27.32 | 0.10 | 7.30 | 0.00 |
| | Geometric | Shear Discourse Affine | 24.54 | 0.27 | 3.31 | 2.3 |
| | | Fiecewse Alline | 10.02 | 0.23 | 4.14 | 4.20 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| | | Gaussian | 18.96 | 0.40 | 1.87 | 12.89 |
| | Noise | Shot | 18.31 | 0.41 | 2.36 | 12.08 |
| | | Impulse Speckle | 19.18 | 0.38 | 4.78 | 20.71 |
| | | Defecue | 22.04 | 0.55 | 6 97 | 20.60 |
| | | Glass | 22.94 27.05 | 0.83 | 9.74 | 84.54 |
| | Blur | Motion | 20.51 | 0.61 | 5.53 | 32.79 |
| | | Zoom | 17.32 | 0.50 | 3.56 | 2.70 |
| D: GAN | | Snow | 11.17 | 0.52 | 0.29 | 4.38 |
| RivaGAN-WM | Weather | Frost | 9.98 | 0.60 | 0.33 | 12.97 |
| | reconce | Fog | 13.25 | 0.59 | 0.67 | 2.37 |
| | | Brightness | 14.14 | 0.77 | 0.85 | 51.03 |
| | | Contrast | 14.74 | 0.53 | 0.88 | 5.07 |
| | Digital | Elastic Pivelate | 16.70 22.77 | 0.41 | 4.55 7.18 | 59.62 49.50 |
| | | JPEG | 28.07 | 0.84 | 5.90 | 0.15 |
| | | Scale | 15.64 | 0.42 | 5.82 | 1.18 |
| | a | Rotate | 14.34 | 0.23 | 6.20 | 72.50 |
| | Geometric | Shear | 15.93 | 0.68 | 4.31 | 5.28 |
| | | Piecewse Affine | 12.21 | 0.31 | 2.22 | 4.41 |
| | | | | | | |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| Watermark | Attack Category | Perturbation Gaussian | PSNR 8.67 | SSIM 0.17 | Bit Acc 1.27 | Dect Acc 2.50 |
| Watermark | Attack Category Noise | Perturbation Gaussian Shot | PSNR 8.67 7.72 | SSIM 0.17 0.16 | Bit Acc 1.27 1.49 | Dect Acc 2.50 2.43 |
| Watermark | Attack Category Noise | Perturbation Gaussian Shot Impulse Speakla | PSNR 8.67 7.72 7.59 8.56 | 0.17 0.16 0.15 0.22 | Bit Acc 1.27 1.49 43.87 2.58 | Dect Acc 2.50 2.43 0.00 |
| Watermark | Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle | PSNR 8.67 7.72 7.59 8.56 | 0.17 0.16 0.15 0.22 | Bit Acc 1.27 1.49 43.87 2.58 | Dect Acc 2.50 2.43 0.00 13.89 |
| Watermark | Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus Closs | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 | Dect Acc 2.50 2.43 0.00 13.89 29.40 74.71 |
| Watermark | Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 | Dect Acc 2.50 2.43 0.00 13.89 29.40 74.71 22.30 |
| Watermark | Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 | Dect Acc 2.50 2.44 0.00 13.89 29.40 74.71 22.30 0.04 |
| Watermark | Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 0.26 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.04 3.22 |
| Watermark SSL-WM | Attack Category Noise Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 0.26 0.30 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 | Dect Acc 2.5(2.4; 0.00 13.89 29.4(74.7) 22.3(0.04 3.22 29.7) |
| Watermark SSL-WM | Attack Category Noise Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 0.26 0.30 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.32 | Dect Acc 2.50 2.44 0.00 13.89 29.40 74.71 22.30 0.00 3.22 29.71 59.22 |
| Watermark SSL-WM | Attack Category Noise Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | PSNR 8.67 7.72 7.59 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 0.26 0.30 0.30 0.39 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.32 1.12 | Dect Acc 2.50 2.44 0.00 13.89 29.40 74.71 22.30 0.00 3.22 29.71 59.22 73.01 |
| Watermark SSL-WM | Attack Category Noise Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 | SSIM 0.17 0.16 0.22 0.31 0.42 0.31 0.25 0.26 0.30 0.39 0.27 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.21 0.22 0.32 1.12 0.49 | Dect Acc 2.5(2.4; 0.00 13.8% 29.4(74.7) 22.3(0.0) 3.2; 29.7(59.2; 73.01 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 8.34 | SSIM 0.17 0.16 0.22 0.31 0.42 0.31 0.25 0.26 0.30 0.39 0.27 0.21 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.21 0.20 1.12 0.20 0.49 2.88 | Dect Acc 2.55 2.43 0.00 13.88 29.46 74.77 22.33 0.00 3.22 29.77 3.00 55.44 46.60 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate DEC | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 8.34 11.38 14.00 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 0.26 0.30 0.30 0.30 0.27 0.21 0.32 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.20 0.32 1.12 0.49 2.88 4.65 3.47 2.08 0.20 0.32 1.12 0.20 0.32 1.12 0.49 0. | Dect Acc 2.5(2.4; 0.00 13.88 29.44 74.71 22.33 0.00 3.22 29.71 59.22 73.01 55.45 46.66 5.56 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | PSNR 8.67 7.72 7.59 8.561 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.38 8.34 11.38 14.00 | SSIM 0.17 0.16 0.15 0.22 0.31 0.25 0.26 0.30 0.39 0.27 0.21 0.33 0.42 | Bit Acc 1.27 1.49 43.87 2.58 4.25 6.55 3.47 2.08 0.21 0.20 0.32 1.12 0.49 2.88 4.67 3.19 | Dect Acc 2.5(2.4; 0.0(13.88 29.44 74.71 22.33 0.04 3.2; 29.77 3.01 55.4; 46.66 5.60 2.11 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 8.34 11.38 14.00 3.77 | SSIM 0.17 0.16 0.15 0.22 0.31 0.25 0.26 0.30 0.30 0.30 0.27 0.21 0.33 0.42 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.32 1.12 0.49 2.88 4.67 3.19 2.691 2.691 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.37 30.04 3.22 29.7) 59.22 73.01 55.4; 46.66 2.11 25.66 |
| Watermark SSL-WM | Attack Category Noise Blur Uweather Digital Geometric | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Elastic Pixelate JPEG Scale Rotate Shear | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.36 8.34 11.38 14.00 3.77 2.91 | SSIM 0.17 0.16 0.15 0.22 0.31 0.25 0.26 0.30 0.30 0.39 0.27 0.33 0.42 0.33 0.42 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.20 0.32 1.12 0.49 2.88 4.67 3.19 2.691 2.93 4.01 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.77) 7.22.33 0.00 3.2; 29.77 59.2; 73.01 55.4; 46.66 5.66 5.66 5.66 5.66 5.66 5.66 2.11; 25.66 30.88 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital Geometric | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 8.34 11.38 14.00 3.77 2.91 2.63 3.14 | SSIM 0.17 0.16 0.15 0.22 0.31 0.25 0.26 0.30 0.39 0.27 0.23 0.42 0.30 0.39 0.27 0.23 0.42 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.22 1.12 0.49 2.88 4.67 3.19 26.91 2.93 4.01 28.53 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.00 3.22 29.77 3.00 55.42 46.6(5.6(5.6(5.6(3.0.8) 24.11 22.56(3.0.8) 24.11 22.56(3.0.8) 24.12 25.56(3.0.8) 24.12 25.56(3.0.8) 24.12 25.56(3.0.8) 24.12 25.56(3.0.8) 24.12 25.56(3.0.8) 24.12 25.56(3.0.8) 24.12 25.56(3.0.8) 24.12 25.56(3.0.8) 24.12 25.56(3.0.8) 24.12 25.56(3.0.8) 24.12(25.56(25 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital Geometric Attack Category | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 4.97 6.58 7.04 7.36 4.97 1.38 14.00 3.77 2.91 2.63 3.44 PSNR | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.26 0.30 0.30 0.30 0.30 0.30 0.30 0.27 0.21 0.33 0.42 0.31 0.42 0.30 0.32 0.32 0.33 0.42 0.33 0.42 0.30 0.30 0.30 0.30 0.30 0.32 0.32 0.33 0.42 0.33 0.42 0.33 0.42 0.48 0.35 0.48 0.35 0.35 0.35 0.48 0.35 0.35 0.35 0.35 0.48 0.35 0.35 0.35 0.35 0.35 0.48 0.35 0.35 0.35 0.35 0.35 0.48 0.35 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.232 1.12 0.49 2.88 4.67 3.19 26.91 2.81 4.01 28.53 Bit Acc | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.00 3.22 29.77 3.00 59.22 73.00 55.4; 46.66 5.66 2.11 25.66 30.88 24.19 22.58 24.19 22.58 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piceewse Affine Perturbation Gaussian | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.334 11.38 14.00 3.77 2.63 3.14 PSNR 8.41 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.26 0.30 0.30 0.30 0.30 0.30 0.30 0.30 0.27 0.21 0.33 0.42 0.31 0.42 0.31 0.42 0.31 0.42 0.31 0.26 0.30 0.32 0.27 0.33 0.42 0.33 0.42 0.30 0.30 0.30 0.30 0.32 0.42 0.33 0.42 0.30 0.30 0.32 0.42 0.33 0.42 0.33 0.42 0.33 0.42 0.33 0.42 0.48 0.35 0.48 0.48 0.41 0.48 0.48 0.41 0.48 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.22 0.23 1.12 0.49 2.88 4.67 3.19 26.91 2.833 4.01 28.53 Bit Acc 2.11 | Dect Acc 2.5(2.4; 0.0(13.88 29.4(74.7) 22.33 0.00 3.2; 29.7) 59.2; 73.00 55.4; 46.6(5.6(2.1) 25.6; 30.88; 24.11; 22.56; 30.88; 24.11; 22.56; 30.88; 24.11; 25.66; 30.88; 24.11; 25.66; 30.88; 24.12; 25.66; 30.84; 24.12; 25.66; 30.84; 24.12; 25.66; 30.84; 24.12; 25.66; 26.12; 27. |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 8.34 14.00 3.71 2.63 3.14 8.34 8.34 | SSIM 0.17 0.16 0.12 0.31 0.42 0.31 0.25 0.26 0.30 0.39 0.27 0.33 0.42 0.33 0.42 0.33 0.42 0.35 0.41 SSIM 0.07 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.32 1.12 0.49 2.88 4.67 3.19 26.91 28.53 Bit Acc 2.11 2.13 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.04 3.22 73.00 55.4; 46.6(2.1) 25.6; 30.88 24.1(22.56 30.88 24.1(22.56) 7.55 64.11 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse | PSNR 8.67 7.59 8.56 11.48 13.62 8.64 5.56 4.97 6.58 7.36 8.34 14.38 14.00 3.77 2.91 2.63 3.14 PSNR 8.41 8.33 4.76 | SSIM 0.17 0.16 0.12 0.31 0.42 0.31 0.25 0.30 0.30 0.30 0.30 0.31 0.25 0.26 0.30 0.30 0.30 0.271 0.33 0.42 0.48 0.25 0.41 SSIM 0.28 0.031 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.20 0.32 1.12 0.40 0.28 4.67 3.19 26.91 2.83 4.01 28.53 Bit Acc 2.11 2.13 4.30 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.77) 72.2.3(0.0) 3.2; 29.7(59.2; 73.0) 55.4(46.66 5.66 5.66 5.66 5.66 5.66 5.66 5.6 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 8.33 14.00 8.33 4.76 8.41 8.33 4.76 8.16 | SSIM 0.17 0.16 0.15 0.22 0.21 0.31 0.42 0.31 0.25 0.26 0.30 0.30 0.30 0.30 0.30 0.30 0.27 0.33 0.42 0.33 0.42 0.33 0.42 0.41 SSIM 0.48 0.031 0.31 0.31 0.31 0.34 0.31 0.34 0.31 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.21 0.20 0.21 0.20 0.32 1.12 0.49 2.88 4.67 3.19 26.91 2.83 A01 28.53 Bit Acc 2.11 2.13 4.30 3.25 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.00 3.22 29.77 3.00 55.4; 46.6(5.6(5.6(3.0.8) 24.1(22.56 [*]) 30.83 24.1(22.56 [*]) 46.6(5.6(3.0.8) 24.1(22.56 [*]) 24.1(22.56 [*]) 24.1(22.56 [*]) 29.4(29.4(29.4) 29.4(29.4(29.4) 29.4(29 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 7.38 11.38 14.00 3.72 9.91 2.63 3.14 8.33 4.76 8.11 8.3026 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 0.26 0.30 0.30 0.39 0.21 0.33 0.42 0.34 0.35 0.42 0.42 0.42 0.43 0.42 0.43 0.44 0.44 | Bit Acc 1.27 1.49 4.357 2.58 4.22 6.55 3.47 2.08 0.21 0.22 0.32 1.12 0.49 2.88 4.67 3.19 26.91 4.01 28.53 Bit Acc 2.11 2.13 4.30 3.25 3.48 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.00 3.2; 29.77, 30.00 55.4; 46.66 5.66 5.66 5.66 2.11 22.56 30.8; 24.11 22.56 30.8; 24.11 22.56 30.8; 24.11 22.56 30.8; 24.12 25.67 30.8; 24.12 25.67 30.8; 24.12 25.67 30.8; 24.12 25.67 30.8; 24.12 25.67 21.55 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motice | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 8.34 11.38 14.00 3.71 2.63 3.14 8.83 4.76 8.33 4.76 30.26 17.98 11.48 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.30 0.30 0.30 0.33 0.42 0.31 0.25 0.30 0.33 0.42 0.33 0.42 0.33 0.42 0.33 0.42 0.34 0.35 0.42 0.43 0.44 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.32 1.12 0.32 1.12 0.49 2.88 4.67 3.19 2.691 2.83 4.01 2.83 Bit Acc Bit Acc 3.19 Bit Acc 3.43 3.43 3.48 3.54 2.54 2.55 3.44 | Dect Acc 2.5(2.4; 0.0(13.88 29.4(74.7) 22.33 0.00 3.2; 29.7) 59.2; 73.00 55.4; 46.6(5.6(2.1) 55.4; 46.6(5.6(2.1) 22.56; 30.88; 24.11 22.56; 30.88; 24.11 1.80 13.75; 64.11 1.80 13.75; 21.55; 21.55; 21.75; 2 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Sheat Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | PSNR 8.67 7.59 8.56 11.48 13.62 8.64 5.56 4.97 6.58 7.36 8.34 14.38 14.00 3.314 PSNR 8.41 8.33 4.76 8.16 30.26 17.98 11.48 5.40 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 0.20 0.30 0.30 0.30 0.30 0.30 0.22 0.48 0.25 0.35 0.30 0.30 0.30 0.30 0.42 0.48 0.25 0.35 0.34 0.04 SSIM 0.44 0.31 0.48 0.31 0.48 0.32 0.31 0.48 0.31 0.48 0.31 0.48 0.31 0.48 0.31 0.48 0.31 0.48 0.21 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.20 0.23 1.12 0.20 0.32 1.12 0.28 4.67 3.19 26.91 28.53 Bit Acc 2.11 2.13 4.30 3.25 3.48 3.54 3.54 3.54 3.54 | Dect Acc 2.5(2.4; 0.00 13.89 29.4(74.7; 22.33 0.0 0.0 3.2; 29.7; 59.2; 73.0; 75.9; 29.7; 59.2; 73.0; 59.2; 73.0; 59.2; 73.0; 59.2; 73.0; 59.2; 73.0; 59.2; 73.0; 59.2; 73.0; 56.4; 12.2; 56.4; 12.2; 57.5; 64.11; 1.8; 22.5; 64.11; 1.8; 22.5; 64.11; 23.5; 24.12; 24.12; 24.12; 24.12; 25.5; 25.5; 25.5; 25.5; 27.5; |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Glass Motion Zoom | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 4.97 6.58 7.04 7.36 4.97 6.58 7.04 7.36 4.97 6.58 7.04 7.36 4.97 6.58 7.04 7.36 8.34 11.38 11.38 14.00 8.34 11.38 14.00 8.34 11.38 14.02 8.64 8.34 11.38 14.02 8.64 8.34 11.38 14.02 8.64 8.34 11.38 14.02 8.64 8.34 11.38 14.02 8.64 8.34 11.38 14.02 8.64 8.34 11.38 14.02 8.64 8.34 11.38 14.02 8.57 7.04 | SSIM 0.17 0.16 0.15 0.22 0.21 0.23 0.31 0.25 0.26 0.30 0.30 0.30 0.31 0.25 0.26 0.30 0.30 0.30 0.21 0.33 0.42 0.25 0.36 0.41 SSIM 0.48 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.31 0.41 0.48 0.41 0.41 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.32 1.12 0.49 2.88 4.67 3.19 2.93 4.01 2.93 4.01 2.93 Bit Acc 2.11 2.13 4.30 3.25 3.48 3.48 3.46 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.00 3.22 29.77 3.00 55.4; 46.6(5.6(5.6(30.8) 24.1(22.56) 30.8) 24.1(22.56) 64.11 1.80 30.8) 24.1(22.56) 24.1(22.56) 24.1(27.16) 24.1(27.16) 24.1(27.16) 27.1(27.16) 27.1(27.16) 27.1(27.16) 27.1(27.16) 27.1(27.16)2 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Unitse | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.34 7.34 7.34 7.34 7.34 8.34 8.33 4.76 8.41 8.33 4.76 30.26 17.98 11.48 5.40 6.21 4.57 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 0.26 0.30 0.30 0.39 0.271 0.33 0.422 0.34 0.42 0.35 0.42 0.42 0.43 0.42 0.42 0.42 0.42 0.42 0.43 0.44 0.44 0.44 0.41 0.44 | Bit Acc 1.27 1.49 4.387 2.58 4.22 6.55 3.47 2.08 0.21 0.232 1.12 0.49 2.88 4.67 3.19 26.91 4.01 28.53 Bit Acc 3.348 3.54 3.54 3.54 3.54 3.54 3.54 3.54 3.54 3.54 3.54 3.54 3.54 3.54 3.54 3.54 3.54 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7 22.33 0.00 3.2; 29.7 7.30; 55.4; 46.6(5.6(5.6(5.6; 21; 25.6; 30.8; 24.1; 22.5; 64.11 1.88 13.75 56.4; 11.18 25.6; 30.8; 24.19 25.6; 30.8; 24.19 25.6; 30.8; 24.19 25.6; 30.8; 21.15 56, 17.90 21.55 21.55 21.75 21.55 21.75 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Usise Blur Blur Blur Blur Blur Blur Blur Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Picelastic Shear Picedese Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.34 11.38 14.00 3.77 2.63 3.14 PSNR 8.33 4.76 8.33 4.76 5.40 6.21 4.57 4.57 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.25 0.30 0.33 0.42 0.30 0.33 0.42 0.33 0.42 0.34 0.35 0.41 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.43 0.44 0.44 0.44 0.44 0.45 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.32 1.12 0.49 2.88 4.67 3.19 26.91 2.93 4.01 2.833 4.01 2.13 4.30 3.54 | Dect Acc 2.5(2.4; 0.0(13.8; 29.4(74,7,7 22.3) 0.0 3.2; 29.7; 73.0(73.0) 73.0(5.54; 46.6(5.6(3.0.8; 24.11; 22.56; 64.11 1.80 1.755 1.8555 1.7555 1.790 29.35 2.707 7.72 3.300 3.144 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Uses Blur Uses Blur Uses | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccwse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fost Fost Fog Brightness | PSNR 8.67 7.59 8.56 11.48 13.62 10.25 8.64 5.56 7.59 8.54 7.65 8.34 11.38 14.00 3.77 2.91 2.63 3.14 8.841 8.33 4.76 8.16 30.26 17.98 11.48 5.56 3.026 17.98 1.48 5.56 5.51 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.31 0.42 0.42 0.31 0.25 0.26 0.30 0.30 0.30 0.30 0.30 0.30 0.21 0.33 0.22 0.48 0.25 0.35 0.34 0.041 0.28 0.07 0.31 0.48 0.21 0.48 0.25 0.35 0.41 0.28 0.31 0.48 0.21 0.48 0.21 0.41 0.28 0.17 0.31 0.28 0.17 0.31 0.28 0.17 0.32 0.28 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.20 0.22 0.20 0.32 1.12 0.20 0.28 4.67 3.19 2.6.91 2.83 4.01 28.53 Bit Acc 2.11 2.13 4.30 3.25 3.48 3.54 3.54 3.573 6.67.73 5.73 6.30 3.80 3.54 | Dect Acc 2.5(2.4; 0.00 13.89 29.4(74.7; 22.33 0.0 0.0 3.22 29.7; 59.22 73.00 59.22 73.00 59.22 73.00 5.6(5.6(5.6(5.6(5.6(5.6(3.0.8) 22.55 64.11 1.80 0.08 13.75 56.41 11.18 22.55 21.55 21.55 21.55 21.55 21.70 29.35 2.770 7.727 3.300 3.44 4.41 1.19 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Piccewse Affine Defocus Glassian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 8.33 14.00 3.77 2.91 2.63 3.14 8.41 8.33 4.76 8.16 30.26 17.98 11.48 5.401 4.57 4.17 3.41 | SSIM 0.17 0.16 0.12 0.22 0.23 0.24 0.31 0.25 0.26 0.30 0.30 0.30 0.33 0.42 0.30 0.30 0.33 0.42 0.27 0.33 0.42 0.33 0.42 0.33 0.42 0.33 0.42 0.41 SSIM 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.41 <td>Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 2.83 4.01 2.853 Bit Acc 2.11 2.13 4.30 3.48 3.48 5.73 6.07 3.80 5.73 6.07 3.80</td> <td>Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.04 3.22 29.77 59.22 73.00 55.4; 46.66 5.66 5.66 5.66 5.66 3.0.8; 24.11 22.55 64.11 1.80 13.75 64.21 1.80 13.75 21.55 17.90 29.33 2.70 7.72 7.33.90 31.14 1.91 9 3.88</td> | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 2.83 4.01 2.853 Bit Acc 2.11 2.13 4.30 3.48 3.48 5.73 6.07 3.80 5.73 6.07 3.80 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.04 3.22 29.77 59.22 73.00 55.4; 46.66 5.66 5.66 5.66 5.66 3.0.8; 24.11 22.55 64.11 1.80 13.75 64.21 1.80 13.75 21.55 17.90 29.33 2.70 7.72 7.33.90 31.14 1.91 9 3.88 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Unitse Blur Digital Di | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.34 11.38 11.38 14.00 3.77 2.91 2.63 3.14 8.33 4.76 8.61 30.26 17.98 11.48 5.40 6.21 4.57 4.17 3.41 1.18 3.73 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.32 0.31 0.25 0.26 0.30 0.39 0.27 0.33 0.42 0.35 0.42 0.35 0.42 0.35 0.42 0.42 0.43 0.42 0.44 0.48 0.31 0.48 0.31 0.17 0.48 0.31 0.44 0.28 0.31 0.14 0.24 0.17 0.31 0.14 0.24 0.37 | Bit Acc 1.27 1.49 4.387 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.21 0.23 1.12 0.49 2.88 4.67 3.19 26.91 2.93 4.01 2.83 4.01 2.83 3.41 2.13 3.45 3.46 3.54 3.54 3.54 3.54 3.54 5.73 6.07 3.80 1.96 | Dect Acc 2.5(2.4) 0.00 13.88 29.4(74.7) 22.33 0.0-0 3.22 29.77 3.00 55.42 46.66 5.66 5.66 5.66 2.12 25.55 44.66 5.66 2.13 22.55 64.11 1.88 13.75 21.55 21.55 2.770 7.72 33.90 31.14 1.19 3.388 2.45 2.55 2.777 2.2777 2.2777 2.2777 2.2777 2.2777 2.2777 2.2777 2.2777 2.27777 2.27777 2.27777777 2.277777777 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Unitse Digital Digital Digital Digital Digital Digital Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piceewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Elastic Elastic Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate IDEC | PSNR 8.6.7 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 7.34 11.38 14.00 3.77 2.63 3.14 PSNR1 8.33 4.76 8.16 30.26 17.98 11.48 5.40 6.21 4.17 3.41 1.18 1.18 3.13 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.30 0.25 0.26 0.30 0.33 0.24 0.30 0.33 0.42 0.33 0.42 0.34 0.35 0.35 0.41 0.28 0.31 0.41 0.48 0.31 0.41 0.41 0.42 0.43 0.44 0.44 0.41 0.41 0.42 0.43 0.44 0.44 0.48 0.49 0.49 0.49 0.49 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.221 0.23 1.12 0.49 2.853 4.67 3.19 2.691 2.691 2.853 4.01 2.13 4.304 3.255 3.348 3.54 3.54 3.54 3.54 3.54 5.73 6.07 3.80 1.96 1.87 1.96 1.87 2.33 | Dect Acc 2.50 2.43 0.00 13.88 29.46 74.71 72.2.36 0.04 3.22 29.77 73.00 75.54 46.66 5.60 2.12 22.56 7.55 64.11 1.80 13.75 24.16 22.58 7.55 11.59 2.20 7.55 11.59 2.20 7.72 3.3.90 31.14 1.19 3.88 1.03 5.47 7.57 7.52 7.72 3.3.90 31.14 1.19 7.55 7.77 7.72 3.3.90 31.14 1.19 7.55 7.77 7.72 3.3.90 31.14 1.19 7.55 7.77 7.72 7.55 7.77 7.72 7.55 7.77 7.72 7.55 7.77 7.72 7.55 7.77 7.72 7.55 7.77 7.72 7.55 7.77 7.72 7.55 7.77 7.72 7.55 7.77 7.72 7.72 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Use Blur Digital Digital Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Defocus Gaussian Shot Impulse Speckle Defocus Glass Glas Gla | PSNR 8.67 7.79 8.56 11.48 13.62 8.64 5.56 4.97 6.58 7.04 7.36 8.34 11.38 14.00 3.77 2.91 2.63 3.14 PSNR 8.841 8.33 4.76 8.16 30.26 17.98 11.48 5.77 4.17 3.12 4.57 4.47 5.73 | SSIM 0.17 0.16 0.12 0.15 0.22 0.31 0.42 0.31 0.25 0.26 0.30 0.30 0.30 0.30 0.30 0.30 0.25 0.26 0.30 0.30 0.27 0.33 0.28 0.35 0.44 0.48 0.25 0.36 0.31 0.48 0.28 0.07 0.31 0.48 0.21 0.31 0.48 0.21 0.31 0.48 0.21 0.32 0.31 0.48 0.31 0.48 0.21 0.31 0.48 0.17 0.32 0.28 0.37 0.37 0.38 0.37 0.37 0.37 | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.22 1.12 0.20 0.32 1.12 2.88 4.67 3.47 2.83 4.67 2.93 4.01 28.53 Bit Acc 2.11 2.13 4.30 3.25 3.48 3.54 3.64 3.73 6.73 6.80 1.96 1.87 2.33 3.24 3.40 | Dect Acc 2.50 2.43 0.00 13.88 29.46 74.717 22.33 0.04 3.22 29.77 59.22 73.01 59.22 73.01 59.22 73.01 59.22 73.01 59.22 73.01 59.22 73.01 59.22 73.01 59.22 73.01 59.22 73.01 59.22 73.01 5.66 30.82 24.11 22.56 7.55 64.11 1.80 21.55 7.75 21.55 7.75 21.55 21.75 21.75 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Useather Digital Geometric Attack Category Noise Blur Useather Digital Digi | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shoat Shot Shot Shot Shot Shot Shot Shot Sho | PSNR 8.67 7.72 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.36 8.34 11.38 14.00 3.77 2.91 2.63 3.14 8.33 4.76 8.16 30.26 17.98 8.41 8.33 4.76 8.16 3.026 17.98 11.48 1.38 14.45 4.77 4.17 3.41 1.18 3.73 1.18 3.55 1.18 3.55 1.18 3.55 1.18 1.18 3.55 1 | SSIM 0.17 0.16 0.15 0.22 0.21 0.22 0.31 0.42 0.31 0.25 0.26 0.30 0.33 0.23 0.34 0.25 0.26 0.30 0.33 0.42 0.34 0.27 0.35 0.41 SSIM 0.48 0.25 0.36 0.41 0.48 0.25 0.36 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 0.41 0.48 <td>Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 2.83 4.01 2.93 4.01 2.853 3.48 3.48 5.73 6.07 3.80 1.96 1.87 2.80 3.42</td> <td>Dect Acc 2.43 0.00 13.89 29.44 74.71 22.33 0.04 3.22 29.77 3.01 55.45 46.66 5.66 2.12 22.57 30.82 24.15 22.55 64.11 1.80 13.75 21.55 64.21 22.55 64.21 1.02 2.45 64.11 1.80 13.75 21.55 64.11 1.80 13.75 21.55 64.11 1.80 13.75 21.55 17.90 29.33.90 3.114 1.93 3.88 1.03 5.37 4.60 2.73 3.90 2.73 3.90 2.73 3.90 2.73 3.90 3.114 1.93 3.87 4.80 2.73 3.90 3.114 1.93 3.87 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.97 3.90 3.97 3.90 3.97 3.90 3.94</td> | Bit Acc 1.27 1.49 43.87 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 0.21 0.20 2.83 4.01 2.93 4.01 2.853 3.48 3.48 5.73 6.07 3.80 1.96 1.87 2.80 3.42 | Dect Acc 2.43 0.00 13.89 29.44 74.71 22.33 0.04 3.22 29.77 3.01 55.45 46.66 5.66 2.12 22.57 30.82 24.15 22.55 64.11 1.80 13.75 21.55 64.21 22.55 64.21 1.02 2.45 64.11 1.80 13.75 21.55 64.11 1.80 13.75 21.55 64.11 1.80 13.75 21.55 17.90 29.33.90 3.114 1.93 3.88 1.03 5.37 4.60 2.73 3.90 2.73 3.90 2.73 3.90 2.73 3.90 3.114 1.93 3.87 4.80 2.73 3.90 3.114 1.93 3.87 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.114 3.97 3.90 3.97 3.90 3.97 3.90 3.97 3.90 3.94 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geometric Attack Category Noise Blur Unitse Blur Blur Geomtric Blur Geomtric | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Contrast Elastic Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Scale Rotate Shear | PSNR 8.67 7.72 7.59 8.56 11.48 13.62 10.25 8.64 5.56 4.97 6.58 7.04 7.34 11.38 14.00 3.74 2.91 2.63 3.14 8.31 4.070 2.91 2.63 3.14 8.33 4.66 8.41 8.33 4.66 17.98 11.48 5.40 6.21 4.57 4.17 3.11 1.18 3.73 9.94 2.33 5.66 3.85 | SSIM 0.17 0.16 0.15 0.22 0.31 0.42 0.32 0.31 0.25 0.26 0.30 0.39 0.27 0.33 0.42 0.33 0.42 0.36 0.39 0.27 0.30 0.39 0.27 0.33 0.42 0.35 0.42 0.35 0.42 0.42 0.43 0.44 0.31 0.17 0.31 0.17 0.31 0.14 0.28 0.37 0.31 0.17 0.31 0.17 0.31 0.17 0.32 0.39 0.37 0.33 0.48 0.31 0.39 0.37 0.31 0.28 0.32 0.39 0.33 0.49 0.07 0.35 | Bit Acc 1.27 1.49 4.387 2.58 4.22 6.55 3.47 2.08 0.21 0.20 0.21 0.23 1.12 0.49 2.88 4.67 3.19 26.91 2.93 4.01 2.83 4.01 2.83 3.14 2.33 3.54 3.54 5.73 6.07 3.80 1.87 2.33 3.24 3.324 | Dect Acc 2.5(2.4; 0.00 13.88 29.4(74.7) 22.33 0.0.0 3.2; 29.77, 301 55.42 46.6(5.6(5.6(5.6(5.6(5.6(5.6) 21.12 22.55; Dect Acc 7.55 64.11 1.80 13.75 21.55 2.70 7.72 3.300 31.14 1.19 3.88 3.82 2.33 0.27, 3.44 0.00 3.22 2.55 0.22 3.300 3.14 1.19 3.38 3.25 2.70 3.34 3.25 3.27 3.34 3.27 3.27 3.34 3.27 3.27 3.27 3.27 3.27 3.27 3.27 3.27 |

Table 5: NExT-GPT image watermarks under image perturbations.

| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
|---------------------|---|--|--|---|--|--|
| | | Gaussian | 19.12 | 0.39 | 1.80 | 16.93 |
| | Noise | Shot | 18.62 | 0.37 | 2.08 | 25.3 |
| | | Speckle | 20.22 | 0.33 | 3.73 | 59.36 |
| | | Defocus | 23.93 | 0.69 | 11.01 | 35.49 |
| | Blur | Glass | 27.61 | 0.84 | 15.26 | 93.41 |
| | | Motion | 21.20 | 0.66 | 7.77 | 8.4 |
| | | Zoom | 11.20 | 0.31 | 2.14 | 0.0 |
| DctDwtSvd-WM | | Frost | 16.44 | 0.48 | 6.68 | 16.89 |
| | Weather | Fog | 12.66 | 0.60 | 0.55 | 0.8 |
| | | Brightness | 14.35 | 0.76 | 1.00 | 19.2 |
| | | Contrast | 17.50 | 0.55 | 0.58 | 1.70 |
| | Digital | Pixelate | 21.03 | 0.49 | 8.06 | 0.5 |
| | | JPEG | 27.83 | 0.82 | 6.29 | 0.0 |
| | | Scale | 11.04 | 0.23 | 1.72 | 0.0 |
| | Geometric | Rotate | 9.23 | 0.17 | 1.27 | 0.00 |
| | | Piecewse Affine | 14.48 | 0.24 | 3.78 | 7.23 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Ac |
| | | Gaussian | 19.03 | 0.35 | 1.78 | 12.69 |
| | AT - | Shot | 18.56 | 0.37 | 2.00 | 15.65 |
| | Noise | Impulse | 17.93 | 0.33 | 4.10 | 6.36 |
| | | Speckle | 20.14 | 0.49 | 3.07 | 29.42 |
| | | Defocus | 23.81 | 0.69 | 7.00 | 46.98 |
| | Blur | Motion | 27.23 21.14 | 0.82 | 7.91 5.34 | 95.22 47.78 |
| | | Zoom | 16.09 | 0.51 | 2.36 | 0.60 |
| D: 010000 | | Snow | 11.38 | 0.48 | 0.37 | 6.85 |
| KıvaGAN-WM | Weather | Frost | 15.47 | 0.71 | 1.53 | 46.23 |
| | | Fog Brightness | 12.58 | 0.60 | 0.56 | 8.27 |
| | | Grataria | 14.00 | 0.73 | 0.70 | 40.22 |
| | | Elastic | 14.06 | 0.54 | 0.58 | 8.23 84.18 |
| | Digital | Pixelate | 21.01 | 0.55 | 5.51 | 4.17 |
| | | JPEG | 27.71 | 0.81 | 5.78 | 2.26 |
| | | Scale | 11.04 | 0.23 | 1.79 | 33.00 |
| | Geometric | Rotate | 9.23 | 0.17 | 1.30 | 13.00 |
| | | Piecewse Affine | 14.48 | 0.24 | 4.24 | 58.45 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| | | Gaussian | 9.12 | 0.33 | 1.31 | 0.00 |
| | Noise | Shot | 6.61 | 0.21 | 2.26 | 0.00 |
| | | Impulse | 7.03 | 0.51 | 4.83 | 0.00 |
| | | Speckle | 4.15 | 0.43 | 0.00 | 3.41 |
| | | Speckle | 4.15 22.78 | 0.43 | 3.98 | 28.31 |
| | Plus | Speckle Defocus Glass | 4.15 22.78 18.67 | 0.43 0.33 0.28 | 3.98 2.19 | 28.31 |
| | Blur | Speckle Defocus Glass Motion | 4.15 22.78 18.67 10.00 | 0.43 0.33 0.28 0.18 | 3.98 2.19 3.21 | 28.31 88.30 45.85 |
| | Blur | Speckle Defocus Glass Motion Zoom | 4.15 22.78 18.67 10.00 9.53 | 0.43 0.33 0.28 0.18 0.27 | 3.98 2.19 3.21 1.19 | 28.31 28.30 45.87 4.86 |
| SSL-WM | Blur | Speckle Defocus Glass Motion Zoom Snow | 4.15 22.78 18.67 10.00 9.53 3.64 | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 | 3.98 2.19 3.21 1.19 0.80 | 28.31 28.30 45.85 4.86 5.70 |
| SSL-WM | Blur | Speckle Defocus Glass Motion Zoom Snow Frost Foor | $\begin{array}{r} 4.15\\ \hline 22.78\\ 18.67\\ 10.00\\ 9.53\\ \hline 3.64\\ 4.86\\ 5.94\\ \end{array}$ | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 | 28.31 28.31 88.36 45.87 4.86 5.70 18.43 39.85 |
| SSL-WM | Blur Weather | Speckle Defocus Glass Motion Zoom Snow Frost Frog Brightness | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ \hline 3.64\\ 4.86\\ 5.94\\ 6.93\\ \end{array}$ | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 | 28.31 28.31 88.36 45.87 4.86 5.70 18.44 39.85 41.85 |
| SSL-WM | Blur Weather | Speckle Defocus Glass Motion Zoom Snow Frost Frog Brightness Contrast | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ \hline 3.64\\ 4.86\\ 5.94\\ 6.93\\ \hline 6.92\\ \end{array}$ | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 0.38 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 | 3.41 28.31 88.36 45.87 4.86 5.77 18.42 39.85 41.85 65.78 |
| SSL-WM | Blur Weather | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ \hline 3.64\\ 4.86\\ 5.94\\ 6.93\\ \hline 6.92\\ 5.23\\ \end{array}$ | $\begin{array}{c} 0.43\\ 0.33\\ 0.28\\ 0.18\\ 0.27\\ 0.15\\ 0.22\\ 0.32\\ 0.33\\ 0.38\\ 0.40\\ \end{array}$ | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 | 3.41 28.31 88.33 45.87 4.86 5.70 18.44 39.84 41.85 65.78 33.84 |
| SSL-WM | Blur Weather Digital | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate DEC | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ \hline 3.64\\ 4.86\\ 5.94\\ 6.93\\ \hline 6.92\\ 5.23\\ 8.82\\ 7.92\\ \hline $ | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 0.38 0.40 0.21 0.22 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.42 | 28.3 88.3 45.8 4.8 5.7 (18.4 39.8 41.8 65.7 33.8 21.7 20.2 |
| SSL-WM | Blur Weather Digital | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 8.55\\ 7.98\\ 5.55\\ 7.98\\ 5.55\\ 7.98\\ 7.98\\ 5.55\\ 7.98\\ 7.$ | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 0.38 0.40 0.21 0.38 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 | 3.44 28.33 88.36 45.87 4.86 5.77 18.44 39.85 41.85 65.76 33.8c 21.77 22.38 |
| SSL-WM | Blur Weather Digital | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic JPEG Scale Rotate | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 5.79\\ 6.04\\ \end{array}$ | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 0.38 0.40 0.21 0.38 0.38 0.25 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 | 28.31 28.33 45.85 4.86 5.77 18.44 39.85 41.82 41.82 33.84 21.77 22.38 24.40 25.97 |
| SSL-WM | Blur Weather Digital Geometric | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 5.79\\ 6.04\\ 5.35\end{array}$ | $\begin{array}{c} 0.43\\ 0.33\\ 0.28\\ 0.18\\ 0.27\\ 0.15\\ 0.22\\ 0.32\\ 0.33\\ 0.38\\ 0.40\\ 0.21\\ 0.38\\ 0.25\\ 0.38\\ 0.25\\ 0.38\\ \end{array}$ | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 | 3.41 28.31 88.36 45.87 45.87 41.85 41.85 41.85 41.85 41.85 41.85 41.85 41.85 41.85 22.33 24.46 25.90 23.77 22.33 |
| SSL-WM | Blur Weather Digital Geometric | Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ \hline 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ \hline 5.79\\ 6.04\\ 5.35\\ 6.28\\ \end{array}$ | $\begin{array}{c} 0.43\\ 0.33\\ 0.28\\ 0.18\\ 0.27\\ 0.15\\ 0.22\\ 0.32\\ 0.33\\ 0.38\\ 0.40\\ 0.21\\ 0.38\\ 0.25\\ 0.38\\ 0.25\\ 0.38\\ 0.18\\ \end{array}$ | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 | 3.4 28.3 88.3 45.8 4.8 39.8 41.8 4.8 41.8 41.8 41.8 41.8 21.7 22.3 24.4 25.9 23.7 7 0.00 |
| SSL-WM | Blur Weather Digital Geometric Attack Category | Speckle Defocus Glass Motion Zoom Frost Fog Brightess Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Piecewsen | 4.15 22.78 18.67 10.00 9.53 3.64 4.86 5.93 6.93 6.92 5.23 8.82 7.98 5.79 6.04 5.35 6.28 PSNR | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 0.38 0.40 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.38 0.21 0.38 0.38 0.48 0.38 0.38 0.38 0.38 0.38 0.38 0.48 0.38 0.38 0.38 0.48 0.48 0.49 0.32 0.33 0.38 0.48 0.49 0.49 0.49 0.38 0.48 0.49 0.49 0.49 0.38 0.49 | 3.33 3.98 2.19 3.21 1.19 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc | 3.41 28.33 88.33 45.85 4.86 5.77 18.44 39.85 41.85 73.38 33.88 21.77 22.38 24.44 25.90 23.77 0.00 Dect Acc |
| SSL-WM | Blur Weather Digital Geometric Attack Category | Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Piecewse Affine Caussian | 4.15 22.88 18.67 10.00 9.53 3.64 4.86 5.94 6.93 6.92 5.23 8.82 7.98 5.79 6.04 5.35 6.28 PSNR 8.75 | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.33 0.38 0.40 0.21 0.38 0.38 0.40 0.21 0.38 0.38 0.40 0.21 0.38 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.21 0.33 0.38 0.40 0.21 0.38 0.40 0.21 0.33 0.38 0.40 0.21 0.38 0.40 0.21 0.33 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.38 0.40 0.25 0.38 0.48 0.40 0.25 0.38 0.48 0.40 0.25 0.38 0.48 0.48 0.40 0.25 0.38 0.48 0.48 0.49 0.38 0.40 0.25 0.38 0.48 0.48 0.48 0.49 0.38 0.48 0.40 0.55 0.38 0.48 0.48 0.48 0.48 0.49 0.38 0.48 0 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc 2.84 2.84 | 3.41 28.31 88.33 45.85 4.86 5.77 18.44 39.88 41.88 41.88 41.88 41.88 41.88 41.88 41.88 41.83 22.33 82 24.44 25.99 22.378 0.000 Dect Acc |
| SSL-WM | Blur Weather Digital Geometric Attack Category Noise | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse | 4.15 22.78 18.67 10.00 9.53 3.64 4.86 5.94 6.92 5.23 8.82 7.98 6.04 5.35 6.28 PSNR 8.75 7.03 6.31 | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 0.38 0.40 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.32 0.33 0.22 0.33 0.38 0.21 0.32 0.33 0.38 0.21 0.32 0.33 0.38 0.21 0.32 0.33 0.38 0.21 0.32 0.33 0.21 0.32 0.32 0.33 0.21 0.32 0.33 0.21 0.32 0.33 0.21 0.32 0.33 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.25 0.38 0.21 0.38 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc 2.84 3.90 3.34 | 3.4. 28.3: 88.3: 4.8: 4.8: 5.77 18.4: 4.8: 41.8: 41.8: 41.8: 41.8: 41.8: 41.8: 41.4: 5.9: 2.3: 24.4: 25.9: 23.7: 0.00 Dect Acc 0.00 0.46 0.72 |
| SSL-WM | Blur Weather Digital Geometric Attack Category Noise | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle | 4.15 22.88 18.67 10.00 9.53 3.64 4.86 5.94 6.93 6.92 5.23 8.82 7.98 6.04 5.23 8.82 7.98 6.04 5.35 6.28 PSNR 8.75 7.03 6.31 7.73 | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 0.38 0.40 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.38 0.21 0.32 0.33 0.22 0.32 0.33 0.38 0.48 0.48 0.49 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.86 3.17 2.80 2.88 Bit Acc 2.88 Bit Acc 2.84 3.90 3.34 2.45 | 3.4. 28.3. 88.3. 4.5.8' 4.88. 4.88. 5.77 18.4. 39.8' 33.8' 21.77' 22.37' 0.00 Dect Acc 0.00 0.46 0.37' 22.85' |
| SSL-WM | Blur Weather Digital Geometric Attack Category Noise | Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle | 4.15 22.78 18.67 10.00 9.53 3.64 4.86 5.94 6.93 6.92 5.23 8.82 8.82 7.98 5.79 6.04 5.35 6.28 PSNR 8.77 3.631 7.73 6.31 7.73 32.87 | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 0.38 0.40 0.21 0.38 0.25 0.38 0.25 0.38 0.25 0.38 SSIM 0.18 0.40 0.21 0.38 0.25 0.38 0.25 0.38 0.25 0.38 0.25 0.38 0.25 0.38 0.25 0.38 0.21 0.33 0.22 0.32 0.33 0.33 0.33 0.33 0.33 0.33 0.33 0.33 0.34 0.40 0.21 0.35 0.25 0.32 0.33 0.38 0.25 0.38 0.25 0.38 0.25 0.38 0.25 0.38 0.25 0.38 0.38 0.40 0.40 0.40 0.40 0.38 0.38 0.38 0.40 0.38 0.38 0.40 0.38 0.40 0.38 0.38 0.40 0.38 0.40 0.38 0.40 0.38 0.40 0.38 0.40 0.38 0.40 0.38 0.40 0.38 0.40 0.38 0.40 0.38 0.40 0.38 0.40 0.40 0.38 0.40 0.38 0.40 0.38 0.58 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.95 1.31 4.43 2.36 3.95 1.31 2.80 2.88 Bit Acc 2.88 Bit Acc 2.84 3.34 2.45 2.67 | 3.4. 28.3. 88.3.3 45.8° 4.88 4.88 4.88 4.88 4.88 4.88 4.88 4 |
| SSL-WM | Blur Weather Digital Geometric Attack Category Noise Blur | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass | 4.15 22.78 18.67 10.00 9.53 3.64 4.86 5.94 6.93 6.92 5.23 8.82 7.98 5.79 6.04 5.35 6.28 PSNR 8.75 7.03 6.31 7.73 32.87 7.93 | 0.43 0.33 0.28 0.18 0.27 0.15 0.22 0.32 0.33 0.38 0.40 0.21 0.38 0.25 0.38 0.18 SSIM 0.40 0.25 0.38 0.18 0.22 0.32 0.33 0.33 0.34 0.40 0.21 0.38 0.25 0.38 0.25 0.38 0.21 0.33 0.32 0.33 0.33 0.33 0.33 0.33 0.33 0.34 0.40 0.21 0.38 0.25 0.33 0.38 0.40 0.25 0.38 0.40 0.25 0.38 0.40 0.25 0.38 0.40 0.25 0.38 0.40 0.25 0.38 0.40 0.40 0.25 0.38 0.48 0.40 0.25 0.38 0.48 0.40 0.40 0.40 0.38 0.48 0.40 0.38 0.48 0.40 0.38 0.38 0.38 0.40 0.38 0.38 0.38 0.38 0.40 0.38 0.38 0.40 0.38 0.38 0.40 0.38 0.40 0.38 0.40 0.38 0.40 0.40 0.40 0.38 0.40 0.42 0.40 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc 2.84 3.90 3.34 2.45 5.34 3.95 1.31 2.84 3.90 3.34 2.45 3.95 3.84 3.90 3.34 2.45 3.85 3.85 3.85 3.85 3.85 3.85 3.85 3.8 | 3.4. 28.3. 88.3.3 45.8' 4.8: 4.8: 4.8: 4.8: 4.8: 4.8: 5.77 3.3.8: 5.77 3.3.8: 21.77 22.33 24.4: 25.99 23.77 0.000 0.000 0.464 0.037 22.85 24.969 21.14 |
| SSL-WM | Blur Weather Digital Geometric Attack Category Noise Blur | Speckle Defocus Glass Motion Zoom Frost Fog Brighteess Contrast Elastic Pixelate JPEG Scale Rotate Shear Picewse Affine Caussian Shot Impulse Speckle Defocus Glass Motion Zoom | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 5.79\\ 6.04\\ 5.35\\ 6.28\\ \hline \textbf{PSNR}\\ \textbf{8.75}\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 19.54\\ 11.48\\ 4.95\\ \hline \textbf{9}\\ \textbf{11.48}\\ 4.95\\ \hline \textbf{11.48}\\ \textbf{11.48}\\ \textbf{11.48}\\ \textbf{11.48}\\ \textbf{11.48}\\ \end{array}$ | 0.43 0.33 0.28 0.18 0.22 0.32 0.32 0.33 0.38 0.40 0.25 0.38 0.38 0.38 0.38 0.38 0.40 0.25 0.38 0.38 0.38 0.25 0.38 0.38 0.25 0.38 0.25 0.38 0.25 0.38 0.25 0.38 0.25 0.33 0.38 0.25 0.38 0.25 0.38 0.25 0.33 0.38 0.25 0.38 0.38 0.25 0.38 0.39 0.38 0.39 0 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc Bit Acc 2.67 3.84 3.44 2.44 3.90 3.34 2.45 3.95 5.78 Bit Acc | 3.4. 28.3; 88.3; 45.8; 4.8; 4.8; 41.8; 41.8; 41.8; 41.8; 41.8; 41.8; 41.8; 41.8; 41.8; 41.8; 41.8; 41.8; 41.8; 41.8; 42.9; 42.9; 42.9; 42.9; 42.9; 42.9; 42.9; 42.8; 42.9; 42.8; 42.9; 42, |
| SSL-WM | Blur Weather Digital Geometric Attack Category Noise Blur | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Elastic Shear Pixelate JPEG Scale Rotate Shear Piccewse Affine Gaussian Shot Impulse Speckle Defocus Glass Glass Glass Glass Shotion Zoom Snow | 4.15 22.78 18.67 10.00 9.53 3.64 4.86 5.94 6.93 6.92 5.23 8.82 7.98 5.79 6.04 5.35 6.28 PSNR 8.75 7.03 6.28 PSNR 8.75 7.03 6.28 7.73 32.87 19.54 11.48 4.55 7.79 6.75 7.73 6.75 7.73 7.73 8.75 7.73 8.75 7.73 7.73 8.75 7.73 8.75 7.73 8.75 7.73 8.75 7.73 8.75 7.73 8.75 7.73 8.75 7.73 8.75 7.73 8.75 7.73 8.75 7.73 8.75 7.73 7.73 7.73 7.73 7.73 7.73 7.73 7 | 0.43 0.33 0.28 0.28 0.28 0.28 0.28 0.22 0.32 0.32 0.32 0.33 0.38 0.40 0.21 0.38 0.38 0.25 0.38 0.38 0.38 0.25 0.38 0.38 0.38 0.38 0.38 0.34 0.40 0.25 0.38 0.38 0.38 0.22 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc 2.84 3.90 3.34 2.45 2.67 3.90 3.34 2.45 2.67 3.50 2.87 3.50 2.85 2.67 3.50 2.67 3.50 2.85 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 2.67 3.50 3 | 3.4. 28.3: 88.3: 45.8: 4.8: 4.8: 41.8: 41.8: 41.8: 65.7: 33.8: 21.7: 22.3: 24.4: 25.9: 22.4: 0.00 0.46 0.37: 22.85: 24.96 21.14: 23.84 14.80 21.14: 23.84 14.80 21.25: 24.96 21.14: 21.85: 24.96 21.14: 21.85 |
| SSL-WM Watermark | Blur Weather Digital Geometric Attack Category Noise Blur | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost | $\begin{array}{r} 4.15\\ 22.78\\ 12.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 6.04\\ 5.35\\ 6.28\\ \textbf{PSNR}\\ \textbf{PSNR}\\ \textbf{8.75}\\ 7.03\\ 6.28\\ \textbf{7.73}\\ 32.87\\ 19.54\\ 11.48\\ 4.95\\ 6.76\\ 4.05\\ \textbf{4.05}\\ \textbf{6.76}\\ 4.05\\ \textbf{4.05}\\ \textbf{6.76}\\ \textbf{4.05}\\ \textbf{5.76}\\ \textbf{6.76}\\ \textbf{6.76}$ | 0.43 0.33 0.28 0.28 0.28 0.28 0.28 0.27 0.22 0.32 0.32 0.33 0.33 0.33 0.33 0.33 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc Bit Acc 3.34 2.45 3.34 3.43 3.44 3.45 3. | 3.4. 28.3. 88.3. 88.3. 4.5.8' 4.8.8' 39.8' 39.8' 39.8' 39.8' 39.8' 39.8' 39.8' 39.8' 39.8' 39.8' 31.7' 22.3' 24.4' 25.9' 23.7' 0.0' Dect Acc 0.0' |
| SSL-WM Watermark | Blur Weather Digital Geometric Attack Category Noise Blur United States Blur Blur Blur Blur Blur Blur Blur Blur | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 4.86\\ 5.93\\ 6.92\\ 5.23\\ 8.82\\ 8.82\\ 8.82\\ 8.82\\ 8.82\\ 8.82\\ 7.98\\ 5.79\\ 6.04\\ 5.35\\ 6.28\\ \hline \textbf{PSNR}\\ \hline \textbf{PSNR}\\ 8.75\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 19.54\\ 11.48\\ 4.95\\ 6.76\\ 4.05\\ 6.13\\ \hline \textbf{a} \end{array}$ | 0.43 0.33 0.28 0.28 0.28 0.28 0.28 0.22 0.22 0.32 0.33 0.33 0.33 0.33 0.33 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.95 1.31 4.43 2.80 2.88 Bit Acc 2.88 Bit Acc 2.89 2.84 3.34 2.45 3.45 2.67 3.86 4.83 5.28 6.57 | 3.4. 28.3. 88.3.3 45.8° 4.88 39.8° 41.88 41.88 57.7° 22.38 24.44 25.99 23.7° 0.00 Dect Acc 0.00 0.46 0.37 22.38 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 24.95 25.97 22.85 24.96 21.14 23.85 24.96 21.14 23.85 24.96 |
| SSL-WM Watermark | Blur Weather Digital Geometric Attack Category Noise Blur Weather | Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 5.79\\ 6.04\\ 5.35\\ 6.28\\ \textbf{PSNR}\\ \textbf{8.75}\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 7.03\\ 6.31\\ 1.48\\ 4.95\\ 6.76\\ 4.05\\ 6.13\\ 3.123\\ \textbf{1.23}\\ \end{array}$ | $\begin{array}{c} 0.43\\ 0.43\\ 0.38\\ 0.28\\ 0.28\\ 0.28\\ 0.28\\ 0.22\\ 0.32\\ 0.33\\ 0.38\\ 0.40\\ 0.21\\ 0.38\\ 0.40\\ 0.38\\ 0.41\\ 0.38\\ 0.48\\ 0.25\\ 0.38\\ 0.18\\ \textbf{SSIM}\\ \textbf{SSIM}\\ \textbf{SSIM}\\ \textbf{SSIM}\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.48\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.48\\ 0.38\\$ | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.85 3.95 1.31 2.80 2.88 Bit Acc 2.84 3.34 2.45 3.34 2.45 3.34 2.45 3.34 2.45 3.34 2.45 3.34 2.45 3.34 2.45 3.34 2.45 3.34 2.45 3.34 2.45 3.34 2.45 3.45 3.45 3.45 3.45 3.45 3.45 3.45 3 | 3.4. 28.3. 88.3. 45.8' 4.8: 5.77 18.4. 39.8' 41.8: 5.97 22.33 24.4: 25.99 23.77 0.00 Dect Acc 0.00 0.46 0.37 22.85 24.96 21.14 23.84 14.80 33.577 35.76 35.77 35.76 24.00 0.000 |
| SSL-WM Watermark | Blur Weather Digital Geometric Attack Category Noise Blur Weather Weather | Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Elastic Shear Picelate JPEG Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fost Fog Brightness Contrast Elastic El | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 5.79\\ 6.04\\ 5.35\\ 6.28\\ \textbf{PSNR}\\ \textbf{PSNR}\\ \textbf{8.75}\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 19.54\\ 11.48\\ 4.05\\ 6.76\\ 4.05\\ 6.76\\ 4.05\\ 6.76\\ 1.23\\ 1.13\\ 2.05\\ \end{array}$ | 0.43 0.33 0.28 0.28 0.28 0.28 0.28 0.22 0.32 0.33 0.33 0.38 0.40 0.21 0.38 0.38 0.41 0.38 0.41 0.38 0.43 0.38 0.43 0.38 0.38 0.43 0.38 0.43 0.38 0.43 0.43 0.44 0.43 0.44 0.44 0.44 0.44 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc 2.84 3.94 3.34 2.45 3.44 2.85 5.28 Bit Acc 4.83 3.44 2.45 5.28 Bit Acc 4.84 3.94 3.44 3.95 5.88 Bit Acc 5.84 3.95 5.84 3.95 5.85 | 3.4. 28.3. 88.3. 88.3. 4.8. 4.8. 4.8. 4.1.8. 41.8. 65.7. 33.8. 41.8. 21.7. 22.3. 24.4. 25.9. 23.7. 0.00 0.00 0.646 0.37 22.85 24.96 21.14. 23.84 23.84 23.85 24.96 21.14. 23.84 23.84 23.85 24.96 21.14. 23.84 23.85 24.96 21.14. 23.84 23.85 24.96 21.15. 21.85 21.95 21. |
| SSL-WM Watermark | Blur Weather Digital Geometric Attack Category Noise Blur Blur Weather Digital | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piceewse Affine Defocus Glass Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 6.04\\ 5.35\\ 6.28\\ \hline \textbf{PSNR}\\ \textbf{PSNR}\\ \textbf{8.75}\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 19.54\\ 11.48\\ 4.95\\ 6.76\\ 6.13\\ 1.23\\ 1.13\\ 2.08\\ 1.13\\ 2.08\\ 1.93\\ 1.13\\ 2.08\\ 1.93\\ 1.13\\ 2.08\\ 1.93\\ 1.13\\ 2.08\\ 1.93\\ 1.13\\ 2.08\\ 1.93\\ 1.13\\ 2.08\\ 1.93\\ $ | 0.43 0.33 0.28 0.28 0.28 0.28 0.28 0.22 0.32 0.32 0.32 0.32 0.32 0.32 0.33 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.38 0.40 0.28 0.38 0.40 0.28 0.38 0.43 0.43 0.43 0.43 0.43 0.43 0.43 0.44 0.43 0.44 0.43 0.44 0.43 0.44 0.44 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc Bit Acc 2.84 3.90 3.34 2.45 2.84 3.90 3.34 2.45 5.28 6.67 6.67 6.67 6.78 | 3.41 28.31 88.33 45.85 4.86 5.77 18.44 39.85 41.85 21.77 22.35 24.44 25.99 23.77 0.00 Dect Acc 0.00 0.46 0.37 22.85 24.96 21.14 23.84 14.80 33.576 24.05 0.000 0.000 0.372 25.59 0.000 0.000 0.372 25.59 0.000 0.000 0.372 0.000 0.000 0.372 0.0000 0.000000 0.00000 0.000000 0.00000 0.00000 0.00000000 |
| SSL-WM Watermark | Blur Weather Digital Geometric Attack Category Noise Blur Uweather Digital Digital | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Picewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Glass Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | 4.15 22.88 18.67 10.00 9.53 3.64 4.86 5.94 6.92 5.23 8.82 7.98 5.79 6.04 5.35 7.03 6.28 PSNR 8.75 7.03 6.28 PSNR 8.75 7.03 6.28 6.28 5.79 6.04 5.35 7.03 6.28 5.79 6.04 5.35 7.03 6.28 8.55 7.03 6.28 5.70 6.28 8.55 7.03 6.28 5.20 8.55 7.03 6.28 8.55 7.03 8.55 7.03 6.28 8.55 7.03 6.28 8.55 7.03 8.55 7.03 6.28 8.55 7.03 6.28 8.55 6.28 8.55 7.03 8.55 6.28 8.55 6.28 8.55 7.03 8.55 6.28 8.55 8.55 8.55 8.55 8.55 8.55 8.55 8 | 0.43 0.33 0.28 0.28 0.28 0.28 0.28 0.27 0.32 0.32 0.32 0.32 0.33 0.40 0.21 0.38 0.40 0.25 0.38 0.40 0.38 0.38 0.40 0.38 0.38 0.38 0.38 0.40 0.38 0.39 0.39 0.39 0.35 0.32 0.35 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 4.43 2.85 3.95 1.31 4.43 2.86 3.17 2.80 2.88 Bit Acc Bit Acc 2.87 3.86 4.83 5.28 6.78 6.77 6.77 6.77 1.74 1.74 | 3.41 28.31 38.8.33 4.5.87 4.88 39.88 39.88 39.88 39.88 39.88 39.88 39.88 39.88 39.88 39.88 39.88 39.88 39.88 30.87 30.77 20.85 30.77 20.85 30.77 20.85 30.77 20.85 20.90 30.77 20.85 20.90 30.77 20.85 20.90 30.77 20.85 20.90 30.77 20.97 30.77 30.78 30.78 30.77 30.78 30.77 30.78 30.77 30.78 30.77 30.78 30.78 30.77 30.78 30.78 30.77 30.78 30.78 30.78 30.77 30.78 3 |
| SSL-WM | Blur Weather Digital Geometric Attack Category Noise Blur Weather Digital Digital | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Contrast Elastic Contrast Elastic Pixelate Contrast Elastic Elastic Pixelate Contrast Elastic Elast | 4.15 22.78 18.67 10.00 9.53 3.64 4.86 5.94 6.93 6.92 5.23 8.82 8.82 8.82 8.83 6.98 PSNR 8.75 6.28 PSNR 8.75 7.03 6.31 7.73 3.2.87 19.54 11.48 19.54 11.32 6.56 6.13 1.23 1.13 2.08 8.193 9.35 | 0.43 0.33 0.28 0.28 0.28 0.28 0.28 0.28 0.28 0.22 0.32 0.33 0.33 0.33 0.33 0.33 0.33 0.34 0.21 0.38 0.25 0.33 0.38 0.25 0.33 0.38 0.40 0.21 0.38 0.21 0.33 0.38 0.25 0.33 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.25 0.33 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.49 0.48 0.49 0.48 0.49 0.49 0.43 0.44 0.49 0.43 0.49 0.44 0.43 0.44 0.43 0.44 0.43 0.44 0.42 0.42 0.42 0.43 0.44 0.43 0.44 0.44 0.44 0.42 0.43 0.44 0.43 0.44 0.43 0.44 0.45 0.44 0.45 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 4.43 2.85 3.95 1.31 4.43 2.85 3.95 1.31 4.43 2.86 2.88 Bit Acc 2.84 3.34 2.45 2.67 3.86 4.83 5.28 6.99 6.78 6.47 6.47 1.74 1 | 3.41 28.33 88.33 45.87 4.88 4.88 5.77 18.44 39.88 41.88 65.77 33.88 21.77 22.38 24.44 25.97 0.00 0.46 0.37 22.85 24.96 21.14 23.84 14.80 0.3357 5.76 24.96 21.14 23.85 24.96 24.96 21.14 23.85 24.96 25.97 23.878 24.85 24.85 24.85 24.96 25.97 23.878 24.85 24.85 24.85 24.85 25.97 23.878 24.85 24.85 24.85 25.97 23.878 26.8588 26.858 26.858 26.8588 26.8588 26.8588 26.8588 26.85 |
| SSL-WM | Blur Weather Digital Geometric Attack Category Noise Blur Ueather Digital Geomtric | Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Contrast Glass Motion Zoom Shot Impulse Speckle Defocus Glass Motion Zoom | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 5.79\\ 6.04\\ 5.35\\ 6.28\\ \textbf{PSNR}\\ 8.75\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 7.03\\ 6.31\\ 1.148\\ 4.95\\ 6.76\\ 4.05\\ 6.13\\ 1.23\\ 1.13\\ 1.23\\ 1.13\\ 2.28\\ 1.93\\ 9.28\\ 3.50\\ 4.82\\ \end{array}$ | 0.43 0.33 0.28 0.28 0.28 0.28 0.28 0.22 0.32 0.32 0.32 0.33 0.33 0.38 0.40 0.21 0.33 0.38 0.40 0.21 0.38 0.40 0.21 0.38 0.41 0.38 0.41 0.38 0.41 0.38 0.41 0.43 0.43 0.48 0.44 0.43 0.48 0.44 0.43 0.48 0.44 0.44 0.45 0.44 0.45 0.44 0.45 0.45 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.86 3.17 2.80 2.88 Bit Acc 2.84 3.34 2.84 3.34 2.45 3.34 2.45 5.26 5.72 6.47 6.47 6.47 6.78 5.72 2.47 3.86 4.83 5.28 | 3.41 28.31 88.33 45.87 41.88 65.77 33.88 41.88 65.77 33.88 21.77 22.38 24.44 25.90 23.77 0.00 Dect Acc 0.00 0.46 0.37 22.85 24.96 21.14 23.84 14.80 0.33 5.76 21.15 0.00 0.46 0.37 22.85 24.96 21.14 23.84 14.88 33.576 24.05 0.00 0.00 0.46 0.37 22.85 24.96 21.14 23.84 14.88 24.57 24.58 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 24.59 25.59 25.59 25.59 25.58 26.58 |
| SSL-WM Watermark | Blur Weather Digital Geometric Attack Category Noise Blur Ueather Digital Geomtric | Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Caussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | $\begin{array}{r} 4.15\\ 22.78\\ 18.67\\ 10.00\\ 9.53\\ 3.64\\ 4.86\\ 5.94\\ 6.93\\ 6.92\\ 5.23\\ 8.82\\ 7.98\\ 5.79\\ 6.04\\ 5.35\\ 6.28\\ \textbf{PSNR}\\ \textbf{PSNR}\\ \textbf{8.75}\\ 7.03\\ 6.31\\ 7.73\\ 32.87\\ 19.54\\ 11.48\\ 4.95\\ 6.76\\ 4.05\\ 6.17\\ 1.23\\ 1.13\\ 2.08\\ 1.23\\ 1.13\\ 2.08\\ 1.23\\ 3.50\\ 4.81\\ 3.50\\ 4.82\\ 3.81\\ 1.42\\ 3.81\\ 1.42\\ 3.81\\ 3.$ | 0.43 0.33 0.28 0.28 0.28 0.28 0.28 0.28 0.22 0.32 0.33 0.38 0.40 0.21 0.38 0.41 0.38 0.21 0.38 0.41 0.38 0.21 0.38 0.43 0.38 0.43 0.38 0.43 0.38 0.43 0.43 0.43 0.43 0.43 0.43 0.44 0.43 0.44 0.44 | 3.33 3.98 2.19 3.21 1.19 0.80 0.78 1.11 1.41 2.85 3.95 1.31 4.43 2.36 3.17 2.80 2.88 Bit Acc 2.84 3.94 2.84 3.94 2.85 5.28 Bit Acc 6.57 6.47 6.78 6.78 6.77 6.47 6.78 5.72 1.72 1.72 1.85 2.94 2.34 3.95 5.72 1. | 3.41 28.31 88.33 45.87 41.88 5.77 18.43 39.87 41.88 5.77 22.33 24.44 25.99 23.77 0.00 Dect Acc 0.00 0.464 0.37 22.85 24.96 21.17 33.57 33.57 33.57 33.57 24.06 0.00 0.00 0.37 22.59 24.96 0.00 0.00 0.37 22.85 24.96 21.97 33.78 33.57 35.7 |

Table 6: Stable Diffusion image watermarks under image perturbations.

| | 0 | | | | 0.0 | 1 |
|---------------------|--|--|--|--|---|--|
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| | | Gaussian | 18.91 | 0.39 | 1.83 | 12.61 |
| | Noise | Shot | 18.15 | 0.39 | 2.22 | 16.81 |
| | | Impulse | 18.18 | 0.37 | 4.42 | 7.38 |
| | | Speckie | 19.02 | 0.48 | 3.05 | 39.08 |
| | | Class | 22.90 | 0.64 | 5.64 | 33.88 |
| | Blur | Motion | 21.20 | 0.64 | 7.00 5.10 | 9.65 |
| | | Zoom | 16.18 | 0.49 | 2.83 | 0.00 |
| | - | Snow | 11.13 | 0.51 | 0.31 | 10.75 |
| DctDwtSvd-WM | 1 | Frost | 10.36 | 0.60 | 0.40 | 5.13 |
| | Weather | Fog | 13.21 | 0.61 | 0.65 | 1.08 |
| | | Brightness | 13.84 | 0.77 | 0.78 | 28.58 |
| | | Contrast | 14.48 | 0.54 | 0.83 | 2.40 |
| | Digital | Elastic | 16.50 | 0.43 | 4.20 | 17.17 |
| | 0 | Pixelate IPEC | 21.04 | 0.56 | 5.23 | 17.97 |
| | | 51 EG | 28.03 | 0.00 | 0.09 | 0.00 |
| | | Scale | 10.88 | 0.25 | 1.50 | 9.98 |
| | Geomtric | Shear | 10.72 | 0.15 | 2.40 | 4.15 |
| | | Piecewse Affine | 15.50 | 0.43 | 5.58 | 3.09 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| materia | intucia cutogory | Constant | 10.07 | 0.20 | 1.00 | 15.00 |
| | | Shot | 18.21 | 0.39 | 2.33 | 13.90 |
| | Noise | Impulse | 18.22 | 0.40 | 5.06 | 11.07 |
| | | Speckle | 19.71 | 0.49 | 3.71 | 23.89 |
| | | Defocus | 23.02 | 0.65 | 7.86 | 37.77 |
| | Dlum | Glass | 27.64 | 0.86 | 12.50 | 91.53 |
| | Dlur | Motion | 20.34 | 0.62 | 6.30 | 38.05 |
| | | Zoom | 16.19 | 0.49 | 3.19 | 0.6 |
| DivoCAN WM | | Snow | 11.17 | 0.52 | 0.32 | 5.9 |
| invagniv- w M | Weather | Frost | 10.40 | 0.61 | 0.31 | 14.36 |
| | | Fog Brightnose | 13.22 | 0.62 | 0.40 | 4.22 |
| | | Brightness | 13.30 | 0.15 | 0.05 | 30.80 |
| | | Contrast | 14.49 | 0.55 | 0.99 | 6.47 74.99 |
| | Digital | Pixelate | 21.10 | 0.43 | 6.72 | 20.17 |
| | | JPEG | 28.82 | 0.85 | 6.20 | 0.55 |
| | | Scale | 10.87 | 0.25 | 1.36 | 75.57 |
| | a | Rotate | 9.31 | 0.18 | 1.00 | 16.16 |
| | Geomtric | Shear | 10.81 | 0.27 | 1.81 | 0.00 |
| | | Piecewse Affine | 15.57 | 0.42 | 4.02 | 0.00 |
| Watermark | Attack Category | Perturbation | PSNR | \mathbf{SSIM} | Bit Acc | Dect Acc |
| | | Gaussian | 10.77 | 0.02 | 0.08 | 3.41 |
| | Noise | Shot | 11.83 | 0.08 | 3.31 | 2.33 |
| | | Impulse | 5.58 | 0.19 | 3.76 | 4.82 |
| | | Speckle | 6.93 | 0.35 | 3.58 | 1.83 |
| | | Defocus | 22.73 | 0.28 | 3.17 | 18.88 |
| | | | | | | 00.00 |
| | Blur | Glass | 20.40 | 0.38 | 3.21 | 66.63 |
| | Blur | Glass Motion Zoom | 23.48 21.85 18.42 | 0.38 | 3.21 4.75 4.24 | 66.63 25.34 28.64 |
| | Blur | Glass Motion Zoom | 23.48 21.85 18.42 | 0.38 0.46 0.31 0.27 | 3.21 4.75 4.24 | 66.63 25.34 28.64 |
| SSL-WM | Blur | Glass Motion Zoom Snow Frost | 23.48 21.85 18.42 4.31 5.68 | 0.38 0.46 0.31 0.27 0.28 | 3.21 4.75 4.24 3.82 1.41 | 66.63 25.34 28.64 27.80 47.85 |
| SSL-WM | Blur Weather | Glass Motion Zoom Snow Frost Fog | 23.48 21.85 18.42 4.31 5.68 8.80 | 0.38 0.46 0.31 0.27 0.28 0.35 | 3.21 4.75 4.24 3.82 1.41 3.89 | 66.63 25.34 28.64 27.80 47.85 44.42 |
| SSL-WM | Blur Weather | Glass Motion Zoom Snow Frost Fog Brightness | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 | 66.63 25.34 28.64 27.80 47.85 44.42 41.23 |
| SSL-WM | Blur Weather | Glass Motion Zoom Snow Frost Fog Brightness Contrast | $23.48 \\ 21.85 \\ 18.42 \\ 4.31 \\ 5.68 \\ 8.80 \\ 9.41 \\ 10.53 \\ $ | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 | 66.63 25.34 28.64 27.80 47.85 44.42 41.23 37.64 |
| SSL-WM | Blur Weather Dicited | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | $23.43 \\ 21.85 \\ 18.42 \\ 4.31 \\ 5.68 \\ 8.80 \\ 9.41 \\ 10.53 \\ 11.32 \\$ | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 | 666.63 25.34 28.64 27.80 47.85 44.42 41.23 37.64 36.94 |
| SSL-WM | Blur Weather Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate | $23.43 \\ 21.85 \\ 18.42 \\ 4.31 \\ 5.68 \\ 8.80 \\ 9.41 \\ 10.53 \\ 11.32 \\ 6.42 \\ \end{cases}$ | $\begin{array}{c} 0.38\\ 0.46\\ 0.31\\ \hline 0.27\\ 0.28\\ 0.35\\ 0.34\\ \hline 0.30\\ 0.38\\ 0.32\\ \end{array}$ | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 | $\begin{array}{c} 666.63\\ 25.34\\ 28.64\\ \hline 27.80\\ 47.85\\ 44.42\\ 41.23\\ \hline 37.64\\ 36.94\\ 21.44\end{array}$ |
| SSL-WM | Blur Weather | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | $\begin{array}{c} 25.48\\ 21.85\\ 18.42\\ \hline \\ 4.31\\ 5.68\\ 8.80\\ 9.41\\ \hline \\ 10.53\\ 11.32\\ 6.42\\ 3.31\\ \hline \end{array}$ | $\begin{array}{c} 0.38\\ 0.46\\ 0.31\\ \hline 0.27\\ 0.28\\ 0.35\\ 0.34\\ \hline 0.30\\ 0.38\\ 0.32\\ 0.35\\ \hline \end{array}$ | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 | 666.63 25.34 28.64 27.80 47.85 44.42 41.23 37.64 36.94 21.44 22.85 |
| SSL-WM | Blur Weather Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale | $\begin{array}{c} 25.48\\ 21.85\\ 18.42\\ \hline \\ 4.31\\ 5.68\\ 8.80\\ 9.41\\ \hline \\ 10.53\\ 11.32\\ 6.42\\ 3.31\\ \hline \\ 5.83\\ \end{array}$ | $\begin{array}{c} 0.38\\ 0.46\\ 0.31\\ \hline 0.27\\ 0.28\\ 0.35\\ \hline 0.34\\ \hline 0.30\\ 0.38\\ 0.32\\ \hline 0.35\\ \hline 0.14\\ \end{array}$ | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 | 666.63 25.34 28.64 27.80 47.85 44.42 41.22 37.64 36.94 21.44 22.85 38.74 |
| SSL-WM | Blur Weather Digital Geomtric | Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate | $23.43 \\ 21.85 \\ 18.42 \\ 4.31 \\ 5.68 \\ 8.80 \\ 9.41 \\ 10.53 \\ 11.32 \\ 6.42 \\ 3.31 \\ 5.83 \\ 2.78 \\ 2.78 \\ $ | $\begin{array}{c} 0.38\\ 0.46\\ 0.31\\ \hline 0.27\\ 0.28\\ 0.35\\ \hline 0.34\\ \hline 0.30\\ 0.38\\ 0.32\\ \hline 0.35\\ \hline 0.14\\ 0.32\\ \end{array}$ | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 | $\begin{array}{c} 666.63\\ 25.34\\ 28.64\\ 27.86\\ 47.85\\ 44.42\\ 41.22\\ 37.64\\ 36.94\\ 21.44\\ 22.85\\ 38.74\\ 14.84\end{array}$ |
| SSL-WM | Blur Weather Digital Geomtric | Glass Motion Zoom Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixeore Affe | $\begin{array}{c} 23.48\\ 21.85\\ 18.42\\ 4.31\\ 5.68\\ 8.80\\ 9.41\\ 10.53\\ 11.32\\ 6.42\\ 3.31\\ 5.83\\ 2.78\\ 3.33\\ 2.78\\ 3.33\\ 2.92\\ \end{array}$ | $\begin{array}{c} 0.36\\ 0.46\\ 0.31\\ 0.27\\ 0.28\\ 0.35\\ 0.34\\ \hline 0.30\\ 0.38\\ 0.32\\ 0.35\\ \hline 0.14\\ 0.32\\ 0.02\\ 0.01\\ \hline \end{array}$ | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 9.25 | 66.63 25.34 28.64 27.80 47.85 44.42 41.23 37.64 36.94 21.44 22.85 38.74 14.84 24.00 2.27 |
| SSL-WM | Blur Weather Digital Geomtric | Glass Motion Zoom Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.78 | $\begin{array}{c} 0.36\\ 0.46\\ 0.31\\ 0.27\\ 0.28\\ 0.35\\ 0.34\\ \hline 0.30\\ 0.38\\ 0.32\\ 0.35\\ \hline 0.14\\ 0.32\\ 0.01\\ 0.01\\ 0.01\\ \hline 0.01\\ 0.02\\ \hline 0.01\\ \hline 0.02\\ \hline 0.01\\ \hline 0.02\\ \hline 0.0$ | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 | 66.63 25.34 28.64 47.85 47.85 44.42 41.23 37.64 36.94 21.44 22.85 38.74 14.84 24.00 3.75 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Piscelate JPEG Scale Rotate Shear Piecewse Affine Perturbation | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 6.42 3.31 5.83 2.78 3.33 2.82 PSNR | 0.36 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.32 0.32 0.32 0.32 0.35 0.14 0.32 0.02 0.01 SSIM | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc | 66.65 25.34 28.66 47.85 44.42 41.23 37.64 36.94 21.44 22.85 38.74 14.85 24.00 3.76 Dect Acc |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category | Glass Motion Zoom Zoom Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian State | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.82 PSNR 5.02 5.02 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.32 0.32 0.32 0.32 0.35 0.14 0.32 0.02 0.01 SSIM 0.24 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 4.42 2.83 8.27 Bit Acc 1.49 | 66.65 25.34 28.66 27.86 44.42 41.23 37.64 36.94 21.44 22.88 38.74 14.48 24.00 3.75 Dect Acc 54.41 54.41 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse | 23.48 21.85 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 | 0.36 0.36 0.31 0.27 0.28 0.35 0.34 0.35 0.34 0.32 0.35 0.32 0.02 0.01 SSIM 0.24 0.24 0.24 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 | 66.65 25.34 28.64 27.80 47.85 44.42 41.22 37.64 36.94 21.44 22.85 38.74 14.84 22.85 Dect Acc 54.41 55.31 9 05 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Glass Motion Zoom Frost Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 8.04 | 0.36 0.36 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.35 0.14 0.32 0.02 0.01 SSIM 0.24 0.41 0.11 0.29 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.40 9.241 2.01 3.82 | 66.65 25.33 28.64 27.80 47.85 44.42 41.23 37.64 36.94 21.44 22.85 38.74 14.84 24.00 3.75 Dect Acc 54.41 55.31 2.25 9.62 9.62 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocur | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 8.94 8.04 8.04 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.35 0.34 0.32 0.35 0.34 0.32 0.35 0.34 0.32 0.35 0.32 0.35 0.34 0.32 0.35 0.32 0.35 0.34 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 1.49 2.41 2.01 3.69 | 66.65 25.34 28.64 27.80 47.85 44.42 41.23 37.64 36.94 21.44 22.85 38.77 14.84 24.00 3.75 Dect Acc 54.41 55.31 2.25 9.62 9.62 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 8.04 8.75 12.88 | 0.38 0.46 0.31 0.27 0.28 0.34 0.34 0.30 0.38 0.32 0.32 0.32 0.32 0.14 0.32 0.02 0.01 SSIM 0.24 0.21 0.24 0.21 0.24 0.22 0.24 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.82 6.93 4.92 | 66.65 25.34 28.64 27.80 47.85 44.42 44.42 37.64 36.94 21.44 422.85 38.74 14.84 24.00 3.78 Dect Acc 54.41 5.31 2.25 9.62 9.62 17.83 14.84 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion | 21.85 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.78 3.33 2.78 3.33 2.78 3.33 2.82 PSNR 5.02 3.95 7.95 7.95 8.80 4.875 12.88 13.85 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.32 0.32 0.32 0.32 0.35 0.14 0.32 0.02 0.01 SSIM 0.24 0.41 0.41 0.29 0.20 0.30 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.82 6.93 4.92 6.21 | 66.65 25.33 28.64 47.85 44.42 41.22 37.64 36.94 21.44 22.85 38.74 14.88 24.00 3.75 Dect Acc 54.41 55.31 2.25 9.62 2.17.83 14.89 5.04 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Blur | Glass Motion Zoom Frost Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 8.04 8.875 12.88 13.85 13.00 | $\begin{array}{c} 0.36\\ 0.46\\ 0.31\\ 0.27\\ 0.28\\ 0.35\\ 0.34\\ 0.30\\ 0.38\\ 0.32\\ 0.35\\ 0.34\\ 0.32\\ 0.02\\ 0.01\\ \textbf{SSIM}\\ 0.24\\ 0.41\\ 0.11\\ 0.29\\ 0.20\\ 0.38\\ 0.10\\ 0.17\\ \end{array}$ | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.82 5.91 1.23 1.23 1.23 1.23 1.23 1.23 1.23 1.2 | 66.65 25.33 28.64 27.80 47.85 44.42 41.23 37.64 36.94 21.44 22.85 38.74 14.88 24.00 3.75 Dect Acc 5.41 5.5.31 2.25 9.622 17.83 14.89 5.04 1.73 14.89 5.04 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.73 1.48 1.48 1.73 1.48 1.73 1.48 1.73 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur | Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | 21.85 21.85 21.85 18.42 4.31 5.68 8.80 9.41 10.53 8.80 9.41 10.53 3.11.32 6.42 3.31 5.83 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 8.04 8.75 12.88 13.85 13.80 1.65 | 0.36 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.35 0.34 0.32 0.35 0.32 0.35 0.34 0.32 0.32 0.02 0.01 SSIM 0.24 0.24 0.24 0.24 0.21 0.20 0.20 0.38 0.32 0.02 0.01 0.21 0.22 0.35 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.32 0.35 0.32 0.32 0.35 0.32 0.32 0.35 0.32 0.35 0.32 0.02 0.02 0.02 0.02 0.02 0.02 0.02 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.62 6.93 4.92 6.21 4.82 | 66.65 25.34 28.64 27.80 47.85 44.42 41.22 37.64 36.94 21.44 22.85 38.74 14.84 24.00 3.75 Dect Acc 54.41 55.31 2.25 9.62 9.62 17.83 14.89 5.04 1.73 10.85 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Uweather | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost | 21.85 21.85 18.42 4.31 5.68 8.80 9.41 10.53 8.80 9.41 10.53 6.42 3.31 11.32 6.42 3.31 2.82 PSNR 5.02 3.95 7.33 8.04 8.75 12.88 13.85 13.00 5.22 8.25 12.85 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.82 6.93 4.92 6.21 4.82 8.82 | 66.63 (25.33) (27.88) (4.44) (4.12) (37.66) (36.99) (21.47) (22.88) (24.00) (3.77) (22.88) (24.00) (3.77) (25.53) (25.53) (25.53) (25.53) (25.53) (25.53) (25.53) (25.54) (25. |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Unitse U | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Perturbation | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.78 3.33 2.78 3.33 2.78 3.33 2.78 3.33 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 8.04 8.75 12.88 13.85 13.00 1.65 3.28 3.29 9.90 1.55 13.00 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.35 0.34 0.32 0.35 0.32 0.35 0.34 0.32 0.35 0.32 0.35 0.34 0.32 0.32 0.35 0.24 0.41 0.29 0.20 0.20 0.20 0.20 0.20 0.20 0.20 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.23 1.23 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.82 6.93 4.92 6.21 4.82 6.23 4.82 6.23 | 66.63 25.33 28.64 27.80 47.83 44.44 41.22 37.64 36.94 21.44 22.88 24.00 37.76 38.77 14.88 24.00 37.77 Dect Acc 54.41 55.31 2.25 9.62 17.83 14.89 5.04 1.73 10.85 29.95 5.04 1.73 10.85 29.95 10.85 29.95 10.85 29.95 10.85 29.95 10.85 29.95 10.85 29.95 20.95 10.85 20.95 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur United State Blur Blur Blur Blur Blur Blur Blur Blur | Glass Motion Zoom Zoom Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 PSNR 5.02 3.95 7.33 8.04 8.75 12.88 13.85 13.00 1.65 3.28 3.390 4.00 | 0.36 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.35 0.34 0.32 0.35 0.32 0.35 0.34 0.32 0.35 0.32 0.35 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.23 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.20 8.21 8.21 8.21 8.21 8.21 8.21 8.21 8.21 | 66.65 25.33 28.64 27.80 47.85 44.42 41.23 37.64 36.94 21.44 22.85 38.74 14.88 24.00 3.75 Dect Acc 5.44 55.31 2.25 9.62 17.83 14.89 5.04 1.73 10.85 5.94 1.73 10.85 29.59 18.13 19.41 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Uweather | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 8.80 9.41 10.53 11.32 6.42 3.31 1.32 6.42 3.33 2.78 3.33 2.82 PSNR 8.50 3.90 1.65 3.288 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.88 13.85 12.8 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 4.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.82 6.93 4.92 6.21 4.88 6.93 4.92 6.21 4.88 6.93 4.92 6.21 4.88 6.93 4.92 6.21 3.82 6.93 4.92 6.21 3.82 6.93 4.92 6.21 3.82 6.93 4.92 6.21 3.82 6.93 4.92 6.21 3.82 6.93 4.92 6.21 3.82 6.93 4.92 6.21 3.82 6.93 6.93 6.93 6.93 6.93 6.93 6.93 6.93 | 66.63 25.34 28.64 27.80 47.85 44.42 41.23 37.64 36.94 21.44 22.85 38.74 14.84 24.00 3.75 Dect Acc Dect Acc 54.41 55.31 2.25 9.62 9.62 17.83 14.89 5.04 1.73 10.85 29.59 18.13 19.41 2.774 27.75 27.75 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Uweather Digital Digital | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate | 21.85 21.85 21.85 18.42 4.31 5.68 8.80 9.41 10.53 8.80 9.41 10.53 2.64 2.33 11.32 6.42 3.31 5.83 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 2.82 PSNR 5.02 3.95 7.33 8.04 8.53 2.84 3.390 4.00 8.553 20.41 3.45 3.28 3.28 3.28 3.28 3.28 3.28 3.28 3.28 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.82 6.21 4.82 6.21 4.82 6.21 4.88 6.28 6.23 4.92 6.21 4.88 6.28 5.83 5.88 | 66.65 25.33 28.64 27.88 44.42 41.22 37.64 36.94 21.44 22.88 38.74 14.88 24.00 3.776 Dect Acc 54.41 55.31 2.255 9.62 17.83 14.89 5.04 1.73 10.85 29.59 18.13 18.13 10.85 29.59 18.13 18.13 10.85 29.59 18.13 18.13 19.27.74 24.93 10.777 10.777 10.777 10.777 10.77777 10.77777 10.77777 10.77777 10.77777 10.777777 10.777777777777777777777777777777777777 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur United State Blur Digital Digital | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 11.32 6.42 3.31 5.83 2.78 3.33 2.78 3.33 2.78 3.33 2.78 3.33 2.78 3.33 2.78 3.33 2.78 3.33 2.78 3.33 2.82 PSNR 5.02 3.95 7.95 7.12.88 13.80 1.65 3.28 3.90 4.00 8.53 20.41 3.45 6.80 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.35 0.34 0.32 0.35 0.34 0.32 0.32 0.35 0.34 0.32 0.32 0.35 0.32 0.35 0.32 0.32 0.32 0.35 0.32 0.32 0.32 0.02 0.02 0.02 0.02 0.02 | 3.21 4.75 4.24 3.82 1.48 9.591 1.23 1.23 1.23 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.82 6.23 4.92 6.21 4.82 6.23 6.23 4.82 6.23 6.23 6.23 6.23 6.23 6.23 6.23 6.2 | $\begin{array}{c} 66.65\\ 25.33\\ 25.34\\ 27.80\\ 47.85\\ 44.42\\ 41.22\\ 37.64\\ 36.94\\ 21.44\\ 22.85\\ 38.74\\ 14.88\\ 24.00\\ 37.6\\ 0.28\\ 24.00\\ 37.6\\ 0.28\\ 24.00\\ 11.44\\ 22.85\\ 24.00\\ 11.44\\ 24.00\\ 11.44\\ 24.00\\ 11.48\\ 20.25\\ 9.62\\ 20.5\\ 11.83\\ 11.83\\ 10.85\\ 29.59\\ 18.13\\ 10.41\\ 12.77\\ 44.93\\ 10.7\\ 8.10\\ 0.85\\ 10.42\\ 10.4$ |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur United Weather Digital Digital | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piceewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale | $\begin{array}{c} 23.48\\ 21.85\\ 18.42\\ 4.31\\ 5.68\\ 8.80\\ 9.41\\ 10.53\\ 11.32\\ 6.42\\ 3.31\\ 1.32\\ 2.83\\ 2.83\\ 2.83\\ 2.83\\ 2.83\\ 8.04\\ 8.75\\ 12.88\\ 13.85\\ 13.00\\ 1.65\\ 3.28\\ 3.90\\ 4.00\\ 8.53\\ 3.041\\ 13.45\\ 5.02\\ 5.5\\ 12.88\\ 13.85\\ 13.00\\ 1.65\\ 3.28\\ 3.90\\ 4.00\\ 8.53\\ 3.041\\ 1.345\\ 5.5\\ 12.88\\ 13.85\\ 13.00\\ 1.65\\ 3.28\\ 3.90\\ 4.00\\ 8.53\\ 3.041\\ 1.345\\ 5.5\\ 12.88\\ 13.85\\ 13.00\\ 1.65\\ 3.28\\ 3.90\\ 4.00\\ 1.65\\ 3.28\\ 3.90\\ 4.00\\ 1.65\\ 3.28\\ 3.90\\ 4.00\\ 1.65\\ 3.28\\ 3.90\\ 4.00\\ 1.65\\ 3.28\\ 3.90\\ 4.00\\ 1.65\\ 3.28\\ 3.90\\ 4.00\\ 1.55\\ 3.28\\ 3.90\\ 4.00\\ 1.55\\ 3.28\\ 3.90\\ 4.00\\ 1.55\\ 3.28\\ 3.90\\ 1.55\\ 3.28\\ 3.90\\ 1.55\\ 1.5$ | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.35 0.34 0.32 0.35 0.32 0.35 0.34 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.35 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.42 2.83 8.27 Bit Acc 1.23 4.82 4.83 6.93 4.92 6.93 4.92 6.93 4.92 6.93 4.82 4.88 6.28 2.08 5.32 5.32 5.32 5.32 5.33 3.88 5.83 5.83 5.83 5.83 | 66.65 25.33 28.64 27.80 47.85 44.42 41.23 37.64 36.94 21.44 22.85 38.74 14.88 24.00 3.75 Dect Acc 5.44 55.31 2.25 9.62 17.83 14.89 5.04 1.73 10.85 5.04 1.73 10.85 5.04 1.73 10.85 5.04 1.73 1.94 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Uweather Digital | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate | 23.48 21.85 18.42 4.31 5.68 8.80 9.41 10.53 8.80 9.41 10.53 2.64 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 8.04 8.75 12.88 13.85 13.85 13.85 13.80 4.00 8.53 2.64 13.85 13.65 3.28 3.90 4.00 8.53 2.64 1.258 2.58 2.58 3.20 1.258 2.58 3.20 1.258 3.20 1.258 3.20 1.258 3.259 3.258 3.259 3.258 3.258 3.259 3.258 3.258 3.259 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.24 4.42 2.83 8.27 Bit Acc 1.49 2.41 2.01 3.82 6.21 4.82 6.23 4.92 6.21 4.82 6.23 4.92 6.21 4.82 6.23 4.92 6.23 3.88 5.23 3.388 5.53 3.388 5.53 3.297 1.25 2.28 | 66.65 25.33 28.64 27.86 47.85 44.42 21.44 22.87 37.64 36.94 21.44 22.87 37.64 36.94 21.44 24.00 3.775 Dect Acc 5.441 55.31 2.255 9.62 17.83 14.89 5.04 1.73 10.085 29.59 18.13 19.41 27.74 24.93 1.077 8.10 3.31 3.31 3.91 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur United State Blur Geomtric Geomtric Geomtric Geomtric | Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | 21.85 21.85 21.85 18.42 4.31 5.68 8.80 9.41 10.53 6.42 3.31 1.32 6.42 3.31 5.83 2.78 3.33 2.82 PSNR 5.02 3.95 7.33 8.04 8.75 12.88 3.30 8.04 8.75 12.88 3.30 8.00 8.53 2.64 3.28 3.28 3.28 3.28 3.28 3.28 3.28 3.28 | 0.38 0.46 0.31 0.27 0.28 0.35 0.34 0.30 0.38 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.21 4.75 4.24 3.82 1.41 3.89 5.91 1.23 1.35 2.94 3.74 9.44 1.42 2.83 8.27 Bit Acc 1.49 2.41 2.41 2.41 2.41 2.41 2.41 2.41 2.41 | $\begin{array}{c} 66.65\\ 25.33\\ 25.34\\ 27.86\\ 47.85\\ 44.42\\ 41.22\\ 37.64\\ 36.94\\ 21.44\\ 22.85\\ 38.74\\ 14.84\\ 24.06\\ 38.74\\ 14.84\\ 24.06\\ 38.74\\ 14.89\\ 25.9\\ 62\\ 17.83\\ 14.89\\ 5.04\\ 1.73\\ 10.85\\ 29.59\\ 18.13\\ 10.85\\ 29.59\\ 18.13\\ 10.87\\ 24.93\\ 10.87\\ 3.10\\ 3.31\\ 3.91\\ 8.00\\ \end{array}$ |

Table 7: DALLE3 image watermarks under image perturbations.

| Watermark | Attack Category | Perturbation | PSNR | \mathbf{SSIM} | Bit Acc | Dect Acc |
|---------------------|--|---|--|--|--|--|
| | | Gaussian | 18.90 | 0.29 | 1.55 | 19.75 |
| | Noise | Shot | 18.08 | 0.28 | 1.52 | 22.86 |
| | | Speckle | 19.73 | 0.27 | 2.50 | 51.08 |
| | | Defocus | 26.79 | 0.79 | 17.35 | 38.88 |
| | Blur | Glass | 31.14 | 0.91 | 23.44 | 96.75 |
| | Diui | Motion | 23.46 | 0.74 | 11.21 | 14.25 |
| | | Zoom | 17.83 | 0.61 | 3.65 | 0.00 |
| DctDwtSvd-WM | 1 | Snow | 11.14 | 0.49 | 0.03 | 16.47 |
| | Weather | Fog | 16.97 | 0.72 | 0.69 | 25.25 |
| | | Brightness | 13.52 | 0.81 | 0.07 | 29.25 |
| | | Contrast | 15.68 | 0.65 | 0.85 | 3.10 |
| | Digital | Elastic | 19.63 | 0.58 | 10.55 | 26.39 |
| | 0 | Pixelate IPEC | 23.30 | 0.65 | 12.28 | 7.29 |
| | | Si EG | 10.40 | 0.01 | 1.02 | 0.00 |
| | <i>a</i> | Rotate | 12.40 | 0.35 | 1.81 | 22.00 |
| | Geomtric | Shear | 12.37 | 0.36 | 3.17 | 0.00 |
| | | Piecewse Affine | 17.06 | 0.52 | 8.02 | 10.17 |
| Watermark | Attack Category | Perturbation | PSNR | \mathbf{SSIM} | Bit Acc | Dect Ac |
| | | Gaussian | 18.84 | 0.28 | 1.53 | 9.11 |
| | Noise | Shot | 18.04 | 0.28 | 1.50 | 9.60 |
| | | Impulse Speckle | 18.31 | 0.27 | 3.92 | 5.23 |
| | | Deferre | 13.00 | 0.01 | 2.02 | 13.16 |
| | | Glass | 26.55 30.33 | 0.77 | 9.33 9.78 | 51.98 98.14 |
| | Blur | Motion | 23.35 | 0.74 | 6.69 | 52.41 |
| | | Zoom | 17.82 | 0.60 | 3.18 | 0.98 |
| D. GAN HIM | | Snow | 11.18 | 0.48 | 0.03 | 9.4 |
| nivaGAN-WM | Weather | Frost | 15.82 | 0.71 | 1.35 | 46.92 |
| | | Fog Brightness | 13.68 | 0.69 | 0.69 | 6.58 54.60 |
| | | Griness | 15.02 | 0.11 | 0.05 | 04.00 |
| | | Contrast Elastic | 15.67 | 0.65 | 0.85 | 0.13 90.94 |
| | Digital | Pixelate | 23.22 | 0.64 | 7.49 | 8.8 |
| | | JPEG | 30.28 | 0.86 | 6.95 | 1.90 |
| | | Scale | 12.47 | 0.34 | 1.64 | 82.98 |
| | Geomtric | Rotate | 10.22 | 0.26 | 1.15 | 16.2 |
| | | Shear Discourses Affine | 12.37 | 0.35 | 2.13 | 76.0 |
| 337.4 1 | A.V. 1. G.V. | Piecewse Annie | 17.05 | 0.51 | 4.00 | 09.3 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| | | | 11.04 | 0.05 | 0.10 | 3.75 |
| | | Gaussian | 11.24 | 0.19 | 2.60 | 0.10 |
| | Noise | Gaussian Shot Impulse | 11.24 12.45 6.12 | 0.12 | 3.62 | 2.6 |
| | Noise | Gaussian Shot Impulse Speckle | 11.24 12.45 6.12 7.56 | 0.12 0.24 0.39 | 3.62 3.87 3.69 | 2.67 5.16 2.18 |
| | Noise | Gaussian Shot Impulse Speckle Defocus | 11.24 12.45 6.12 7.56 23.11 | 0.12 0.24 0.39 | 3.62 3.87 3.69 3.28 | 2.6 5.10 2.18 30.3 |
| | Noise | Gaussian Shot Impulse Speckle Defocus Glass | 11.24 12.45 6.12 7.56 23.11 26.02 | 0.12 0.24 0.39 0.31 0.55 | 3.62 3.87 3.69 3.28 3.32 | 2.6 5.10 2.18 30.33 69.8 |
| | Noise | Gaussian Shot Impulse Speckle Defocus Glass Motion | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 | 0.12 0.24 0.39 0.31 0.55 0.48 | 3.62 3.87 3.69 3.28 3.32 4.86 | 2.67 5.16 2.18 30.33 69.81 27.75 |
| | Noise | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | $ \begin{array}{r} 11.24\\ 12.45\\ 6.12\\ 7.56\\ \hline 23.11\\ 26.02\\ 22.28\\ 19.05\\ \hline \end{array} $ | $\begin{array}{c} 0.13\\ 0.12\\ 0.24\\ 0.39\\ \hline 0.31\\ 0.55\\ 0.48\\ 0.33\\ \hline \end{array}$ | 3.62 3.87 3.69 3.28 3.32 4.86 4.35 | 2.65 5.16 2.18 30.33 69.81 27.73 31.06 |
| SSL-WM | Noise | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow | $\begin{array}{c} 11.24\\ 12.45\\ 6.12\\ 7.56\\ \hline \\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ \hline \\ 4.89\\ 2.45\\ \hline \end{array}$ | 0.12 0.24 0.39 0.31 0.55 0.48 0.33 0.29 | 3.62 3.87 3.69 3.28 3.32 4.86 4.35 3.93 | 2.67 5.10 2.18 30.33 69.81 27.75 31.00 29.22 |
| SSL-WM | Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Foor | $\begin{array}{c} 11.24\\ 12.45\\ 6.12\\ 7.56\\ \hline \\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ \hline \\ 4.89\\ 6.17\\ 9.34\\ \end{array}$ | 0.12 0.24 0.39 0.31 0.55 0.48 0.33 0.29 0.30 0.37 | 3.62 3.87 3.69 3.28 3.32 4.86 4.35 3.93 1.61 3.90 | 2.6 5.1(2.13 30.3; 69.8; 27.7 31.00 29.2; 49.2 49.2 |
| SSL-WM | Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | $\begin{array}{c} 11.24\\ 12.45\\ 6.12\\ 7.56\\ \hline \\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ \hline \\ 4.89\\ 6.17\\ 9.34\\ 10.03\\ \end{array}$ | $\begin{array}{c} 0.33\\ 0.12\\ 0.24\\ 0.39\\ \hline 0.31\\ 0.55\\ 0.48\\ 0.33\\ \hline 0.29\\ 0.30\\ 0.37\\ 0.36\\ \end{array}$ | 3.62 3.62 3.87 3.69 3.28 3.32 4.86 4.35 3.93 1.61 3.90 6.02 | 2.6' 5.1(2.13 30.3; 69.8; 27.7' 31.00 29.2; 49.2' 45.8; 42.6; |
| SSL-WM | Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Frost Fog Brightness Contrast | $\begin{array}{c} 11.24\\ 12.45\\ 6.12\\ 7.56\\ \hline \\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ \hline \\ 4.89\\ 6.17\\ 9.34\\ 10.03\\ \hline \\ 11.15\\ \end{array}$ | 0.12 0.24 0.39 0.31 0.55 0.48 0.33 0.29 0.30 0.37 0.36 0.32 | 3.62 3.87 3.69 3.28 3.32 4.86 4.35 3.93 1.61 3.90 6.02 1.43 | 2.67 2.67 5.10 2.18 30.33 69.81 27.77 31.00 29.22 49.27 45.88 42.63 38.00 |
| SSL-WM | Noise Blur Weather Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | $\begin{array}{c} 11.24\\ 12.45\\ 6.12\\ 7.56\\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ 4.89\\ 6.17\\ 9.34\\ 10.03\\ 11.15\\ 12.00\\ \end{array}$ | $\begin{array}{c} 0.12\\ 0.24\\ 0.39\\ \hline 0.31\\ 0.55\\ 0.48\\ 0.33\\ \hline 0.29\\ 0.30\\ 0.37\\ 0.36\\ \hline 0.32\\ 0.41\\ \end{array}$ | $\begin{array}{c} 3.62\\ 3.87\\ 3.69\\ \hline 3.28\\ 3.32\\ 4.86\\ 4.35\\ \hline 3.93\\ 1.61\\ 3.90\\ 6.02\\ \hline 1.43\\ 1.55\\ \end{array}$ | 2.67 2.67 5.10 2.18 30.33 69.81 27.75 31.00 29.22 49.22 45.84 42.65 38.00 37.36 |
| SSL-WM | Noise Blur Weather Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate | $\begin{array}{c} 11.24\\ 12.45\\ 6.12\\ 7.56\\ \hline \\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ \hline \\ 4.89\\ 6.17\\ 9.34\\ 10.03\\ \hline \\ 11.15\\ 12.00\\ 7.01\\ \hline \end{array}$ | $\begin{array}{c} 0.12\\ 0.24\\ 0.39\\ \hline 0.31\\ 0.55\\ 0.48\\ 0.33\\ \hline 0.29\\ 0.30\\ 0.37\\ 0.36\\ \hline 0.32\\ 0.41\\ 0.34\\ \end{array}$ | $\begin{array}{c} 3.62\\ 3.87\\ 3.69\\ 3.28\\ 3.32\\ 4.86\\ 4.35\\ \hline 3.93\\ 1.61\\ 3.90\\ 6.02\\ \hline 1.43\\ 1.55\\ 3.04\\ \end{array}$ | 2.60 5.10 2.11 30.33 69.81 27.77 31.00 29.22 49.22 49.22 45.84 42.65 38.00 37.36 23.85 |
| SSL-WM | Noise Blur Weather Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | $\begin{array}{c} 11.24\\ 12.45\\ 6.12\\ 7.56\\ \hline \\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ \hline \\ 4.89\\ 6.17\\ 9.34\\ 10.03\\ \hline \\ 11.15\\ 12.00\\ 7.01\\ 3.87\\ \hline \end{array}$ | $\begin{array}{c} 0.12\\ 0.24\\ 0.39\\ \hline 0.31\\ 0.55\\ 0.48\\ 0.33\\ \hline 0.29\\ 0.30\\ 0.37\\ 0.36\\ \hline 0.32\\ 0.41\\ 0.34\\ 0.37\\ \end{array}$ | $\begin{array}{c} 3.62\\ 3.69\\ 3.28\\ 3.32\\ 4.86\\ 4.35\\ \hline 3.93\\ 1.61\\ 3.90\\ 6.02\\ \hline 1.43\\ 1.55\\ 3.04\\ 3.84\\ \end{array}$ | 2.61 2.61 5.10 2.13 30.33 69.81 27.77 31.00 29.22 49.27 49.27 45.88 42.63 38.00 37.33 23.85 25.22 |
| SSL-WM | Noise Blur Weather Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale | $\begin{array}{c} 11.24\\ 11.24\\ 12.45\\ 6.12\\ 7.56\\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ 19.05\\ 4.89\\ 6.17\\ 9.34\\ 10.03\\ 11.15\\ 12.00\\ 7.01\\ 3.87\\ 4.75\\ \end{array}$ | $\begin{array}{c} 0.12\\ 0.24\\ 0.39\\ \hline 0.31\\ 0.55\\ 0.48\\ 0.33\\ \hline 0.29\\ 0.30\\ 0.37\\ 0.36\\ \hline 0.32\\ 0.41\\ 0.34\\ 0.37\\ \hline 0.31\\ \end{array}$ | $\begin{array}{c} 3.62\\ 3.69\\ \hline 3.69\\ \hline 3.28\\ 3.32\\ 4.86\\ 4.35\\ \hline 3.93\\ 1.61\\ 3.90\\ 6.02\\ \hline 1.43\\ 1.55\\ 3.04\\ 3.84\\ \hline 5.88\\ \end{array}$ | 2.66 5.1(2.18 30.33 69.83 27.77 31.00 29.22 49.27 45.88 42.68 38.00 37.30 37.30 38.00 37.30 32.88 25.28 24.98 |
| SSL-WM | Noise Blur Weather Digital Geomtric | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate | $\begin{array}{c} 11.24\\ 12.45\\ 6.12\\ 7.56\\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ 4.89\\ 6.17\\ 9.34\\ 10.03\\ 11.15\\ 12.00\\ 7.01\\ 3.87\\ 4.75\\ 6.27\\ 5.42\\ \end{array}$ | $\begin{array}{c} 0.12\\ 0.24\\ 0.39\\ \hline 0.31\\ 0.55\\ 0.48\\ 0.33\\ \hline 0.29\\ 0.30\\ 0.37\\ \hline 0.36\\ \hline 0.32\\ 0.41\\ 0.34\\ 0.37\\ \hline 0.31\\ 0.28\\ 0.20\\ \hline \end{array}$ | $\begin{array}{c} 3.62\\ 3.69\\ 3.69\\ 3.28\\ 3.32\\ 4.86\\ 4.35\\ 3.93\\ 1.61\\ 3.93\\ 1.61\\ 3.93\\ 1.61\\ 3.93\\ 1.55\\ 3.04\\ 3.84\\ 5.88\\ 4.72\\$ | 2.6 2.6 5.11 2.11 30.3 69.8 27.74 31.00 29.22 45.8 42.63 38.00 37.33 23.8 ⁸ 25.22 24.93 24.92 24.92 24.93 25.22 24.93 24.93 25.22 24.93 25.22 24.93 25.22 24.93 25.22 24.93 25.22 26.93 27.43 27.43 27.43 27.44 27 |
| SSL-WM | Noise Blur Weather Digital Geomtric | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine | $\begin{array}{c} 11.24\\ 12.45\\ 6.12\\ 7.56\\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ 4.89\\ 6.17\\ 9.34\\ 10.03\\ 11.15\\ 12.00\\ 7.01\\ 3.87\\ 4.75\\ 6.27\\ 5.43\\ 4.22\end{array}$ | $\begin{array}{c} 0.12\\ 0.24\\ 0.39\\ \hline 0.31\\ 0.55\\ 0.48\\ 0.33\\ \hline 0.29\\ 0.30\\ 0.37\\ \hline 0.36\\ \hline 0.32\\ 0.41\\ 0.34\\ 0.37\\ \hline 0.31\\ 0.28\\ 0.30\\ 0.28\\ \hline 0.28\\ 0.30\\ 0.28\\ \hline 0.28\\ \hline 0.28\\ 0.28\\ \hline 0.28\\ \hline$ | 3.62 3.87 3.69 3.28 4.86 4.35 3.90 6.02 1.43 1.55 3.04 3.84 4.72 4.70 4.71 | $\begin{array}{c} 2.6 \\ 5.1 \\ 2.6 \\ 5.1 \\ 2.1 \\ 30.3 \\ 30.3 \\ 30.3 \\ 31.0 \\ 31.0 \\ 31.0 \\ 31.0 \\ 32.9 \\ 24.9 \\ 24.2 \\ 38.0 \\ 37.3 \\ 33.8 \\ 25.2 \\ 24.9 \\ 24.2 \\ 28.5 \\ 24.2 \\ 24.2 \\ 28.5 \\ 20.8 \\ \end{array}$ |
| SSL-WM | Noise Blur Weather Digital Geomtric Attack Category | Gaussian Shot Impulse Speckle Defocuts Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.83 PSNR | 0.12 0.24 0.39 0.31 0.55 0.48 0.33 0.29 0.30 0.37 0.36 0.37 0.36 0.32 0.41 0.37 0.37 0.37 0.31 0.28 0.37 0.28 0.32 0.28 0.32 0.28 | 3.62 3.87 3.69 3.29 4.86 4.35 3.32 4.86 4.35 3.90 6.02 1.43 1.55 3.04 3.84 5.88 5.88 5.88 5.84 5.88 5.88 5.84 5.88 5.84 5.84 | 2.6 5.1 2.1 30.3 69.8 27.7 31.0 29.2 24.9.2 45.8 42.6 38.00 37.3 37.3 33.8 23.8 25.2 24.9 24.9 24.9 24.9 24.9 24.9 24.9 24 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR | 0.12 0.24 0.39 0.31 0.55 0.48 0.33 0.29 0.30 0.37 0.36 0.37 0.36 0.32 0.41 0.37 0.37 0.31 0.28 0.30 0.28 0.30 0.28 0.30 0.28 | 3.62 3.87 3.89 3.28 3.32 4.86 4.35 3.93 1.61 3.93 1.61 3.93 1.61 3.93 1.61 3.93 1.61 3.93 4.72 4.73 4.72 4.70 4.71 Bit Acc | 2.6.6 2.6.6 5.1(2.1) 30.33 69.8 27.7 31.00 29.22 45.8 42.60 38.00 37.33 23.8 ⁸ 25.22 24.92 26.85 20.87 20.97 20. |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Piscelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR 5.35 | 0.12 0.24 0.39 0.31 0.55 0.48 0.33 0.29 0.30 0.37 0.36 0.37 0.36 0.32 0.41 0.34 0.31 0.34 0.37 0.31 0.28 0.30 0.28 SSIM 0.28 | 3.62 3.87 3.69 3.28 3.32 4.86 4.35 3.93 1.61 3.90 6.02 1.43 1.55 3.04 3.84 5.88 4.72 4.72 4.71 Bit Acc 9.75 2.57 | 2.6. 2.6. 5.1(2.1) 30.33 69.8 27.7 31.00 29.22 49.2 45.8 42.66 38.00 37.33 23.8' 25.22 24.92 24.92 24.2 28.5' 20.8' Dect Acc 9.11 2.84 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Piecewse Affine Gaussian Shot Impulse | 11:24 12:45 6:12 7:56 23:11 26:02 22:28 19:05 4:89 6:17 9:34 10:03 11:15 12:00 7:01 3:87 4:75 6:27 5:43 4:22 PSNR 5:19 3:85 7:25 | 0.12 0.24 0.39 0.31 0.55 0.48 0.33 0.29 0.30 0.37 0.36 0.37 0.36 0.32 0.41 0.34 0.34 0.34 0.37 0.31 0.28 SSIM 0.53 0.05 0.17 | 3.62 3.87 3.69 3.28 3.32 4.35 3.93 1.61 3.90 6.02 1.43 1.55 3.54 3.04 3.84 5.88 4.72 4.70 4.71 Bit Acc 9.75 2.57 1.87 | 2.6 2.6 5.11 2.13 30.33 69.8 27.7 31.00 29.22 49.8 40.8 40.0 40.2 40.2 40.8 40.8 40.8 40.2 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.8 40.2 40.4 40.2 40.4 40.2 40.4 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Piecewse Affine Gaussian Shot Impulse Speckle | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR 5.19 3.85 7.25 8.61 | 0.12 0.12 0.24 0.31 0.55 0.48 0.30 0.37 0.36 0.37 0.36 0.32 0.41 0.34 0.37 0.36 0.32 0.41 0.32 0.41 0.32 0.37 0.36 0.32 0.32 0.32 0.31 0.55 0.48 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.62 3.63 3.69 3.28 3.32 4.86 4.33 1.61 3.90 6.02 1.43 1.43 1.61 3.90 6.02 1.43 1.43 1.43 1.43 1.43 1.43 1.43 1.43 | 2.6.6 2.6.6 5.11 3.0.33 6.9.8 27.77 31.00 29.22 45.8 42.63 38.00 37.33 23.87 24.52 24.94 24.94 2 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise | Gaussian Shot Impulse Speckle Defocuts Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Piscelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle | $\begin{array}{c} 11.24\\ 12.45\\ 22.45\\ 6.12\\ 7.56\\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ 19.05\\ 19.05\\ 10.03\\ 11.15\\ 10.00\\ 7.01\\ 3.87\\ 11.15\\ 12.00\\ 7.01\\ 3.87\\ 11.15\\ 12.00\\ 7.01\\ 3.87\\ 12.5\\ 8.42\\ 22\\ \textbf{PSNR}\\ 5.19\\ 3.85\\ 7.25\\ 8.45\\ 7.25\\ 8.45\\ 1.25\\ 8.45\\ 1.25\\ $ | 0.12 0.24 0.24 0.31 0.55 0.48 0.33 0.29 0.30 0.37 0.36 0.37 0.36 0.37 0.36 0.37 0.37 0.36 0.37 0.37 0.37 0.36 0.37 0.37 0.37 0.37 0.36 0.37 0.37 0.37 0.36 0.37 0.37 0.37 0.37 0.36 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 | 3.62 3.63 3.69 3.28 3.32 4.83 4.33 1.61 3.90 6.02 1.43 1.55 3.04 3.84 4.72 4.70 4.70 4.70 4.70 Bit Acc 9.75 2.57 1.87 3.87 3.87 | 2.6.6 2.6.6 5.11 2.11 30.33 69.8 27.77 31.00 29.22 49.22 45.8 42.63 38.00 37.30 23.88 25.22 24.92 24.92 24.92 24.92 24.92 24.92 24.93 20.88 Dect Acc 9.92 9.42 80 Dect Acc 9.12 2.84 9.92 21.480 0.120 1.200 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR 5.19 3.85 7.25 8.61 6.648 8.12,11 0.02 | 0.12 0.12 0.24 0.31 0.55 0.33 0.29 0.30 0.33 0.33 0.33 0.33 0.33 0.37 0.37 | 3.62 3.87 3.87 3.28 3.32 4.86 4.35 3.93 1.61 3.93 1.61 3.93 1.61 3.93 1.61 3.93 1.61 3.93 4.35 3.04 4.35 5.88 4.72 4.70 4.71 Bit Acc 9.57 1.87 3.95 7.01 5.02 4.02 | 2.6.6 2.6.6 5.11 2.11 30.33 69.8 27.77 31.00 29.22 45.8 42.60 38.00 37.33 23.8 ⁸ 25.22 24.52 24.52 24.52 24.52 24.52 20.8 ⁸ Dect Acc 9.11 2.84 9.92 1.2 8.48 9.92 1.2 8.48 9.92 1.17 2.48 9.12 2.4.20 2.4 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixelate JPEG Scale Rotate Shear Picewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR 5.19 3.85 7.25 8.61 6.48 12.11 9.38 4.21 5.19 3.85 7.25 8.61 | 0.12 0.12 0.24 0.39 0.31 0.55 0.48 0.33 0.29 0.30 0.33 0.37 0.33 0.37 0.36 0.32 0.36 0.37 0.37 0.31 0.34 0.37 0.31 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.62 3.87 3.69 3.32 4.86 4.35 3.93 1.61 3.93 1.61 3.93 1.61 3.93 4.62 4.72 4.70 4.71 Bit Acc 9.75 2.57 1.87 3.95 5.55 3.55 | 2.6.6 2.6.6 5.11 2.13 30.33 69.8 27.77 31.00 29.22 49.2 49.2 49.2 49.2 49.2 49.2 49. |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Blur | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Piecewse Affine Piecewse Affine Defocus Shot Impulse Speckle Defocus Glass Motion Zoom | 11.245 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR 5.19 3.85 7.25 8.61 6.48 12.11 9.03 12.11 9.03 12.11 9.03 12.11 9.03 14.21 9.03 14.21 9.03 14.21 9.03 14.21 9.03 14.21 9.03 14.21 9.03 14.21 9.03 14.21 9.03 14.21 9.03 14.21 9.03 14.21 9.03 14.21 | 0.12 0.12 0.24 0.31 0.55 0.33 0.29 0.30 0.37 0.36 0.37 0.36 0.37 0.37 0.36 0.37 0.37 0.37 0.36 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 | 3.62 3.63 3.69 3.28 3.32 4.86 4.35 3.93 1.61 3.90 6.02 1.43 1.43 1.43 3.04 3.84 5.88 4.72 4.70 4.71 Bit Acc 9.75 2.57 1.87 3.95 7.01 5.95 7.01 5.02 4.18 4.88 4.88 4.88 | 2.67 2.67 5.11 2.11 30.33 69.8 27.77 31.00 29.22 45.8 42.63 38.00 37.33 23.87 24.52 24.92 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Utack | Gaussian Shot Impulse Speckle Defocuts Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocuts Glass Motion Zoom | $\begin{array}{c} 11.24\\ 11.24\\ 12.45\\ 6.12\\ 7.56\\ 23.11\\ 26.02\\ 22.28\\ 19.05\\ \hline \\ 4.89\\ 6.17\\ 9.34\\ 10.03\\ \hline \\ 11.15\\ 12.00\\ 7.01\\ 3.87\\ \hline \\ 1.15\\ 12.00\\ 7.01\\ 3.87\\ \hline \\ 5.19\\ 3.85\\ 7.25\\ 8.66\\ \hline \\ \mathbf{PSNP}\\ 5.19\\ 5.86\\ \hline \\ 12.11\\ 5.19\\ 3.85\\ 7.25\\ 8.61\\ \hline \\ \mathbf{S.19}\\ 3.85\\ \mathbf{S.25}\\ \mathbf{S.25}\\ \mathbf{S.19}\\ \mathbf{S.19}\\ \mathbf{S.19}\\ \mathbf{S.19}\\ \mathbf{S.19}\\ \mathbf{S.19}\\ \mathbf{S.25}\\ \mathbf{S.19}\\ \mathbf{S.25}\\ \mathbf{S.19}\\ \mathbf{S.25}\\ \mathbf{S.25}\\ \mathbf{S.25}\\ \mathbf{S.10}\\ \mathbf{S.25}\\ S.$ | 0.12 0.12 0.24 0.31 0.55 0.48 0.33 0.29 0.30 0.37 0.36 0.37 0.36 0.37 0.36 0.32 0.37 0.36 0.37 0.36 0.32 0.37 0.36 0.33 0.37 0.36 0.33 0.37 0.36 0.32 0.37 0.37 0.36 0.37 0.37 0.36 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 | 3.62 3.63 3.87 3.69 3.28 3.32 4.33 1.61 3.90 6.02 1.43 1.55 3.04 3.84 4.72 4.70 4.70 4.70 4.70 5.257 1.87 3.95 5.257 1.87 3.95 5.257 1.87 3.95 5.257 1.87 3.95 5.257 1.875 1.87 | 2.6.6 2.6.6 5.11 2.11 30.33 69.8 27.77 31.00 29.22 45.8 42.63 38.00 37.34 32.38 24.22 24.93 24.93 24.92 24.93 24.92 24.93 24.93 24.92 24.93 24.94 24.9 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Unitse Un | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 19.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR 5.19 3.85 7.25 8.45 8.41 8.11 9.34 4.12 5.43 4.22 | $\begin{array}{c} 0.30\\ 0.12\\ 0.24\\ 0.31\\ 0.55\\ 0.33\\ 0.29\\ 0.30\\ 0.33\\ 0.29\\ 0.30\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.37\\ 0.31\\ 0.38\\ 0.30\\ 0.28\\ \textbf{SSIM}\\ 0.38\\ 0.31\\ 0.17\\ 0.12\\ 0.28\\ 0.31\\ 0.17\\ 0.19\\ 0.02\\ 0.33\\ 0.31\\ 0.31\\ 0.31\\ 0.31\\ 0.31\\ 0.31\\ 0.31\\ 0.33\\ 0.31\\ 0.33\\ 0.31\\ 0.33\\ 0.31\\ 0.33\\ 0.31\\ 0.33\\ 0.31\\ 0.33\\ 0.31\\ 0.33\\ 0.31\\ 0.33\\ 0.$ | 3.62 3.67 3.69 3.28 3.32 4.86 4.33 3.93 1.61 3.94 4.75 3.04 4.75 3.04 4.75 3.04 4.70 4.71 1.87 3.97 4.70 4.71 1.87 3.97 4.70 4.71 1.87 3.97 4.70 4.71 1.87 3.93 4.70 4.71 1.87 3.93 4.70 4.71 1.87 3.93 4.70 4.71 1.87 3.93 4.70 4.71 1.87 3.93 4.70 4.71 1.87 3.93 4.70 4.71 1.87 3.93 4.70 4.71 1.87 3.93 4.72 4.70 4.70 4.70 4.70 4.70 4.70 4.70 4.70 | 2.6.6 2.6.6 5.11 2.11 30.33 69.8 27.77 31.00 29.22 45.8 42.63 38.00 37.33 23.8 ⁸ 25.22 24.92 24.92 24.92 24.92 24.92 24.92 24.92 24.92 24.92 24.92 24.92 24.93 20.8 ⁸ Dect Acc 9.92 14.80 0.27 7 1.50 1.10 0.27 7 1.50 1.40 4.29 8 4.02 1.20 1.17 8 1.00 1.20 1.17 8 1.00 1.20 1.17 8 1.00 8 1.20 1.20 1.20 1.20 1.20 1.20 2.21 2.21 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Snow Frost Fog Brightness | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR 5.19 3.85 7.25 8.61 6.48 6.21 9.03 14.01 2.278 3.48 4.13 3.02 | $\begin{array}{c} 0.30\\ 0.12\\ 0.24\\ 0.30\\ 0.31\\ 0.55\\ 0.48\\ 0.33\\ 0.29\\ 0.30\\ 0.33\\ 0.29\\ 0.30\\ 0.37\\ 0.31\\ 0.37\\ 0.31\\ 0.31\\ 0.31\\ 0.30\\ 0.28\\ \textbf{SSIM}\\ \textbf{SSIM}\\ \textbf{SSIM}\\ \textbf{SSIM}\\ 0.31\\ 0.32\\ 0.31\\ 0.30\\ 0.28\\ \textbf{SIM}\\ 0.17\\ 0.17\\ 0.24\\ 0.38\\ 0.38\\ 0.31\\ 0.17\\ 0.19\\ 0.02\\ 0.38\\ 0.38\\ 0.31\\ 0.28\\ 0.38\\ 0.31\\ 0.17\\ 0.19\\ 0.02\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.31\\ 0.20\\ 0.38\\ 0.3$ | 3.62 3.87 3.87 3.28 4.35 3.32 4.86 4.35 3.93 1.61 3.90 6.02 1.43 1.55 3.04 3.84 4.72 4.72 4.71 Bit Acc 9.75 2.57 1.87 3.95 7.01 5.02 4.88 4.38 4.38 4.72 4.72 4.71 5.25 7.01 5.02 4.88 4.38 5.88 4.72 4.72 4.71 5.73 7.01 5.02 4.88 4.38 5.88 4.35 5.50 7.01 5.02 4.38 5.02 4.38 5.02 4.35 5.02 4.38 5.02 5.02 4.38 5.02 5.02 5.02 5.02 4.38 5.02 5.02 5.02 5.02 5.02 5.02 5.02 5.02 | 2.6.6 2.6.6 5.11 2.11 30.33 69.8 27.77 31.00 29.22 45.8 42.66 38.00 37.31 23.8% 225.22 24.9 24.2 28.55 20.8% Dect Acc 9.11 2.84 9.92 14.80 1.17 3.10 0.27 7 1.50 14.04 29.48 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Unite Noise Noi | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixelate JPEG Scale Rotate Shear Pixelate JPEG Contrast Contrast Elastic Pixelate JPEG Scale Rotate Shear Picewse Affine Caussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR 5.19 3.85 7.25 8.66 6.48 12.11 9.03 14.21 19.03 14.21 12.41 | 0.12 0.12 0.24 0.31 0.55 0.38 0.30 0.31 0.55 0.48 0.30 0.31 0.32 0.33 0.39 0.30 0.31 0.32 0.31 0.32 0.31 0.32 0.31 0.32 0.31 0.32 0.33 0.30 0.31 0.32 0.33 0.34 0.37 0.38 0.30 0.32 0.44 0.37 0.45 0.42 0.44 0.45 0.41 0.42 0.41 0.41 0.41 0.41 0.41 0.42 | 3.62 3.87 3.69 3.29 4.86 4.35 3.93 1.61 3.93 1.61 3.93 1.61 3.93 4.62 4.70 4.71 Bit Acc 9.75 2.57 1.87 3.95 2.57 1.87 3.95 4.70 4.71 Bit Acc 9.75 2.57 1.87 3.95 4.70 4.71 5.25 5.25 5.25 5.25 5.25 5.25 5.25 5.2 | 2.616 2.616 5.11 2.18 30.33 69.81 27.77 31.00 29.22 49.22 49.22 49.22 49.22 49.23 42.66 38.00 37.33 23.88 25.22 24.92 24 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Uweather Digital | Gaussian Shot Impulse Speckle Defocuts Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piceewse Affine Perturbation Gaussian Shoar Impulse Speckle Defocuts Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Picelate Shear Picelate Speckle Defocuts Glass Motion Zoom | $\begin{array}{c} 11.24\\ 11.24\\ 12.45\\ 6.12\\ 7.56\\ 12.6\\ 7.56\\ 12.6\\ 12$ | 0.12 0.12 0.24 0.31 0.55 0.48 0.33 0.29 0.30 0.37 0.36 0.37 0.36 0.37 0.36 0.37 0.37 0.36 0.37 0.36 0.37 0.37 0.37 0.37 0.36 0.37 0.37 0.37 0.37 0.37 0.37 0.37 0.37 | 3.62 3.63 3.69 3.28 3.32 4.33 1.61 3.90 6.02 1.43 1.53 3.04 3.84 4.72 4.70 4.70 4.70 4.70 9.75 2.57 1.87 9.75 2.57 1.87 3.95 7.01 5.02 4.18 4.38 4.38 4.38 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 4.13 5.02 5.02 4.13 5.02 5.02 4.13 5.02 5.02 4.13 5.02 5.02 4.13 5.02 5.02 4.13 5.02 5.02 4.13 5.02 5.02 5.02 5.02 5.02 5.02 5.02 5.02 | 2.66 2.66 5.11 2.11 3.0.33 69.81 27.77 31.00 29.22 49.92 45.88 42.66 38.00 37.34 23.87 25.22 24.92 24. |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Weather Digital Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shoar Piccewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 4.89 6.17 9.34 9.34 9.34 9.34 9.34 9.34 9.34 9.34 | 0.12 0.12 0.24 0.31 0.55 0.48 0.30 0.31 0.55 0.48 0.30 0.31 0.32 0.36 0.37 0.36 0.37 0.36 0.37 0.36 0.37 0.36 0.37 0.38 0.30 0.28 0.30 0.53 0.53 0.53 0.53 0.54 0.28 0.38 0.53 0.53 0.53 0.54 0.53 0.53 0.31 0.17 0.19 0.03 0.24 0.24 | 3.62 3.63 3.69 3.67 4.33 4.435 4.435 4.435 4.435 6.02 6.02 6.02 6.02 6.02 6.02 6.02 6.02 | 2.66 2.66 5.11 2.11 3.0.33 69.81 27.77 31.00 29.22 49.22 45.88 42.65 38.00 37.30 23.88 24.52 24.52 24.52 24.52 24.52 24.52 24.52 24.52 24.52 24.52 24.52 24.52 24.52 24.52 24.52 24.55 20.88 Dect Acce 9.92 14.80 1.20 1.17 3.100 0.277 1.50 1.404 29.84 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.48 24.52 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Weather Digital Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Snow Frost Fog Snow Frost Sot Sot Shot Impulse Speckle Shear Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate Scala | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 5.43 4.22 PSNR 5.19 3.85 7.25 8.61 6.48 12.11 9.03 14.01 2.78 3.48 12.11 9.03 14.01 2.78 3.48 12.11 9.03 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 3.48 14.01 2.78 3.48 3.48 14.01 2.78 3.48 3.48 14.01 2.78 3.48 3.48 14.01 2.78 3.48 14.01 2.78 3.48 3.48 14.01 2.78 3.48 14.01 2.78 3.48 14.01 2.78 3.48 3.48 14.01 2.78 3.48 3.48 14.01 2.78 3.48 3.48 14.01 2.78 3.48 3.48 3.48 3.48 3.48 3.48 3.48 3.4 | 0.12 0.12 0.24 0.31 0.55 0.48 0.33 0.29 0.30 0.37 0.33 0.37 0.37 0.37 0.37 0.31 0.37 0.31 0.37 0.34 0.37 0.37 0.37 0.37 0.31 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 3.62 3.63 3.87 3.28 3.32 4.86 4.35 3.93 1.61 3.95 1.57 7.01 5.02 4.43 8.62 2.57 7.01 5.02 4.438 6.62 2.57 7.73 5.73 7.74 7.77 5.73 7.747 7.75 7.747 7.75 7.747 7.75 7.57 7.747 7.75 7.747 7.75 7.77 7.77 | 2.6:6 2.6:6 5.1(2.11) 3.0.33 69.81 27.7; 31.00 29.2; 49.2; 45.84 42.65 38.06 37.36 23.83 24.52 24.52 24.52 24.57 20.83 Dect Acc 9.11 2.84 9.92 14.80 1.20 1.17 3.10 0.27 7 1.50 14.04 29.85 24.92 24.22 24.25 25.25 26.25 24.25 24.25 24.25 24.25 24.25 24.25 24.25 24.25 24.25 24.25 24.25 24.25 24.25 24.25 24.25 25.25 24.25 2 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Weather Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fost Fost Fost Fost Fost Fost Elastic Pixelate JPEG Scale Rotate | 11.24 12.45 6.12 7.56 23.11 26.02 22.28 19.05 4.89 6.17 9.34 10.03 11.15 12.00 7.01 3.87 4.75 6.27 4.75 6.23 4.22 PSNR 5.19 3.85 7.25 8.61 6.48 12.11 9.03 14.01 12.08 6.28 3.48 4.22 PSNR 6.17 5.19 3.85 7.25 8.61 12.10 6.43 12.11 9.03 14.01 12.00 6.63 12.01 14.01 12.00 7.01 7.01 7.01 7.01 7.01 7.01 7.01 7 | 0.12 0.12 0.24 0.31 0.55 0.38 0.29 0.30 0.31 0.55 0.48 0.37 0.30 0.37 0.38 0.31 0.32 0.31 0.32 0.31 0.32 0.31 0.32 0.31 0.32 0.33 0.31 0.32 0.33 0.31 0.32 0.33 0.34 0.35 0.36 0.37 0.38 0.31 0.32 0.33 0.34 0.35 0.36 0.37 0.38 0.31 0.42 0.42 | 3.62 3.87 3.69 3.29 3.32 4.86 4.35 3.93 1.61 3.90 6.02 1.43 1.55 3.04 4.72 4.72 4.72 4.72 4.72 4.72 4.72 4.7 | 2.67 2.67 5.16 2.18 30.33 69.81 27.77 31.00 29.22 49.27 49.27 49.27 49.27 49.27 24.92 24.24 28.57 20.87 Dect Acc 9.02 14.80 9.02 14.80 9.02 14.80 1.17 3.10 0.027 7 1.50 14.04 29.44 8 5.34 24.25 25.25 20.87 20 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Uweather Digital Geomtric | Gaussian Shot Impulse Speckle Defocuts Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piceewse Affine Perturbation Gaussian Shotian Zoom Snow Frost Fog Bass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Stale Rotate Shear Picease Affine Contrast Elastic Pixelate JPEG Scale Rotate Scale Contrast Elastic Pixelate JPEG Scale Rotate Shear | $\begin{array}{c} 11.24\\ 11.24\\ 12.45\\ 6.12\\ 7.56\\ 12.6\\ 7.56\\ 12.6\\ 12$ | $\begin{array}{c} 0.30\\ 0.12\\ 0.24\\ 0.31\\ 0.55\\ 0.48\\ 0.33\\ 0.29\\ 0.30\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.37\\ 0.36\\ 0.38\\ 0.53\\ 0.53\\ 0.53\\ 0.53\\ 0.17\\ 0.19\\ 0.28\\ 0.38\\ 0.53\\$ | 3.62 3.63 3.87 3.69 3.28 3.32 4.33 1.61 3.90 6.02 1.43 1.58 4.72 4.70 4.70 4.70 4.70 4.70 4.70 4.70 9.75 2.57 1.87 3.95 7.01 5.02 4.18 4.38 4.38 4.72 2.57 1.87 3.95 7.01 5.02 4.18 4.38 4.38 4.38 4.38 4.38 4.38 4.38 4.3 | 2.67 2.67 5.10 2.18 30.33 69.81 27.77 31.00 29.22 49.92 45.84 42.65 38.00 37.34 23.87 25.22 24.9 |

Table 8: SDXL-Lightning image watermarks under image perturbations.

| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
|---------------------|--|---|--|---|--|---|
| | category | Gaussian | 10.10 | 0.20 | 0.00 | 14.15 |
| | | Shot | 19.19 | 0.30 | 2.23 | 35.73 |
| | Noise | Impulse | 17.70 | 0.27 | 5.01 | 8.26 |
| | | Speckle | 20.87 | 0.49 | 4.75 | 67.80 |
| | | Defocus | 24.43 | 0.75 | 8.24 | 38.18 |
| | Blur | Glass Motion | 27.98 | 0.86 | 10.37 | 92.87 |
| | | Zoom | 16.86 | 0.71 | 3.47 | 0.00 |
| | | Snow | 11.45 | 0.43 | 0.49 | 10.60 |
| DctDwtSvd-WM | I Westless | Frost | 15.81 | 0.66 | 2.68 | 19.44 |
| | weather | Fog | 11.88 | 0.57 | 0.47 | 0.72 |
| | | Brightness | 14.77 | 0.70 | 1.69 | 18.32 |
| | | Contrast | 13.94 | 0.56 | 0.61 | 2.10 |
| | Digital | Pixelate | 21.65 | 0.57 | 7.07 | 5.11 |
| | | JPEG | 28.70 | 0.83 | 7.23 | 0.00 |
| | | Scale | 11.36 | 0.33 | 2.26 | 1.43 |
| | Geomtric | Rotate | 9.83 | 0.26 | 2.06 | 16.60 |
| | | Biogeneo Affine | 11.18 | 0.35 | 3.05 | 6.49 7.56 |
| XX7 / 1 | 100 L C L | Tiecewse Annie | 10.20 | 0.01 | 0.00 | 7.50 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| | | Gaussian | 19.25 | 0.30 | 2.27 | 5.58 |
| | Noise | Impulse | 19.31 | 0.37 | 3.79 5.76 | 13.11 |
| | | Speckle | 20.98 | 0.51 | 7.90 | 28.58 |
| | | Defocus | 24.58 | 0.76 | 16.53 | 47.98 |
| | Blur | Glass | 28.39 | 0.89 | 22.61 | 94.15 |
| | LIUI | Motion | 21.96 | 0.73 | 12.57 | 48.42 |
| | | Zoom | 16.87 | 0.58 | 5.23 | 0.47 |
| RivaGAN-WM | | Snow | 11.50 | 0.44 | 0.50 | 5.56 |
| | Weather | Fog | 10.50 | 0.67 | 0.46 | 42.01 |
| | | Brightness | 14.97 | 0.73 | 2.27 | 31.75 |
| | | Contrast | 13.94 | 0.56 | 0.61 | 5.60 |
| | Digital | Elastic | 18.30 | 0.58 | 11.13 | 82.63 |
| | Digital | Pixelate | 21.70 | 0.64 | 12.52 | 5.54 |
| | | JPEG | 28.93 | 0.84 | 7.92 | 2.21 |
| | | Scale Botate | 0.83 | 0.33 | 3.15 2.73 | 74.49 |
| | Geomtric | Shear | 11.18 | 0.35 | 4.96 | 69.68 |
| | | Piecewse Affine | 17.27 | 0.52 | 9.30 | 82.23 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| | 0, | | | | | |
| | | Gaussian | 9.56 | 0.35 | 1.43 | 0.31 |
| | Noise | Gaussian Shot | 9.56 7.07 | 0.35 0.23 | 1.43 2.38 | 0.31 |
| | Noise | Gaussian Shot Impulse Speckle | 9.56 7.07 7.49 4.31 | 0.35 0.23 0.52 0.44 | 1.43 2.38 4.95 3.45 | 0.31 0.99 0.45 3.61 |
| | Noise | Gaussian Shot Impulse Speckle | 9.56 7.07 7.49 4.31 | 0.35 0.23 0.52 0.44 | 1.43 2.38 4.95 3.45 | 0.31 0.99 0.45 3.61 |
| | Noise | Gaussian Shot Impulse Speckle Defocus Glass | 9.56 7.07 7.49 4.31 23.04 19.93 | 0.35 0.23 0.52 0.44 0.34 0.29 | 1.43 2.38 4.95 3.45 4.10 2.21 | 0.31 0.99 0.45 3.61 39.60 89.56 |
| | Noise Blur | Gaussian Shot Impulse Speckle Defocus Glass Motion | 9.56 7.07 7.49 4.31 23.04 19.93 11.30 | 0.35 0.23 0.52 0.44 0.34 0.29 0.19 | 1.43 2.38 4.95 3.45 4.10 2.21 3.23 | 0.31 0.99 0.45 3.61 39.60 89.56 46.95 |
| | Noise Blur | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | 9.567.077.494.3123.0419.9311.3010.83 | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ \end{array}$ | $ \begin{array}{r} 1.43\\2.38\\4.95\\3.45\\\hline 4.10\\2.21\\3.23\\1.29\\\hline \end{array} $ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 39.60\\ 89.56\\ 46.95\\ 5.16\end{array}$ |
| CCI WA | Noise Blur | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow | 9.56 7.07 7.49 4.31 23.04 19.93 11.30 10.83 4.14 | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ \hline 0.34\\ 0.29\\ 0.19\\ 0.27\\ \hline 0.16\\ \end{array}$ | 1.43 2.38 4.95 3.45 4.10 2.21 3.23 1.29 0.82 | $\begin{array}{c} 0.31 \\ 0.99 \\ 0.45 \\ 3.61 \\ \hline 39.60 \\ 89.56 \\ 46.95 \\ 5.16 \\ \hline 6.00 \end{array}$ |
| SSL-WM | Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ \hline \\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ \hline \\ 4.14\\ 5.36\\ \hline \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ \end{array}$ | 1.43 2.38 4.95 3.45 4.10 2.21 3.23 1.29 0.82 0.80 | 0.31 0.99 0.45 3.61 39.60 89.56 46.95 5.16 6.00 19.53 |
| SSL-WM | Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Prost Fog Prost | 9.56 7.07 7.49 4.31 23.04 19.93 11.30 10.83 4.14 5.36 6.44 7.42 | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ \hline 0.16\\ 0.23\\ 0.33\\ 0.34\\ \end{array}$ | 1.43 2.38 4.95 3.45 4.10 2.21 3.23 1.29 0.82 0.82 0.80 1.13 | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 39.60\\ 89.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 40.12\\ 4$ |
| SSL-WM | Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.4\\ \end{array}$ | 1.43 2.38 4.95 3.45 4.10 2.21 3.23 1.29 0.82 0.80 1.13 1.43 | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 39.60\\ 89.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 42.13\\ 42.13\\ 39.45\\ 42.13\\ 4$ |
| SSL-WM | Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Floatic | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ \hline 23.04\\ 19.93\\ 11.30\\ 10.83\\ \hline 4.14\\ 5.36\\ 6.44\\ 7.43\\ \hline 7.43\\ \hline 7.42\\ 5.72\\ \hline 5.72\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ \end{array}$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ \hline 4.10\\ 2.21\\ 3.23\\ 1.29\\ \hline 0.82\\ 0.80\\ 1.13\\ 1.43\\ \hline 2.87\\ 3.98\\ \hline \end{array}$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 39.60\\ 89.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 42.13\\ 65.06\\ 34.44\end{array}$ |
| SSL-WM | Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ \hline \\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ \hline \\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ \hline \\ 7.42\\ 5.73\\ 9.02\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ \hline 0.34\\ 0.29\\ 0.19\\ 0.27\\ \hline 0.16\\ 0.23\\ 0.33\\ 0.34\\ \hline 0.49\\ 0.41\\ 0.22\\ \end{array}$ | 1.43 2.38 4.95 3.45 4.10 2.21 3.23 1.29 0.82 0.80 1.13 1.43 2.87 3.98 1.33 | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 39.60\\ 89.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 42.13\\ 55.06\\ 34.14\\ 22.93\\ \end{array}$ |
| SSL-WM | Noise Blur Weather Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ \end{array}\\ \begin{array}{c} 0.34\\ 0.29\\ 0.19\\ 0.27\\ \end{array}\\ \begin{array}{c} 0.16\\ 0.23\\ 0.33\\ 0.34\\ \end{array}\\ \begin{array}{c} 0.49\\ 0.41\\ 0.22\\ 0.39\\ \end{array}$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ \end{array}\\ \begin{array}{c} 4.10\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 1.43\\ 1.43\\ 1.43\\ 1.43\\ 1.43\\ 1.43\\ 1.45\\ \end{array}$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 39.60\\ 89.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.44\\ 42.13\\ 55.06\\ 34.14\\ 22.93\\ 23.56\end{array}$ |
| SSL-WM | Noise Blur Weather Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ \end{array}$ | 1.43 2.38 4.95 3.45 4.10 2.21 3.23 1.29 0.82 0.80 1.13 1.43 2.87 3.98 1.33 4.45 4.04 | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 89.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 42.13\\ 55.06\\ 34.14\\ 22.93\\ 23.56\\ 23.46\\ \end{array}$ |
| SSL-WM | Noise Blur Weather Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ \hline 7.42\\ 5.73\\ 9.02\\ 8.18\\ 8.18\\ 9.90\\ 7.65\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.37\\ \end{array}$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 4.10\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 1.43\\ 1.43\\ 1.43\\ 1.43\\ 4.45\\ 4.04\\ 5.73\end{array}$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 3.9.60\\ 89.56\\ 46.95\\ 5.16\\ 42.13\\ 39.45\\ 42.13\\ 55.00\\ 33.945\\ 42.13\\ 22.93\\ 23.56\\ 23.46\\ 22.74\\ \end{array}$ |
| SSL-WM | Noise Blur Weather Digital Geomtric | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixeous Affanci | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 7.65\\ 2.64\\ 3.95\end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.37\\ 0.28\\ 0.31\\ 0.31\\ 0.31\\ 0.31\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.29\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.32\\ 0.33\\ 0.34\\ 0.32\\ 0.33\\ 0.34\\ 0.33\\ 0.34\\ 0.32\\ 0.33\\ 0.34\\ 0.33\\ 0.34\\ 0.33\\ 0.34\\ 0.32\\ 0.33\\ 0.34\\ 0.32\\ 0.33\\ 0.34\\ 0.33\\ 0.34\\ 0.32\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.34\\ 0.32\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.34\\ 0.33\\$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ \hline \\ 4.10\\ 2.21\\ 3.23\\ 1.29\\ \hline \\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 1.43\\ 1.43\\ 1.43\\ 4.45\\ \hline \\ 4.04\\ 5.73\\ 6.79\\ 5.46\\ \hline \end{array}$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 39.60\\ 89.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.44\\ 42.13\\ 55.06\\ 22.93\\ 23.56\\ 23.46\\ 22.74\\ 21.57\\ 22.74\\ 21.57\\ 22.74\\ 21.57\\ 22.74\\ 22.74\\ 21.57\\ 22.74\\ 2$ |
| SSL-WM | Noise Blur Weather Digital Geomtric | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.43\\ 7.43\\ 7.43\\ 7.43\\ 9.02\\ 8.18\\ 9.90\\ 2.65\\ 2.64\\ 3.765\\ 2.64\\ 3.765\\ 2.64\\ 3.765\\ 2.64\\ 3.765\\ 2.64\\ 3.765\\ 3.$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.01\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 2.87\\ 3.98\\ 1.33\\ 4.45\\ 4.04\\ 5.73\\ 6.79\\ 5.76\\ 5.76\\$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 39.60\\ 89.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 42.13\\ 55.06\\ 34.14\\ 22.33\\ 23.56\\ 23.46\\ 22.74\\ 21.57\\ 0.00\\ \end{array}$ |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine | 9.56 7.07 7.49 4.31 23.04 19.93 11.30 10.83 4.14 5.36 6.44 7.43 7.42 5.73 9.02 8.18 9.90 7.65 2.64 3.35 PSNR | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.01\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.39\\ 0.21\\ \textbf{SIIM} \end{array}$ | | 0.31 0.99 0.45 3.61 46.95 5.16 6.00 19.53 39.45 42.13 55.06 34.14 22.93 23.56 23.46 22.74 22.74 21.57 0.00 Dect Acc |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot | 9.56 7.07 7.49 4.31 23.04 19.93 11.30 10.83 4.14 5.36 6.44 7.43 7.42 5.73 9.02 8.18 9.90 7.65 2.64 3.35 PSNR | 0.35 0.23 0.52 0.44 0.29 0.19 0.27 0.16 0.23 0.33 0.34 0.49 0.41 0.22 0.39 0.02 0.37 0.28 0.21 SSIM 0.54 0.54 | 1.43 2.38 4.95 3.45 3.45 0.82 0.80 1.13 1.43 2.87 3.98 1.33 4.45 4.04 5.73 6.79 5.46 Bit Acc 2.11 2.41 | 0.31 0.99 0.45 3.616 89.56 46.95 5.16 6.00 19.53 39.45 39.45 39.45 39.45 39.45 32.35 23.46 22.74 22.74 22.74 22.74 22.74 21.57 0.000 Dect Acc 23.46 22.74 21.84 6 79 0.000 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 7.65\\ 2.64\\ 3.35\\ \textbf{PSNR}\\ 4.07\\ 4.47\\ 7.58\\ \end{array}$ | 0.35 0.23 0.52 0.44 0.29 0.19 0.27 0.16 0.23 0.34 0.41 0.22 0.39 0.41 0.29 0.34 0.41 0.23 0.34 0.41 0.23 0.34 0.41 0.23 0.39 0.20 0.20 0.37 0.28 0.29 0.21 0.29 0.20 0.20 0.20 0.20 0.20 0.20 0.20 | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.33\\ 1.43\\ 2.87\\ 3.38\\ 4.45\\ 4.45\\ 5.73\\ 6.79\\ 5.46\\ \textbf{Bit} \textbf{Acc}\\ \textbf{Bit} \textbf{Acc}\\ 2.11\\ 2.49\\ 1.92\\$ | 0.31 0.99 0.45 3.61 46.95 5.16 6.00 19.53 39.45 42.13 55.06 34.14 22.93 23.56 23.46 22.74 21.57 0.00 Dect Acc 21.84 6.72 21.84 |
| SSL-WM Watermark | Noise Noise Noise Attack Category Noise | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle | 9.56 7.07 7.49 4.31 23.04 19.93 11.30 10.83 4.14 5.36 6.44 7.43 7.42 5.73 9.02 8.18 9.90 7.65 2.64 3.35 PSNR 4.07 4.47 7.58 8.558 | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.34\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.16\\ 0.24\\ 0.16\\ 0.24\\ 0.16\\ 0.24\\ 0.16\\ 0.24\\ 0.16\\ 0.24\\ 0.24\\ 0.16\\ 0.24\\$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 2.87\\ 3.98\\ 1.33\\ 4.45\\ 4.04\\ 5.73\\ 6.79\\ 5.46\\ \hline {\bf Bit} \ {\bf Acc}\\ {\bf 2.11}\\ 2.49\\ 1.92\\ 3.00\\ \hline {\bf 1.12}\\ 2.11\\ 2.49\\ 1.92\\ 3.00\\ \hline {\bf 1.12}\\ 2.11\\ 2.49\\ 1.92\\ \hline {\bf 1.12}\\ 2.11\\ 2.12\\ 2.11\\ 2.12\\ 2.11\\ 2.12$ | 0.31 0.99 0.45 3.616 46.99 5.16 6.00 19.53 39.45 42.13 55.06 34.14 22.93 23.56 23.46 22.74 21.57 0.000 Dect Acc 21.84 6.72 18.57 18.75 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 7.65\\ 2.64\\ 3.35\\ \textbf{PSNR}\\ \textbf{PSNR}\\ 4.07\\ 4.47\\ 7.58\\ 8.55\\ 10.33\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.39\\ 0.02\\ 0.39\\ 0.02\\ 0.39\\ 0.21\\ \textbf{SIM}\\ 0.21\\ \textbf{SIM}\\ 0.24\\ 0.53\\ 0.24\\ 0.55\\ 0.25\\ 0$ | 1.43 2.38 4.95 3.45 3.21 3.23 1.29 0.82 0.80 1.13 1.43 2.87 3.98 1.33 4.45 4.04 5.73 6.79 5.46 Bit Acc 2.17 3.98 1.33 4.45 4.10 2.87 3.98 1.33 4.45 5.16 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1.17 1 | 0.31 0.99 0.45 3.616 8.9.56 46.95 5.16 6.00 19.53 39.45 42.13 55.06 23.46 22.74 21.57 0.00 Dect Acc 21.84 6.72 14.95 18.75 21.75 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Blur | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass | 9.56 7.07 7.49 4.31 23.04 19.93 11.30 0.0.83 4.14 5.36 6.44 7.43 7.42 5.73 9.02 8.18 9.90 7.65 2.64 3.35 PSNR 4.07 4.47 7.58 8.58 8.58 | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.4\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.39\\ 0.02\\ 0.39\\ 0.21\\ \hline \textbf{SSIM}\\ 0.24\\ 0.53\\ 0.24\\ 0.16\\ 0.39\\ 0.05\\ \end{array}$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 2.87\\ 3.98\\ 1.33\\ 4.45\\ 4.04\\ 5.73\\ 4.04\\ 5.73\\ 6.79\\ 5.46\\ \textbf{Bit} \ \textbf{Acc}\\ \textbf{Bit} \ \textbf{Acc}\\ 2.11\\ 2.11\\ 2.41\\ 9.2\\ 3.00\\ 4.82\\ 5.08\\ \end{array}$ | 0.31 0.99 0.45 3.61 46.95 5.16 6.00 19.53 39.45 42.13 55.06 34.14 22.93 23.56 23.46 22.74 22.74 21.75 0.00 Dect Acc 21.84 6.72 14.95 18.75 22.92 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Blur Blur | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 9.90\\ 7.65\\ 2.64\\ 3.35\\ \textbf{PSNR}\\ 4.07\\ 4.47\\ 7.58\\ 8.58\\ 8.58\\ 10.33\\ 11.74\\ 13.75\\ 10.90\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.21\\ 0.22\\ 0.37\\ 0.28\\ 0.21\\ 0.02\\ 0.37\\ 0.28\\ 0.21\\ 0.02\\ 0.37\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.55\\ 0.42\\ 0.05\\ 0.05\\ 0.42\\ 0.05\\$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 3.45\\ 0.82\\ 0.80\\ 0.80\\ 0.82\\$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 3.9.60\\ 8.9.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 3.9.45\\ 42.13\\ 55.06\\ 3.9.45\\ 42.13\\ 55.06\\ 3.9.45\\ 42.13\\ 23.56\\ 22.74\\ 22.74\\ 22.74\\ 22.75\\ 21.57\\ 0.00\\ \hline \textbf{Dect Acc}\\ 21.84\\ 6.72\\ 11.87\\ 5.8.75\\ 21.75\\ 22.92\\ 10.32\\ 22.92\\ 10.32\\ 20.90\\ 9.90\\$ |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Blur | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Glass Shotion Zoom | 9.56 7.07 7.49 4.31 23.04 19.93 11.30 10.83 4.14 5.36 6.44 7.43 7.42 5.73 9.02 8.18 9.90 2.818 9.902 8.18 8.18 9.902 8.18 9.902 8.18 8.18 9.902 8.18 8.18 9.902 8.18 8.18 9.902 8.18 8.103 9.902 8.18 8.18 9.902 8.18 9.902 8.18 9.902 8.18 9.902 8.18 9.902 8.18 9.902 8.18 9.902 | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.44\\ 0.29\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.41\\ 0.22\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.44\\ 0.16\\ 0.39\\ 0.05\\ 0.42\\ 0.039\\ 0.05\\ 0.42\\ 0.042\\ 0.00\\ 0.00\\ 0.02\\ 0.039\\ 0.05\\ 0.42\\ 0.039\\ 0.05\\ 0.42\\ 0.039\\ 0.05\\ 0.42\\ 0.042\\ 0.042\\ 0.05\\ 0.42\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05\\ 0.44\\ 0.16\\ 0.05$ | 1.43 2.38 4.95 3.45 3.45 0.82 0.82 0.82 0.82 0.82 0.82 0.82 0.82 | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 89.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.44\\ 42.13\\ 55.06\\ 39.44\\ 42.13\\ 55.06\\ 39.44\\ 42.13\\ 22.93\\ 23.56\\ 23.56\\ 23.46\\ 22.74\\ 21.57\\ 0.00\\ \hline \textbf{Dect Acc}\\ 21.84\\ 6.72\\ 14.95\\ 18.75\\ 18.75\\ 21.75\\ 22.030\\ 22.030\\ \hline \textbf{Colored}\\ 22.030\\ \mathbf{Colored}\\ Colore$ |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Utuel | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piceewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.902\\ 8.18\\ 9.902\\ 8.18\\ 9.902\\ 8.18\\ 9.902\\ 8.18\\ 9.902\\ 8.18\\ 10.33\\ 11.74\\ 4.47\\ 7.58\\ 8.558\\ 10.33\\ 11.74\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ $ | $\begin{array}{c} 0.35\\ 0.23\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.44\\ 0.29\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.39\\ 0.05\\ 0.42\\ 0.39\\ 0.05\\ 0.42\\ 0.00\\ 0.45\\ 0.00\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.45\\ 0.35\\ 0.35\\ 0.35\\ 0.35\\ 0.35\\ 0.45\\ 0.35\\$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 2.87\\ 3.98\\ 1.33\\ 4.45\\ 4.573\\ 6.79\\ 5.76\\ \textbf{Bit} \textbf{Acc}\\ \textbf{Bit} \textbf{Acc}\\ \textbf{Bit} \textbf{Acc}\\ \textbf{S}, \textbf$ | 0.33 0.95 0.45 3.616 89.56 46.95 5.16 6.00 19.53 39.44 42.13 55.00 39.44 42.13 55.00 39.44 22.93 23.56 23.46 22.74 21.55 0.00 Dect Acc 21.84 6.72 14.95 18.875 21.75 22.92 10.32 20.30 44.78 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Unitse Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixelate Shear Piceewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 4.14\\ 5.36\\ 4.14\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 7.65\\ 2.64\\ 3.35\\ \textbf{PSNR}\\ \textbf{PSNR}\\ 4.07\\ 7.58\\ 8.558\\ 10.33\\ 11.74\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 3.56\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.39\\ 0.02\\ 0.39\\ 0.02\\ 0.39\\ 0.21\\ 0.28\\ 0.21\\ 0.39\\ 0.21\\ 0.39\\ 0.05\\ 0.39\\ 0.05\\ 0.39\\ 0.05\\ 0.44\\ 0.65\\ 0.39\\ 0.05\\ 0.45\\ 0.37\\ 0.03\end{array}$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 2.87\\ 3.98\\ 1.33\\ 4.45\\ 5.73\\ 6.79\\ 5.46\\ \textbf{Bit} \ \textbf{Acc}\\ \textbf{Bit} \ \textbf{Acc}\\ \textbf{Bit} \ \textbf{Acc}\\ 2.19\\ 1.92\\ 3.00\\ 3.00\\ 4.82\\ 5.08\\ 5.71\\ 4.32\\ 4.82\\ 5.55\\ 4.18\\ 4.28\\ 5.55\\ 4.18\\ 1.28\\ 1.25\\ 1.28\\ 1.$ | 0.33 0.45 3.61 8.9.55 46.99 5.10 6.00 19.55 39.44 42.13 55.00 34.14 22.33 23.55 23.46 22.74 21.57 0.00 Dect Acc 21.55 22.92 21.55 22.92 21.03 22.92 21.03 22.92 21.03 22.93 20.30 44.78 17.81 14.75 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 7.65\\ 2.64\\ 3.35\\ \textbf{PSNR}\\ \textbf{PSNR}\\ 4.07\\ 4.47\\ 7.58\\ 8.58\\ 10.33\\ 11.74\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 3.56\\ 4.08\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.41\\ 0.22\\ 0.33\\ 0.34\\ 0.41\\ 0.22\\ 0.37\\ 0.28\\ 0.21\\ \textbf{SSIM}\\ \hline \textbf{SSIM}\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.55\\ 0.42\\ 0.05\\ 0.42\\ 0.03\\ 0.03\\ 0.03\\ 0.03\\ 0.03\\ 0.01\\ 0.03\\ 0.00\\ 0.05\\ 0.03\\ 0.00\\ 0.0$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 2.87\\ 4.04\\ 5.73\\ 6.79\\ 5.46\\ \mathbf{Bit} \mathbf{Acc}\\ \mathbf{Bit} \mathbf{Acc}\\ \mathbf{Bit} \mathbf{Acc}\\ \mathbf{Bit} \mathbf{Acc}\\ 5.73\\ 5.55\\ 5.55\\ 4.18\\ 2.55\\ 5.54\\ \mathbf{Acc}\\ \mathbf{Acc}\\$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 8.9.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 42.13\\ 55.06\\ 33.945\\ 42.13\\ 55.06\\ 33.945\\ 42.13\\ 23.56\\ 22.93\\ 23.56\\ 22.74\\ 22.74\\ 22.73\\ 21.57\\ 0.00\\ \hline \textbf{Dect Acc}\\ 21.84\\ 6.72\\ 21.85\\ 18.75\\ 21.75\\ 22.92\\ 10.32\\ 22.030\\ 44.78\\ 17.81\\ 14.75\\ 21.80\\ \hline Call and and and and and and and and and and$ |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Units Weather | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Speckle Defocus Glass Speckle Spe | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 2.64\\ 3.35\\ \textbf{PSNR}\\ 4.07\\ 4.47\\ 7.58\\ 8.58\\ 8.58\\ 10.33\\ 11.74\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 3.56\\ 4.07\\ 4.408\\ 13.77\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.44\\ 0.29\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.33\\ 0.34\\ 0.41\\ 0.22\\ 0.37\\ 0.28\\ 0.02\\ 0.37\\ 0.28\\ 0.21\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.65\\ 0.42\\ 0.00\\ 0.05\\ 0.42\\ 0.00\\ 0.45\\ 0.37\\ 0.03\\ 0.10\\ 0.09\\ 0.09\\ 0.09\\ 0.09\\ 0.09\\ 0.09\\ 0.09\\ 0.09\\ 0.09\\ 0.00\\ 0.09\\ 0.00\\ 0.09\\ 0.00\\ 0.09\\ 0.00\\ 0.09\\ 0.00\\$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.33\\ 1.43\\ 2.87\\ 3.33\\ 4.45\\ 5.73\\ 6.79\\ 5.46\\ \textbf{Bit} \ \textbf{Acc}\\ \textbf{Bit} \ \textbf{Acc}\\ \textbf{Bit} \ \textbf{Acc}\\ \textbf{S}, 73\\ 6.79\\ 5.46\\ \textbf{Bit} \ \textbf{Acc}\\ \textbf{S}, 73\\ 6.79\\ 5.46\\ \textbf{S}, 73\\ 1.22\\ \textbf{S}, 55\\ 1.12\\ \textbf{S}, 12\\ \textbf{S}, 12\\$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 8.9.56\\ 46.95\\ 5.16\\ 6.00\\ 19.55.06\\ 39.45\\ 39.45\\ 42.13\\ 55.06\\ 39.45\\ 42.13\\ 22.39\\ 23.56\\ 23.46\\ 22.74\\ 22.74\\ 22.74\\ 22.74\\ 22.74\\ 22.74\\ 22.74\\ 22.74\\ 23.56\\ 23.46\\ 22.74\\ 1.55\\ 23.56\\ 23.46\\ 1.75\\ 20.30\\ 20.30\\ 44.78\\ 17.81\\ 14.75\\ 21.80\\ 23.72\\ 20.30\\ 20.30\\$ |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Blur Ueather Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Picewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | 9.56 7.07 7.49 4.31 23.04 19.93 11.30 10.83 4.14 5.36 6.44 7.43 7.42 5.73 9.02 8.18 9.90 7.65 2.64 3.35 PSNR 4.07 4.47 7.42 8.58 10.33 11.74 13.75 10.99 10.41 17.04 3.56 4.377 18.80 9.90 9.10 4.37 17.04 17.75 | $\begin{array}{c} 0.35\\ 0.23\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.44\\ 0.29\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.37\\ 0.28\\ 0.03\\ 0.02\\ 0.37\\ 0.28\\ 0.00\\ 0.42\\ 0.00\\ 0.42\\ 0.00\\ 0.45\\ 0.39\\ 0.05\\ 0.42\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 89.56\\ 46.93\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 42.13\\ 55.06\\ 39.45\\ 42.13\\ 55.06\\ 34.14\\ 22.93\\ 23.56\\ 23.46\\ 22.74\\ 21.57\\ 0.00\\ \hline \textbf{Dect Acc}\\ 21.84\\ 6.72\\ 21.84\\ 6.72\\ 21.85\\ 18.75\\ 22.92\\ 20.30\\ \hline \textbf{d}4.78\\ 14.75\\ 22.32\\ 20.30\\ \hline \textbf{d}4.78\\ 14.75\\ 22.72\\ 3.11\\ 1.5\\ 1.5\\ 1.5\\ 1.5\\ 1.5\\ 1.5\\ 1.5\\ $ |
| SSL-WM Watermark | Noise Blur Weather Bigital Geomtric Attack Category Noise Blur Uigital Digital Digital Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixelate JPEG Scale Rotate Shear Pixelate JPEG Contrast Elastic Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.902\\ 8.18\\ 9.902\\ 8.18\\ 9.902\\ 8.18\\ 9.902\\ 8.18\\ 9.902\\ 8.18\\ 10.33\\ 11.74\\ 4.47\\ 7.58\\ 8.558\\ 10.33\\ 11.74\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 4.07\\ 4.47\\ 7.58\\ 8.553\\ 10.33\\ 11.74\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 4.08\\ 3.55\\ 10.99\\ 10.41\\ 17.04\\ 3.56\\ 4.08\\ 3.53\\ 6.10\\ 0.35\\ 10.33\\ 11.74\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 3.56\\ 4.08\\ 3.53\\ 6.10\\ 0.35\\ 10.33\\ 11.74\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 10.41\\ 17.04\\ 3.56\\ 4.08\\ 3.53\\ 6.10\\ 0.35\\ 10.52\\$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.44\\ 0.29\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.28\\ 0.37\\ 0.33\\ 0.10\\ 0.00\\ 0.45\\ 0.39\\ 0.05\\ 0.45\\ 0.39\\ 0.05\\ 0.45\\ 0.39\\ 0.05\\ 0.45\\ 0.39\\ 0.00\\ 0.45\\ 0.39\\ 0.00\\ 0.00\\ 0.22\\ 0.21\\ 0.30\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.30\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.30\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.30\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.00\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.00\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.00\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.00\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.00\\ 0.02\\ 0.22\\ 0.21\\ 0.30\\ 0.00\\$ | 1.43 2.38 4.95 3.45 3.24 3.23 1.29 0.82 0.82 0.82 0.83 1.33 1.43 2.87 3.98 1.33 4.45 4.573 6.79 5.76 Bit Acc Bit Acc Bit Acc 2.49 1.92 3.00 Bit Acc 2.55 4.18 2.55 5.55 4.18 2.25 5.55 4.14 2.25 5.55 4.14 | 0.31 0.99 0.45 3.616 46.99 5.16 6.00 19.53 39.44 42.13 55.06 39.44 42.13 55.06 23.46 22.74 21.55 0.000 Dect Acc 21.84 6.72 14.95 18.87 5 21.75 22.92 20.30 44.78 14.95 14.75 21.75 22.92 20.30 44.78 14.75 21.84 5 21.75 22.92 20.30 44.78 14.75 21.84 5 21.75 22.92 20.30 44.78 14.75 21.84 5 21.75 21.85 2 |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Attack Category Noise Blur Ueather Digital Digital Digital | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shoar Pixelate Shear Pixelate Shear Pixelate Shear Pixelate Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Shot Shot Shot Shot Shot Shot Shot Shot | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 0.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 7.65\\ 2.64\\ 3.35\\ \textbf{PSNR}\\ \textbf{PSNR}\\ 4.07\\ 4.47\\ 7.58\\ 8.10.33\\ 11.74\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 3.56\\ 4.08\\ 13.77\\ 18.80\\ 0.353\\ 3.53\\ 6.10\\ 3.53\\ 6.10\\ 0.775\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.19\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.41\\ 0.22\\ 0.39\\ 0.02\\ 0.39\\ 0.02\\ 0.39\\ 0.02\\ 0.39\\ 0.21\\ 0.39\\ 0.21\\ 0.39\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.53\\ 0.24\\ 0.05\\ 0.45\\ 0.37\\ 0.03\\ 0.10\\ 0.09\\ 0.22\\ 0.21\\ 0.09\\ 0.22\\ 0.21\\ 0.04\\$ | 1.43 2.38 4.95 3.45 3.45 1.29 0.82 0.80 1.13 1.43 2.87 3.98 1.33 4.45 4.67 5.73 6.79 5.46 Bit Acc 2.49 1.24 9.300 5.71 3.92 3.00 5.71 3.92 5.08 5.71 4.32 5.08 5.71 4.32 5.55 4.18 2.25 5.14 0.05 2.10 0.05 0.05 0.05 0.05 0.05 0.00 0.05 0.000000 | 0.31 0.99 0.45 3.616 8.9.56 46.99 5.16 6.00 19.53 39.45 42.13 55.06 39.45 42.13 34.14 22.93 23.56 23.46 22.74 21.57 0.00 Dect Acc 21.75 22.92 20.30 Acc 21.75 22.92 20.30 44.78 17.81 14.75 21.80 22.83 22.93 20.30 |
| SSL-WM Watermark | Noise Blur Geomtric Attack Category Noise Blur Uigital Geomtric Digital Geomtric Category | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Sonw Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixelate JPEG Scale Rotate Shot Impulse Speckle Defocus Glass Motion Zoom Snow | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 2.64\\ 3.35\\ \textbf{PSNR}\\ 4.07\\ 4.47\\ 7.58\\ 8.58\\ 8.58\\ 8.58\\ 10.33\\ 11.74\\ 4.47\\ 7.58\\ 8.58\\ 8.58\\ 10.33\\ 11.74\\ 13.75\\ 10.33\\ 11.74\\ 13.75\\ 10.33\\ 3.56\\ 10.33\\ 3.56\\ 10.33\\ 3.56\\ 10.56\\ 13.77\\ 18.80\\ 3.55\\ 6.10\\ 7.75\\ 1.78\\ 8.0\\ 3.55\\ 6.10\\ 7.75\\ 1.78\\ 1.78\\ 1.75\\ 1.78\\ 1.78\\ 1.75\\ 1.78\\ 1.78\\ 1.75\\ 1.78\\ 1.7$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.29\\ 0.44\\ 0.29\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.21\\ 0.22\\ 0.37\\ 0.28\\ 0.21\\ 0.52\\ 0.42\\ 0.16\\ 0.39\\ 0.05\\ 0.42\\ 0.37\\ 0.03\\ 0.00\\$ | $\begin{array}{c} 1.43\\ 2.38\\ 4.95\\ 3.45\\ 2.21\\ 3.23\\ 1.29\\ 0.82\\ 0.80\\ 1.13\\ 1.43\\ 2.87\\ 3.87\\ 3.445\\ 4.57\\ 4.573\\ 6.79\\ 5.46\\ 8 \\ 1.33\\ 4.45\\ 4.573\\ 6.79\\ 5.46\\ 8 \\ 1.33\\ 4.45\\ 4.573\\ 6.79\\ 5.46\\ 5.73\\ 6.79\\ 5.46\\ 5.73\\ 6.79\\ 5.46\\ 5.73\\ 6.79\\ 5.46\\ 5.73\\ 6.79\\ 5.46\\ 5.73\\ 6.79\\ 5.41\\ 8 \\ 2.25\\ 5.55\\ 5.14\\ 1.8\\ 2.25\\ 5.54\\ 1.8\\ 2.25\\ 5.14\\ 1.8\\ 2.25\\ 5.14\\ 1.8\\ 2.25\\ 5.14\\ 1.8\\ 2.25\\ 5.14\\ 1.8\\ 2.25\\ 5.14\\ 1.8\\ 2.25\\ 5.14\\ 1.8\\ 2.25\\ 1.48\\ 2.25\\ 1.48\\ 2.25\\ 1.48\\ 2.25\\ 1.48\\ 2.25\\ 1.48\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 2.25\\ 1.48\\ 1.8\\ 1.8\\ 1.8\\ 1.8\\ 1.8\\ 1.8\\ 1.8\\ 1.$ | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 8.9.56\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 42.13\\ 55.06\\ 39.45\\ 42.13\\ 55.06\\ 39.45\\ 42.13\\ 23.356\\ 22.74\\ 22.74\\ 22.73\\ 23.56\\ 22.74\\ 1.57\\ 20.12\\ 1.57\\ 20.12\\ 1.57\\ 20.12\\ 1.57\\ 22.92\\ 10.32\\ 22.030\\ 20.30\\ 41.78\\ 17.81\\ 17.81\\ 17.81\\ 17.81\\ 17.81\\ 17.81\\ 17.81\\ 17.81\\ 18.75\\ 21.85\\ 5.60\\ \end{array}$ |
| SSL-WM Watermark | Noise Blur Weather Digital Geomtric Blur Units U | Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Speckle Speckle Speck | $\begin{array}{c} 9.56\\ 7.07\\ 7.49\\ 4.31\\ 23.04\\ 19.93\\ 11.30\\ 10.83\\ 4.14\\ 5.36\\ 6.44\\ 7.43\\ 7.42\\ 5.73\\ 9.02\\ 8.18\\ 9.90\\ 2.64\\ 3.35\\ \textbf{PSNR}\\ 4.07\\ 4.47\\ 7.58\\ 8.58\\ 8.58\\ 10.33\\ 11.74\\ 4.47\\ 7.58\\ 8.58\\ 8.58\\ 10.33\\ 11.75\\ 10.99\\ 10.41\\ 13.75\\ 10.99\\ 10.41\\ 17.04\\ 3.56\\ 4.07\\ 18.80\\ 3.56\\ 6.10\\ 7.75\\ 1.78\\ 1.78\\ 4.37\\ \end{array}$ | $\begin{array}{c} 0.35\\ 0.23\\ 0.52\\ 0.44\\ 0.34\\ 0.29\\ 0.44\\ 0.29\\ 0.27\\ 0.16\\ 0.23\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.34\\ 0.49\\ 0.33\\ 0.21\\ \textbf{SSIM}\\ 0.22\\ 0.37\\ 0.28\\ 0.21\\ \textbf{SSIM}\\ 0.24\\ 0.53\\ 0.24\\ 0.37\\ 0.03\\ 0.42\\ 0.00\\ 0.42\\ 0.00\\ 0.42\\ 0.00\\ 0.42\\ 0.00\\ 0.42\\ 0.00\\ 0.42\\ 0.00\\ 0.42\\ 0.00\\ 0.42\\ 0.00\\ 0.5\\ 0.5\\ 0.5\\ 0.5\\ 0.5\\ 0.5\\ 0.$ | 1.43 2.38 4.95 3.45 3.45 0.82 0.82 0.82 0.82 0.82 0.82 0.82 0.82 | $\begin{array}{c} 0.31\\ 0.99\\ 0.45\\ 3.61\\ 8.956\\ 46.95\\ 5.16\\ 6.00\\ 19.53\\ 39.45\\ 42.13\\ 55.06\\ 39.45\\ 42.13\\ 55.06\\ 39.44\\ 22.93\\ 22.356\\ 23.46\\ 22.74\\ 22.74\\ 21.57\\ 0.00\\ \hline \textbf{Dect Acc}\\ 21.84\\ 6.72\\ 21.84\\ 6.72\\ 21.84\\ 6.72\\ 21.84\\ 6.72\\ 21.84\\ 6.72\\ 21.84\\ 6.72\\ 23.46\\ 23.72\\ 3.11\\ 14.75\\ 22.80\\ 23.72\\ 3.11\\ 1.82\\ 9.72\\ 3.11\\ 1.82\\ 9.72\\ 3.11\\ 1.82\\ 9.72\\ 3.11\\ 3.82\\ 9.72\\ 3.11\\ 3.82\\ 9.72\\ 3.11\\ 3.82\\ 9.72\\ 3.11\\ 3.82\\ 9.72\\ 3.11\\ 3.82\\ 9.72\\ 3.11\\ 3.82\\ 9.72\\ 3.11\\ 3.82\\ 9.72\\ 3.11\\ 3.82\\ 9.72\\ 3.85\\ 5.85$ |

Table 9: PIXART image watermarks under image perturbations.

| Watermark | Attack Category | Perturbation | PSNR | \mathbf{SSIM} | Bit Acc | Dect Acc |
|----------------------------------|---|--|---|--|--|--|
| | | Gaussian | 19.25 | 0.46 | 2.90 | 1.20 |
| | Noise | Shot | 18.71 | 0.49 | 4.41 | 7.82 |
| | | Speckle | 17.55 | 0.42 | 6.01 5.44 | 22.25 |
| | | Defocus | 21.15 | 0.64 | 5.96 | 19.15 |
| | Plun | Glass | 25.33 | 0.83 | 8.45 | 58.70 |
| | Diur | Motion | 18.63 | 0.60 | 5.44 | 2.3 |
| | | Zoom | 15.09 | 0.45 | 3.27 | 0.0 |
| DctDwtSvd-WM | ſ | Snow | 11.65 | 0.53 | 1.46 | 0.6 |
| | Weather | Fog | 11.27 | 0.54 | 0.39 | 0.0 |
| | | Brightness | 15.85 | 0.72 | 3.88 | 10.3 |
| | | Contrast | 12.48 | 0.44 | 0.41 | 0.72 |
| | Digital | Elastic | 14.65 20.95 | 0.40 | 4.78 | 4.8 |
| | | JPEG | 26.83 | 0.84 | 6.89 | 0.0 |
| | | Scale | 9.85 | 0.19 | 2.57 | 0.0 |
| | Geomtric | Rotate | 8.15 | 0.14 | 2.50 | 0.00 |
| | | Shear Diecewse Affine | 9.91 12.70 | 0.23 | 3.20 | 0.00 |
| 337-41- | Atta de Catanan | Dentembertien | DENID | COLM | 9.40 | Deat Are |
| watermark | Attack Category | Perturbation | PSINK | 551101 | DIL ACC | Dect Acc |
| | | Gaussian Shot | 19.31 | 0.46 | 3.00 | 7.08 |
| | Noise | Impulse | 17.59 | 0.42 | 6.82 | 3.17 |
| | | Speckle | 19.72 | 0.59 | 7.89 | 16.15 |
| | | Defocus | 21.23 | 0.65 | 9.64 | 25.81 |
| | Blur | Glass | 25.57 | 0.85 | 14.67 | 68.94 |
| | | Zoom | 18.65 | 0.61 | 7.86 4.76 | 24.73 |
| | | Snom | 11.60 | 0.52 | 1.10 | 0.25 |
| RivaGAN-WM | Weath | Frost | 10.29 | 0.55 | 1.48 | 2.36 |
| | Weather | Fog | 11.29 | 0.50 | 0.40 | 1.13 |
| | | Brightness | 16.05 | 0.74 | 5.24 | 32.11 |
| | | Contrast | 12.49 | 0.44 | 0.41 | 3.43 |
| | Digital | Elastic Pixelate | 14.65 21.02 | 0.40 | 7.17 | 40.5 |
| | | JPEG | 27.00 | 0.85 | 7.29 | 0.4 |
| | | Scale | 9.86 | 0.19 | 3.36 | 3.86 |
| | Geomtric | Rotate | 8.15 | 0.14 | 3.03 | 4.85 |
| | Geometre | Shear Dianana Affinia | 9.91 | 0.23 | 4.68 | 40.43 |
| | | Piecewse Amne | 12.69 | 0.33 | 0.13 | 19.50 |
| 337 / 1 | A 1 C | D / 1 /* | DOMD | COTA | D'/ 4 | D / 4 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| Watermark | Attack Category | Perturbation Gaussian | PSNR 5.82 | 0.15 0.22 | Bit Acc 1.19 | Dect Acc |
| Watermark | Attack Category Noise | Perturbation Gaussian Shot Impulse | PSNR 5.82 6.88 7.31 | 0.15 0.22 0.31 | Bit Acc 1.19 2.83 3.33 | Dect Acc 1.11 1.41 21.34 |
| Watermark | Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle | PSNR 5.82 6.88 7.31 7.82 | 0.15 0.22 0.31 0.10 | Bit Acc 1.19 2.83 3.33 6.21 | Dect Acc 1.11 1.41 21.34 26.59 |
| Watermark | Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus | PSNR 5.82 6.88 7.31 7.82 7.95 | 0.15 0.22 0.31 0.10 0.11 | Bit Acc 1.19 2.83 3.33 6.21 4.31 | Dect Acc 1.11 1.41 21.34 26.59 27.40 |
| Watermark | Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 | Dect Acc 1.11 1.41 21.34 26.59 27.40 88.21 |
| Watermark | Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.89 | Dect Acc 1.11 1.41 21.34 26.59 27.46 88.21 15.74 3.15 |
| Watermark | Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.20 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.89 5.81 | Dect Acc 1.11 1.44 21.3 26.59 27.40 88.21 15.74 3.16 2.25 27.40 27.4 |
| Watermark SSL-WM | Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost | PSNR 5.82 6.88 7.31 7.95 10.31 11.36 14.85 7.52 8.32 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.39 0.26 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.89 5.81 3.26 | Dect Acc 1.11 1.41 21.3 26.59 27.40 88.21 15.7 3.15 2.22 45.62 |
| Watermark SSL-WM | Attack Category Noise Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.39 0.26 0.22 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.89 5.81 3.26 4.71 | Dect Acc 1.11 1.44 21.3 26.55 27.44 88.21 15.74 3.16 2.22 45.64 33.75 |
| Watermark SSL-WM | Attack Category Noise Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | SNR 5.82 6.88 7.31 7.82 10.31 11.36 14.85 7.52 8.32 6.54 7.83 | 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.26 0.22 0.22 0.22 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.89 5.81 3.26 4.71 2.84 | Dect Acc 1.11 1.44 21.3- 26.59 27.44 88.21 15.74 3.14 2.22 45.66 33.75 32.85 |
| Watermark SSL-WM | Attack Category Noise Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 | 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.26 0.22 0.25 0.21 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.89 5.81 3.26 4.71 2.84 3.91 3.91 | Dect Acc 1.11 1.44 21.34 26.55 27.44 88.21 15.77 3.15 2.22 45.64 33.77 32.85 29.58 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Frog Brightness Contrast Elastic Dissolute Elastic Dissolute Elastic E | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 10.88 0.83 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.39 0.26 0.22 0.25 0.21 0.22 0.22 0.25 | Bit Acc 1.19 2.83 3.33 6.21 4.31 4.33 4.51 4.63 4.89 5.81 5.81 3.26 4.71 2.84 3.91 2.74 | Dect Acc 1.11 1.41 21.33 26.55 27.46 88.22 15.74 3.15 2.22 45.66 33.77 32.88 29.56 29.56 27.00 0.0 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | PSNR 5.82 6.88 7.31 7.82 0.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 10.88 9.93 9.40 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.39 0.26 0.22 0.25 0.21 0.22 0.21 0.22 0.19 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.83 5.81 3.26 4.71 2.84 3.26 4.71 2.84 3.26 4.71 2.84 3.26 4.71 2.84 3.26 4.32 3.26 4.32 3.26 4.32 3.26 4.32 4.32 3.45 4.83 4.83 3.45 4.83 4.85 5.41 4.85 5.41 4.85 5.41 4.85 5.41 4.85 5.41 4.85 5.41 4.85 5.41 4.85 5.41 4.85 5.41 4.85 5.41 4.85 5.41 4.55 5.55 4.55 5.5 | Dect Acc 1.11 1.43 21.33 26.55 27.44 88.22 15.74 3.11 2.22 45.66 33.77 32.88 29.55 27.06 0.00 0.00 |
| Watermark | Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.32 7.83 11.41 10.88 9.93 9.40 | SSIM 0.15 0.22 0.31 0.10 0.11 0.44 0.38 0.39 0.26 0.22 0.25 0.21 0.22 0.22 0.25 0.21 0.22 0.16 0.22 0.21 0.22 0.21 0.22 0.31 0.10 0.10 0.10 0.11 0.44 0.38 0.22 0.31 0.44 0.38 0.22 0.31 0.44 0.38 0.22 0.31 0.44 0.38 0.22 0.31 0.44 0.38 0.22 0.31 0.44 0.39 0.22 0.22 0.22 0.22 0.31 0.44 0.22 0.39 0.22 0.21 0.22 0.25 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.22 0.31 0.44 0.22 0.22 0.22 0.22 0.19 0.19 0.26 0.22 0.22 0.19 0.19 0.22 0.19 0.15 0.19 0.15 0.19 0.19 0.15 0.15 0.19 0.15 0.19 0.19 0.15 0.15 0.15 0.15 0.15 0.19 0.15 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0. | Bit Acc 1.19 2.83 3.23 6.21 4.31 5.73 4.63 4.89 5.81 3.26 4.71 2.84 3.26 4.71 2.84 3.85 2.84 3.85 2.45 4.65 4.5 | Dect Acc 1.11 1.42 21.33 26.55 27.44 88.22 15.74 3.11 2.22 45.66 33.77 32.85 29.55 27.04 0.00 0.00 |
| Watermark | Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 10.88 9.93 9.40 8.26 8.26 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.26 0.22 0.25 0.21 0.22 0.16 0.19 0.15 0.15 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.89 5.81 3.26 4.21 2.84 3.91 2.74 2.74 3.95 2.41 3.95 3.96 3.96 | Dect Acc 1.11 1.41 21.33 26.58 27.44 88.21 15.77 3.15 2.22 45.66 45.66 45.66 45.66 45.66 45.66 45.60 0.00 0.00 0.00 14.88 15.97 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital Geomtric | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 10.88 9.93 9.40 8.26 5.81 6.61 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.39 0.26 0.22 0.25 0.21 0.22 0.16 0.19 0.15 0.18 0.17 | Bit Acc 1.19 2.83 3.33 6.21 4.63 4.63 4.63 4.63 4.89 3.26 4.71 2.84 2.81 3.91 2.74 3.85 2.41 4.05 3.78 4.63 | Dect Acc 1.11 1.44 21.34 26.55 27.46 88.21 15.77 3.15 2.22 45.64 3.377 32.88 29.58 27.00 0.00 0.00 0.00 14.88 15.90 11.29 15.90 11.29 15.90 11.29 11.20 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital Geomtric | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 10.88 9.93 9.40 8.26 5.81 6.61 4.48 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.44 0.38 0.26 0.22 0.25 0.21 0.22 0.16 0.19 0.15 0.18 0.17 0.17 0.11 | Bit Acc 1.19 2.83 3.33 6.21 5.73 4.63 4.89 3.26 4.71 2.74 3.84 3.81 2.74 3.91 2.74 3.91 2.74 3.91 2.74 3.96 2.74 3.96 2.76 3.96 2.76 3.96 2.76 3.96 3.96 2.78 | Dect Acc 1.11 1.13 26.55 27.44 88.22 15.77 3.15 2.22 45.66 33.77 32.88 29.55 27.00 0.00 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital Geomtric Attack Category | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 8.45 7.83 8.32 6.54 7.83 8.993 9.40 8.26 5.81 6.581 6.48 8.45 8.581 6.581 6.581 7.52 7.52 7.52 7.52 7.52 7.52 7.52 7.52 | SSIM 0.15 0.22 0.10 0.11 0.51 0.44 0.39 0.26 0.22 0.25 0.21 0.22 0.25 0.21 0.22 0.25 0.51 0.15 0.18 0.19 0.15 0.19 0.10 0.11 0.11 0.11 0.11 0.44 0.39 0.22 0.22 0.25 0.22 0.25 0.22 0.25 0.22 0.25 0.22 0.25 0.22 0.25 0.22 0.25 0.57 | Bit Acc 1.19 2.83 3.33 6.21 4.63 4.63 4.63 4.63 4.63 4.63 4.71 2.84 3.81 3.85 2.41 3.85 2.41 3.96 3.96 4.57 3.96 4.57 4.57 3.96 4.57 3.96 4.57 3.57 | Dect Acc 1.11 1.41 1.32 26.55 27.44 88.22 15.74 3.15 2.22 45.66 33.77 32.88 29.55 27.00 0.00 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 10.88 9.93 9.90 9.90 9.93 9.40 5.81 6.61 4.48 PSNR | SSIM 0.15 0.22 0.31 0.10 0.11 0.44 0.38 0.26 0.22 0.25 0.21 0.22 0.22 0.25 0.21 0.22 0.25 0.21 0.22 0.25 0.21 0.22 0.25 0.21 0.22 0.25 0.21 0.22 0.25 0.21 0.22 0.25 0.21 0.39 0.26 0.22 0.25 0.22 0.25 0.22 0.25 0.22 0.25 0.22 0.25 0.21 0.22 0.25 0.21 0.22 0.25 0.22 0.25 0.21 0.22 0.25 0.25 0.26 0.26 0.26 0.26 0.26 0.26 0.26 0.27 0.26 0.26 0.27 0.26 0.26 0.27 0.26 0.26 0.27 0.26 0.27 0.27 0.27 0.26 0.19 0.26 0.26 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.26 0.19 0.11 0.11 0.26 0.26 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.18 0.18 0.19 0.11 0.18 0.17 0.17 0.18 0.17 0.17 0.18 0.17 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.63 4.89 3.26 5.81 3.26 3.24 3.85 2.74 3.85 3.96 3.96 2.78 4.57 5.78 4.57 5.78 4.57 5.78 4.57 5.78 4.57 5.78 4.57 5.78 4.57 5.78 4.57 5.78 4.57 5.78 4.57 5.78 4.57 5.78 4.57 | Dect Acc 1.11 1.41 21.33 26.55 27.44 88.22 15.74 3.15 2.22 45.66 33.77 32.88 27.04 88.22 0.00 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 10.88 9.93 9.40 8.26 1 4.03 4.48 PSNR 4.33 4.29 6.13 | SSIM 0.15 0.22 0.31 0.10 0.11 0.44 0.38 0.22 0.25 0.21 0.22 0.16 0.19 0.19 0.18 0.19 0.18 0.19 0.18 0.17 0.12 0.20 0.21 0.20 0.21 0.21 0.22 0.25 0.55 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.63 4.89 3.26 4.71 2.84 3.91 2.74 2.74 3.85 2.41 3.65 2.78 4.05 4.97 4.57 Bit Acc 2.78 1.12 2.24 5.78 | Dect Acc 1.11 1.41 21.33 26.55 27.44 88.22 15.74 3.15 2.22 45.66 33.77 32.88 29.56 27.00 0.00 0.00 0.00 0.00 1.22 20.07 Dect Acc 1.00 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Prixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 8.32 8.32 8.42 7.83 9.40 9.33 9.40 8.26 11.41 10.88 9.93 9.40 8.26 1.41 10.88 8.81 6.61 4.88 1 6.61 4.88 1 6.61 4.88 1 6.61 4.82 1 6.81 1.2 7.82 1 7.83 1 7.82 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.83 1 7.84 1 7.83 1 7.83 1 7.83 1 7.84 1 7.83 1 7.84 1 7.84 1 7.84 1 7.83 1 7.84 1.84 1.84 1.84 1.84 1.84 1.84 1.84 1 | SSIM 0.15 0.22 0.31 0.10 0.11 0.51 0.51 0.51 0.51 0.51 0.51 0.51 0.51 0.52 0.22 0.25 0.21 0.16 0.17 0.18 0.17 0.18 0.17 0.18 0.17 0.18 0.17 0.18 0.17 0.18 0.17 0.18 0.17 0.18 0.12 | Bit Acc 1.19 2.83 3.33 6.21 4.63 4.63 4.63 4.63 3.26 4.71 2.84 3.91 2.74 3.91 2.74 3.91 2.74 3.57 4.65 2.74 4.57 8bit 4.57 8bit 1.12 2.84 2.58 3.41 | Dect Acc 1.11 1.43 26.55 27.44 88.22 15.77 3.18 2.22 45.64 3.3.77 3.2.88 2.9.55 2.7.06 0.000 0.00 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 10.88 9.93 11.41 10.88 9.940 8.26 5.61 4.48 9.40 8.26 5.61 4.48 9.40 9.40 9.40 9.40 8.26 5.81 4.23 9.40 8.26 5.81 1.41 1.58 9.40 8.26 5.81 1.41 1.58 9.40 8.26 5.81 1.41 1.58 9.40 9.40 9.40 9.40 9.40 9.40 9.40 9.40 | SSIM 0.15 0.22 0.10 0.11 0.11 0.14 0.38 0.22 0.22 0.26 0.22 0.26 0.21 0.22 0.15 0.18 0.19 0.21 0.21 0.21 0.15 0.18 0.10 0.11 0.11 0.12 0.12 0.14 0.14 0.14 | Bit Acc 1.19 2.83 3.33 6.21 5.73 4.63 4.89 3.26 4.71 2.84 2.84 3.91 2.74 3.96 2.74 3.96 2.74 3.96 2.74 3.96 2.78 4.65 3.96 2.78 3.96 2.78 2.78 3.91 2.64 2.58 3.40 2.58 3.41 5.58 | Dect Acc 1.11 1.41 21.33 26.55 27.44 88.22 15.77 3.18 2.22 2.45.64 33.77 32.88 2.9.55 2.7.00 0.00 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 6.54 7.83 8.32 6.54 7.83 7.83 8.93 9.40 8.26 5.81 6.81 6.81 6.81 6.81 6.81 6.81 6.81 6 | SSIM 0.15 0.22 0.11 0.14 0.13 0.10 0.11 0.44 0.38 0.26 0.22 0.26 0.26 0.22 0.26 0.21 0.21 0.22 0.15 0.18 0.17 0.19 0.15 0.18 0.10 0.11 0.22 0.21 0.10 0.11 0.12 0.20 0.14 0.12 0.14 0.12 0.14 0.14 0.12 0.14 | Bit Acc 1.19 2.83 3.33 6.21 5.73 4.63 4.63 4.63 4.63 4.63 4.71 2.84 3.816 3.816 3.816 3.816 3.817 2.844 3.816 3.815 2.41 2.74 3.85 2.411 2.74 3.85 3.46 2.76 3.96 2.76 4.05 3.96 2.76 3.96 2.76 3.96 2.76 3.96 2.78 3.96 3.41 2.58 3.41 2.58 3.41 2.58 3.41 3.55 | Dect Acc 1.11 1.13 1.43 26.55 27.44 88.22 15.74 2.22 45.66 33.77 3.15 2.22 45.66 33.77 3.15 2.25 45.66 33.77 3.15 2.25 45.66 33.77 3.15 2.25 45.66 33.77 45.66 33.77 45.66 33.77 45.66 33.77 45.66 33.77 45.66 33.77 45.66 33.77 45.66 33.77 45.66 33.77 45.66 45.6 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Picecwse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 8.99 3.940 9.40 9.40 9.40 9.40 9.40 9.40 9.40 | SSIM 0.15 0.22 0.10 0.11 0.11 0.44 0.38 0.39 0.22 0.26 0.22 0.16 0.22 0.16 0.11 0.22 0.16 0.12 0.17 0.18 0.17 0.15 0.18 0.17 0.10 0.12 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.43 0.24 0.43 | Bit Acc 1.19 2.83 3.83 6.21 4.31 5.73 5.81 3.86 4.63 4.63 4.71 2.84 3.81 3.85 2.74 3.85 3.96 3.96 2.78 4.05 3.96 2.78 4.57 Bit Acc 2.04 2.54 3.41 5.55 5.89 5.76 5.76 | Dect Acc 1.11 1.41 21.33 26.55 27.44 88.22 15.74 3.15 2.22 45.66 33.77 32.88 29.58 27.0-0 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.12 20.00 1.00 1.04 1.03 1.589 1.645 1.645 3.33 3.33 2.589 2.00 |
| Watermark SSL-WM | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Logom L | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.52 6.54 7.83 9.93 9.93 9.93 9.93 9.93 9.93 9.93 9 | SSIM 0.15 0.22 0.11 0.51 0.51 0.31 0.10 0.31 0.11 0.51 0.51 0.38 0.30 0.44 0.38 0.36 0.22 0.22 0.16 0.12 0.15 0.15 0.15 0.15 0.15 0.15 0.16 0.15 0.17 0.22 0.16 0.15 0.17 0.10 0.18 0.12 0.14 0.12 0.18 0.43 0.43 0.28 | Bit Acc 1.19 3.33 3.33 6.21 4.31 5.73 4.63 4.63 4.89 3.26 5.76 3.96 2.74 3.85 2.41 3.96 3.96 2.78 4.57 1.12 2.04 2.04 2.04 2.04 2.55 5.89 5.76 5.99 5.76 5.90 5.76 5.90 | Dect Acc 1.11 1.41 21.33 26.55 27.44 88.22 15.74 3.15 2.22 45.66 33.77 32.88 29.58 27.00 0.00 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur Blur | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Prixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 6.54 7.52 6.54 7.53 11.41 10.88 9.93 9.40 8.26 5.81 4.61 4.48 PSNR 4.29 6.12 7.71 12.44 13.28 13.77 7.71 12.44 13.28 13.77 | SSIM 0.15 0.22 0.10 0.11 0.44 0.38 0.20 0.22 0.21 0.22 0.22 0.21 0.15 0.15 0.21 0.22 0.21 0.22 0.21 0.22 0.15 0.18 0.10 0.19 0.15 0.18 0.12 0.12 0.12 0.12 0.14 0.44 0.43 0.43 0.33 0.33 | Bit Acc 1.19 2.83 3.33 6.21 3.33 6.21 4.63 4.63 4.63 3.26 4.71 2.84 3.31 3.26 4.71 2.84 3.91 2.84 3.91 2.84 3.92 2.41 4.65 3.96 2.74 3.95 2.84 4.57 Bit Acc 2.04 2.58 3.55 5.58 5.76 5.04 5.94 5.94 | Dect Acc 1.11 1.44 21.33 26.55 27.44 88.22 15.77 3.15 2.22 45.64 33.77 32.88 2.9.55 2.7.00 0. |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur Woise Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Galass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Galass Motion Zoom Snow Frost Fog | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.53 8.32 6.54 7.83 11.41 10.88 9.93 11.41 10.88 9.93 11.41 10.88 9.940 8.26 5.61 4.48 9.93 8.26 5.61 4.48 9.93 8.26 5.61 4.48 9.93 8.26 5.61 4.48 9.93 9.40 9.40 9.40 9.40 9.40 9.40 9.40 9.40 | SSIM 0.15 0.22 0.10 0.11 0.11 0.44 0.38 0.22 0.22 0.26 0.22 0.26 0.22 0.26 0.41 0.22 0.15 0.16 0.16 0.10 0.17 0.11 0.18 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.33 0.37 0.30 0.37 | Bit Acc 1.19 2.83 3.33 6.21 1.19 2.83 6.21 5.73 4.63 4.63 4.63 3.26 4.71 2.74 3.84 3.91 2.74 3.96 2.74 3.96 2.74 3.96 2.74 3.96 2.74 3.96 2.74 3.96 2.78 3.91 2.74 3.96 2.74 3.96 2.74 3.96 2.74 3.96 2.78 3.96 2.78 3.96 2.78 3.96 2.78 3.40 2.58 3.41 2.58 3.41 2.58 5.89 5.76 5.04 5.89 3.20 | Dect Acc 1.11 1.14 1.43 26.55 27.4(88.22 15.77 3.15 2.22 45.66 45.66 45.66 45.66 45.66 2.25 2.7.00 0.0 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur Weather Noise Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Precewse Affine Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fost Fost Fost Fost Fost Fost Fost F | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 6.54 7.832 6.54 7.832 6.54 7.832 6.81 11.41 10.88 9.93 9.40 8.26 5.81 6.81 4.48 9.93 9.40 8.26 5.81 6.81 4.48 9.93 9.40 7.71 12.44 13.28 14.28 14.29 14.28 14.28 14.28 14.28 14.29 14.28 14.28 14.28 14.28 14.29 14.28 14.28 14.28 14.28 14.29 14.28 14.28 14.29 14.28 14.28 14.29 14.28 14.29 14.28 14.28 14.29 14.28 14.29 14.28 14.28 14.29 14.28 14.29 14.28 14.29 14.28 14.29 14 | SSIM 0.15 0.22 0.11 0.14 0.44 0.38 0.22 0.26 0.22 0.26 0.22 0.26 0.26 0.21 0.27 0.21 0.28 0.21 0.29 0.21 0.10 0.11 0.21 0.21 0.25 0.16 0.10 0.11 0.12 0.20 0.14 0.12 0.14 0.14 0.28 0.37 0.30 0.27 | Bit Acc 1.19 2.83 3.33 6.21 5.73 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 5.73 3.816 3.84 3.85 2.41 2.74 3.85 2.41 2.74 3.65 2.641 2.58 3.46 2.58 3.41 2.58 3.41 2.55 5.89 5.69 5.94 5.89 3.60 4.00 | Dect Acc 1.11 1.41 2.33 2.6.55 2.7.4(8.8.22) 15.77 3.17 2.22 45.66 33.77 32.85 2.7.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 11.22 20.05 Dect Acc 1.00 1.03 15.89 16.45 21.24 3.33 15.89 16.45 22.88 22.88 22.88 22.85 22.75 22.05 22.05 22.05 22.05 22.05 22.05 22.05 20.05 2 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur Blur Weather | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Contrast Elastic Shear Pixelate JPEG Scale Rotate Shear Picecwse Affine Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 10.88 9.93 9.40 8.26 5.81 6.61 4.48 PSNR 4.33 4.29 6.54 7.87 7.71 12.87 7.71 13.28 13.77 | SSIM 0.15 0.22 0.11 0.44 0.38 0.39 0.22 0.26 0.27 0.16 0.28 0.29 0.21 0.22 0.16 0.22 0.16 0.21 0.25 0.15 0.18 0.17 0.28 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.33 0.33 0.34 | Bit Acc 1.19 2.83 3.83 6.21 4.31 5.73 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 2.74 3.85 2.74 3.96 2.78 4.05 3.96 2.78 4.05 3.96 2.78 4.05 3.96 2.58 3.41 2.54 5.89 5.56 5.64 5.89 5.64 5.89 5.64 5.89 3.20 4.60 4.60 4.60 | Dect Acc 1.11 1.41 1.43 26.55 27.46 88.22 15.74 3.15 2.22 45.66 33.77 32.88 29.55 27.00 0.00 0.00 0.00 0.00 0.00 11.21 20.00 11.21 1. |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur Unitse Digital Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Contrast Elastic Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 11.41 8.9.93 9.40 9.40 8.26 5.81 6.61 4.48 PSNR 4.33 4.29 6.52 7.87 7.71 12.24 7.771 12.24 13.28 13.77 1.19 3.91 4.22 12.87 19.30 | SSIM 0.15 0.22 0.11 0.51 0.12 0.31 0.10 0.11 0.51 0.38 0.30 0.44 0.38 0.36 0.22 0.26 0.21 0.22 0.16 0.15 0.18 0.17 0.12 0.16 0.15 0.18 0.12 0.14 0.12 0.18 0.44 0.28 0.33 0.37 0.37 0.37 0.37 0.29 0.22 0.24 | Bit Acc 1.19 2.83 3.33 6.21 4.31 5.73 4.63 4.63 4.84 4.63 4.84 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 3.62 2.41 3.96 2.74 3.96 3.96 2.78 4.57 5.76 5.90 5.76 5.99 5.76 5.94 5.89 3.20 4.58 3.20 4.50 2.04 | Dect Acc 1.11 1.41 21.33 26.55 27.44 88.22 15.74 3.15 2.22 45.66 33.77 32.88 29.58 27.0-0 0.0 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Prixelate JPEG Contrast Gaussian Shot Impulse Speak Defocus Glass Motion Zoom | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 6.54 7.52 6.54 7.52 8.32 6.54 7.83 9.30 8.26 5.81 4.28 9.40 8.26 5.81 4.29 6.12 7.771 1.24 13.28 13.27 7.777 7.771 1.19 3.21 3.21 3.21 3.34 5.560 | SSIM 0.15 0.22 0.10 0.11 0.44 0.38 0.20 0.22 0.21 0.22 0.22 0.21 0.25 0.21 0.26 0.16 0.15 0.18 0.16 0.19 0.15 0.11 0.10 0.11 0.11 0.12 0.12 0.14 0.12 0.12 0.14 0.33 0.33 0.33 0.37 0.30 0.22 0.24 0.29 0.22 0.24 0.29 0.22 0.24 0.33 0.37 0.34 0.34 | Bit Acc 1.19 2.83 3.33 6.21 3.33 6.21 5.73 4.63 4.63 4.89 5.73 4.63 3.26 4.71 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 2.84 3.91 3.85 3.41 3.85 3.91 3.85 3.91 3.85 3.91 3.85 3.91 3.85 3.85 | Dect Acc 1.11 1.44 2.1.33 2.6.55 2.7.44 8.8.22 1.5.77 3.18 2.22 2.45.64 3.3.77 3.2.88 2.9.55 2.7.06 0.00 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur Unise Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Galass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccuss Affine | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.53 8.32 6.54 7.83 11.41 10.88 9.93 11.41 10.88 9.93 8.26 5.61 4.48 9.93 8.26 5.61 4.48 9.93 9.40 8.26 5.61 4.48 9.93 8.26 5.61 4.48 9.93 9.40 8.26 5.61 4.48 9.93 9.40 9.40 8.26 5.61 4.48 9.93 9.40 9.40 9.40 9.40 9.40 9.40 9.40 9.40 | SSIM 0.15 0.22 0.11 0.14 0.13 0.10 0.11 0.44 0.38 0.22 0.22 0.26 0.22 0.26 0.21 0.22 0.15 0.16 0.16 0.17 0.17 0.11 0.18 0.10 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.12 0.14 0.14 0.14 0.14 0.14 0.14 0.17 0.19 0.18 0.19 0.19 0.19 | Bit Acc 1.19 2.83 3.33 6.21 5.73 4.63 4.63 4.89 3.26 4.71 2.74 3.91 2.74 3.96 2.74 3.96 2.74 3.96 2.74 3.96 2.74 3.96 2.74 3.96 2.78 3.91 2.78 3.91 2.78 3.96 2.78 3.96 2.78 3.96 2.78 3.96 2.78 3.96 2.78 3.96 2.78 3.96 2.78 3.96 5.589 5.76 5.04 5.89 3.20 4.60 4.60 3.85 4.60 3.85 | Dect Acc 1.11 1.11 1.13 1.43 21.33 26.55 27.46 88.21 15.77 3.15 22.22 22.25 27.46 33.77 32.88 29.55 27.04 0.00 0.00 0.00 11.21 20.07 Dect Acc 10.00 1.64 3.33 1.64 5.58 22.89 22.87 23.06 24.85 22.00 1.63 1.63 1.63 0.00 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur Weather Digital | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Gaussian Shot Impulse Speckle | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 8.93 9.40 8.26 5.81 6.61 6.61 6.61 6.4.48 9.93 9.40 8.26 5.81 6.81 6.4.48 7.83 4.29 6.12 7.87 7.71 12.44 13.28 13.21 3.21 3.21 3.21 3.21 3.21 3.21 3.2 | SSIM 0.15 0.22 0.11 0.14 0.13 0.10 0.11 0.44 0.38 0.26 0.22 0.26 0.26 0.22 0.26 0.21 0.22 0.16 0.19 0.15 0.18 0.17 0.21 0.26 0.41 0.12 0.28 0.14 0.12 0.14 0.12 0.28 0.33 0.37 0.30 0.29 0.24 0.21 0.28 0.37 0.30 0.29 0.21 0.21 0.22 0.24 0.21 0.28 0.37 0.30 0.29 0.24 0.21 0.24 | Bit Acc 1.19 2.83 3.33 6.21 5.73 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 5.73 3.13 5.816 3.21 2.841 2.84 2.74 3.85 2.41 2.74 3.85 2.41 2.74 3.96 9.68 4.57 Bit Acc Bit Acc 5.80 3.64 2.55 5.89 5.64 5.89 3.20 4.60 4.58 4.58 4.58 4.58 | Dect Acc 1.11 1.14 1.33 26.55 27.46 88.21 15.74 88.21 15.74 3.15 2.22 45.64 33.77 33.75 2.25 45.64 33.77 32.85 27.04 0.00 0.00 0.00 0.00 11.22 20.07 Dect Acc 1.00 1.03 15.89 16.45 22.89 22.75 22.65 22.06 1.04 1.04 1.03 15.89 16.45 22.89 22.75 22.06 24.85 22.00 1.04 1.04 1.05 22.89 22.75 22.00 1.04 1.04 1.04 1.05 22.89 22.75 22.00 1.04 1.04 1.04 1.05 22.89 22.75 22.00 1.04 1.04 1.04 1.05 22.89 22.75 22.00 1.04 1.04 1.04 1.05 22.89 22.75 22.00 1.04 1.04 1.04 1.05 22.89 22.75 22.00 1.04 1.04 1.04 1.04 1.05 22.89 22.89 22.75 22.00 1.04 1.04 1.04 1.04 1.04 1.04 1.05 22.89 22.80 22.85 22.75 22.00 1.04 1.04 1.04 1.04 1.05 22.89 22.80 22.85 22.00 1.04 1.04 1.04 1.04 1.05 22.89 22.00 1.04 1.04 1.04 1.04 1.04 1.05 22.89 22.00 0 |
| Watermark SSL-WM Watermark | Attack Category Noise Blur Weather Digital Geomtric Attack Category Noise Blur Digital Geomtric | Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Defocus Glass Attent Shot Impulse Speckle Defocus Glass Attent Shot Impulse Speckle Contrast Elastic Frost Fog Brightness Contrast Elastic Pixelate JPEG Shear | PSNR 5.82 6.88 7.31 7.82 7.95 10.31 11.36 14.85 7.52 8.32 6.54 7.83 4.83 9.40 9.40 9.40 9.40 9.40 9.40 9.40 9.40 | SSIM 0.15 0.22 0.11 0.44 0.38 0.39 0.22 0.26 0.25 0.27 0.16 0.22 0.17 0.22 0.16 0.22 0.17 0.22 0.16 0.17 0.17 0.18 0.17 0.19 0.15 0.18 0.17 0.22 0.16 0.10 0.17 0.23 0.24 0.14 0.28 0.33 0.30 0.29 0.24 0.21 0.29 0.24 0.18 0.18 0.19 0.19 | Bit Acc 1.19 2.83 3.83 6.21 4.31 5.43 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 4.63 3.61 2.74 3.64 3.96 2.74 3.64 4.05 3.96 2.78 4.05 3.96 2.58 3.41 2.58 5.59 5.56 5.64 5.89 3.20 4.60 4.63 1.05 2.00 3.85 4.58 4.58 4.63 3.88 1.03 2.44 | Dect Acc 1.11 1.41 1.43 26.55 27.46 88.21 15.74 88.21 2.22 45.64 33.77 32.85 29.55 29.55 27.04 0.00 0.00 0.00 0.00 1.04 1.0 |

Table 10: Kandinsky 2.2 image watermarks under image perturbations.

| | 0 | | DOND | | - <u>0</u> I | |
|---------------------|--|--|---|---|---|---|
| watermark | Attack Category | Perturbation | PSNR | 551M | BIT ACC | Dect Acc |
| | | Gaussian | 18.85 | 0.24 | 1.53 | 19.66 |
| | Noise | Shot | 17.81 | 0.23 | 1.44 | 20.34 |
| | | Impuise | 18.40 | 0.23 | 4.51 | 18.28 |
| | | D | 10.04 | 0.01 | 10.55 | |
| | | Class | 29.37 | 0.81 | 18.77 | 39.10 |
| | Blur | Motion | 25.81 | 0.78 | 12.02 | 14.3 |
| | | Zoom | 19.29 | 0.67 | 4.27 | 0.00 |
| | - | Snow | 11.13 | 0.49 | 0.01 | 12.7 |
| DctDwtSvd-WM | 1 | Frost | 17.19 | 0.73 | 7.50 | 24.38 |
| | weather | Fog | 14.03 | 0.73 | 0.72 | 1.22 |
| | | Brightness | 13.56 | 0.83 | 0.02 | 38.52 |
| | | Contrast | 16.35 | 0.70 | 0.97 | 3.04 |
| | Digital | Elastic | 21.93 | 0.64 | 11.24 | 26.81 |
| | | Pixelate | 25.76 | 0.69 | 13.33 | 6.41 |
| | | JPEG | 31.18 | 0.85 | 1.85 | 0.00 |
| | | Scale | 13.68 | 0.43 | 2.07 | 0.00 |
| | Geomtric | Shear | 10.54 | 0.33 | 3.41 | 0.00 |
| | | Piecewse Affine | 18.48 | 0.58 | 8.48 | 10.05 |
| Watanmank | Attack Catagony | Dontumbotion | DEND | CEIM | Dit Acc | Doot Ao |
| watermark | Attack Category | Perturbation | PSNR | 551M | DII ACC | Dect Acc |
| | | Gaussian | 18.78 | 0.24 | 1.51 | 7.39 |
| | Noise | Snot | 17.77 | 0.22 | 1.42 | 6.15 |
| | | Speckle | 10.41 | 0.23 | 3.90 2.00 | 3.88 13.50 |
| | | Deferme | 10.20 | 0.01 | 10.00 | 10.00 |
| | | Class | 28.94 | 0.80 | 10.22 | 51.71 07.60 |
| | Blur | Motion | 31.89 25.58 | 0.88 | 7.46 | 97.60 52.01 |
| | | Zoom | 19.28 | 0.66 | 3.77 | 1.18 |
| | | Snow | 11.17 | 0.49 | 0.01 | 6 5 |
| RivaGAN-WM | 337 (1 | Frost | 15.79 | 0.48 | 1.31 | 43.64 |
| | Weather | Fog | 14.04 | 0.72 | 0.73 | 6.07 |
| | | Brightness | 13.65 | 0.79 | 0.04 | 52.79 |
| | | Contrast | 16.34 | 0.69 | 0.97 | 6.07 |
| | Digital | Elastic | 21.86 | 0.63 | 6.27 | 91.13 |
| | Ligitai | Pixelate | 25.63 | 0.69 | 8.44 | 9.75 |
| | | JPEG | 30.78 | 0.84 | 7.19 | 1.32 |
| | | Scale | 13.68 | 0.42 | 1.92 | 84.81 |
| | Geomtric | Rotate | 10.54 | 0.33 | 1.29 | 16.27 |
| | | Shear | 13.63 | 0.43 | 2.45 | 75.16 |
| | | r iecewse Affine | 18.46 | 0.57 | 5.35 | 89.7 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| | | Gaussian | 9.62 | 0.38 | 1.45 | 0.42 |
| | Noise | Shot | 7.13 | 0.28 | 2.40 | 0.75 |
| | | Impulse Speckle | 7.55 | 0.75 | 3.99 3.4# | 0.57 |
| | | Special D. C. | -1.40 | 0.40 | 0.40 | 1.02 |
| | | Detocus | 23.25 | 0.38 | 4.13 | 18.52 |
| | | Class | 20.15 | 0.00 | 0.05 | 9 50 |
| | Blur | Glass Motion | 20.15 11.52 | 0.28 | 2.25 | 3.58 |
| | Blur | Glass Motion Zoom | 20.15 11.52 10.95 | 0.28 0.20 0.28 | 2.25 3.50 1.55 | 3.58 5.23 6.95 |
| | Blur | Glass Motion Zoom | 20.15 11.52 10.95 | 0.28 0.20 0.28 | 2.25 3.50 1.55 | 3.58 5.23 6.93 |
| SSL-WM | Blur | Glass Motion Zoom Snow | 20.15 11.52 10.95 4.32 5.48 | 0.28 0.20 0.28 0.11 0.28 | 2.25 3.50 1.55 0.66 0.84 | 3.58 5.23 6.93 8.76 |
| SSL-WM | Blur Weather | Glass Motion Zoom Snow Frost Fog | 20.15 11.52 10.95 4.32 5.48 6.32 | 0.28 0.20 0.28 0.11 0.28 0.48 | 2.25 3.50 1.55 0.66 0.84 1.24 | 3.58 5.23 6.93 8.76 11.03 20.41 |
| SSL-WM | Blur Weather | Glass Motion Zoom Snow Frost Fog Brightness | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 | 3.58 5.23 6.93 8.76 11.03 20.41 44.21 |
| SSL-WM | Blur Weather | Glass Motion Zoom Snow Frost Fog Brightness Contrast | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 | 3.58 5.23 6.93 8.76 11.03 20.41 44.21 |
| SSL-WM | Blur Weather | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | $\begin{array}{r} 20.15\\ 11.52\\ 10.95\\ \hline \\ 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline \\ 6.84\\ 5.85\\ \end{array}$ | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.50 0.48 | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 | 3.58 5.22 6.93 8.76 11.03 20.41 44.21 0.41 92.45 |
| SSL-WM | Blur Weather Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate | $\begin{array}{c} 20.15\\ 11.52\\ 10.95\\ \hline 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline 6.84\\ 5.85\\ 9.16\\ \end{array}$ | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.50 0.48 0.11 | $\begin{array}{c} 2.25\\ 3.50\\ 1.55\\ \hline 0.66\\ 0.84\\ 1.24\\ 1.56\\ \hline 3.56\\ 4.10\\ 1.46\\ \end{array}$ | 3.58 5.23 6.93 8.76 11.03 20.41 44.21 0.41 92.43 3.31 |
| SSL-WM | Blur Weather Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | $\begin{array}{c} 20.15\\ 11.52\\ 10.95\\ \hline \\ 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline \\ 6.84\\ 5.85\\ 9.16\\ 8.28\\ \end{array}$ | $\begin{array}{c} 0.28 \\ 0.20 \\ 0.28 \\ \hline 0.11 \\ 0.28 \\ 0.48 \\ 0.38 \\ \hline 0.50 \\ 0.48 \\ 0.11 \\ 0.48 \\ \end{array}$ | $\begin{array}{c} 2.25\\ 3.50\\ 1.55\\ \hline 0.66\\ 0.84\\ 1.24\\ 1.56\\ \hline 3.56\\ 4.10\\ 1.46\\ 4.50\\ \end{array}$ | $\begin{array}{c} 3.58\\ 5.23\\ 6.93\\ \hline 8.76\\ 11.03\\ 20.41\\ 44.21\\ \hline 0.41\\ 92.45\\ 3.31\\ 2.54\\ \end{array}$ |
| SSL-WM | Blur Weather Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale | $\begin{array}{r} 20.15\\ 11.52\\ 10.95\\ \hline \\ 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline \\ 6.84\\ 5.85\\ 9.16\\ 8.28\\ \hline \\ 9.84\\ \end{array}$ | $\begin{array}{c} 0.28 \\ 0.20 \\ 0.28 \\ \hline 0.11 \\ 0.28 \\ 0.48 \\ 0.38 \\ \hline 0.50 \\ 0.48 \\ 0.11 \\ 0.48 \\ \hline 0.33 \\ \hline \end{array}$ | $\begin{array}{c} 2.25\\ 3.50\\ 1.55\\ 0.66\\ 0.84\\ 1.24\\ 1.56\\ 3.56\\ 4.10\\ 1.46\\ 4.50\\ 3.94\end{array}$ | 3.58 5.23 6.93 8.76 11.03 20.41 44.21 0.41 92.45 3.31 2.54 |
| SSL-WM | Blur Weather Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate | $\begin{array}{c} 20.15\\ 11.52\\ 10.95\\ \hline \\ 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline \\ 6.84\\ 5.85\\ 9.16\\ 8.28\\ \hline \\ 9.84\\ 8.48\\ \end{array}$ | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.50 0.48 0.11 0.48 0.33 0.26 | $\begin{array}{c} 2.25\\ 3.50\\ 1.55\\ 0.66\\ 0.84\\ 1.24\\ 1.56\\ 3.56\\ 4.10\\ 1.46\\ 4.50\\ 3.94\\ 6.37\\ \end{array}$ | $\begin{array}{c} 3.58\\ 5.23\\ 6.93\\ 8.76\\ 11.05\\ 20.41\\ 44.21\\ 0.41\\ 92.45\\ 3.33\\ 2.54\\ 1.15\\ 7.88\end{array}$ |
| SSL-WM | Blur Weather Digital Geomtric | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear | $\begin{array}{c} 20.15\\ 11.52\\ 10.95\\ \hline \\ 4.32\\ 5.48\\ 6.32\\ \hline \\ 6.12\\ \hline \\ 6.82\\ 9.16\\ 8.28\\ \hline \\ 9.84\\ 8.48\\ 2.04\\ \end{array}$ | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ \hline 0.11\\ 0.28\\ 0.48\\ 0.38\\ 0.38\\ 0.50\\ 0.48\\ 0.11\\ 0.48\\ 0.33\\ 0.26\\ 0.24\\ \hline \end{array}$ | $\begin{array}{c} 2.25\\ 3.50\\ 1.55\\ 0.66\\ 0.84\\ 1.24\\ 1.56\\ 3.56\\ 4.10\\ 1.46\\ 4.50\\ 3.94\\ 6.37\\ 4.76\\ \end{array}$ | $\begin{array}{c} 3.58\\ 5.22\\ 6.93\\ \hline \\ 11.03\\ 20.41\\ 44.21\\ \hline \\ 92.45\\ 3.31\\ 2.54\\ \hline \\ 7.88\\ 5.47\end{array}$ |
| SSL-WM | Blur Weather Digital Geomtric | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine | $\begin{array}{c} 20.15\\ 11.52\\ 10.95\\ \hline \\ 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline \\ 6.84\\ 5.85\\ 9.16\\ 8.28\\ \hline \\ 9.84\\ 8.48\\ 2.04\\ \hline \\ 7.64\\ \hline \end{array}$ | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ \hline 0.11\\ 0.28\\ 0.48\\ 0.38\\ 0.50\\ 0.48\\ 0.11\\ 0.48\\ 0.33\\ 0.26\\ 0.24\\ 0.15\\ \hline \end{array}$ | $\begin{array}{c} 2.25\\ 3.50\\ 1.55\\ \hline \end{array}$ | 3.5% 5.22 6.93 8.7(11.03 20.44 44.21 0.41 92.44 3.33 2.5% 1.11 7.8% 5.44 5.54 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation | 20.15 11.52 10.95 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.84 8.48 2.04 7.64 PSNR | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.50 0.48 0.11 0.48 0.33 0.26 0.24 0.15 SSIM | $\begin{array}{c} 2.25\\ 3.50\\ 1.55\\ 0.66\\ 0.84\\ 1.24\\ 1.56\\ 3.56\\ 4.10\\ 1.46\\ 4.50\\ 3.94\\ 6.37\\ 4.76\\ 5.47\\ \textbf{Bit} \ \textbf{Acc} \end{array}$ | 3.58 5.22 6.93 8.76 11.03 20.41 44.21 0.41 92.44 3.31 2.55 7.88 5.44 5.10 Dect Acc |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.84 8.48 8.48 2.04 7.64 PSNR 2.91 | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.50 0.48 0.11 0.48 0.33 0.26 0.24 0.15 SSIM 0.16 | 2.25 3.50 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 3.94 6.37 4.76 5.47 Bit Acc 12.84 | 3.55 5.22 6.93 8.77 11.05 20.41 44.21 0.41 92.45 3.31 2.555 5.47 5.17 Dect Acc 18.82 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.84 8.48 2.04 7.64 PSNR 2.91 4.92 | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.50 0.48 0.11 0.48 0.33 0.26 0.24 0.15 SSIM 0.16 0.04 0.04 | 2.25 3.50 1.55 0.66 0.84 1.56 3.56 4.10 1.46 4.50 3.94 6.37 4.76 5.47 Bit Acc 12.84 2.74 2.74 | 3.5% 5.22 6.93 8.77 11.0% 20.41 44.22 0.44 92.4% 3.33 2.55 1.1% 7.8% 5.4% 5.4% 5.4% 5.4% 5.4% 5.4% 5.4% 5.4 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Sneeke | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.84 8.48 2.04 7.64 PSNR 2.04 7.64 | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.50 0.48 0.11 0.48 0.33 0.26 0.24 0.15 SSIM 0.16 0.04 0.14 0.13 | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 3.94 6.37 5.47 Bit Acc 12.84 2.74 2.52 2.48 | 3.55 5.22 6.93 20.41 44.21 0.41 92.45 3.33 2.54 1.15 7.88 5.44 5.10 Dect Acc 18.82 0.94 2.89 2.59 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.84 8.28 9.84 8.204 7.64 PSNR 2.91 4.92 5.46 7.66 | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.50 0.48 0.11 0.48 0.33 0.26 0.24 0.15 SSIM 0.16 0.04 0.04 0.04 0.14 0.14 0.13 | 2.25 3.50 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 3.94 6.37 4.76 5.47 Bit Acc 12.84 2.74 2.52 3.52 | 3.55 5.22 6.93 8.77 11.00 20.41 44.22 0.44 92.44 3.33 2.54 1.15 7.88 5.44 5.10 Dect Acc 18.82 0.89 2.89 2.89 2.89 2.513 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.84 8.48 2.04 7.64 PSNR 2.91 4.92 5.46 7.68 8.74 | 0.28 0.20 0.28 0.11 0.28 0.48 0.48 0.48 0.48 0.48 0.48 0.48 0.4 | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.10 1.46 4.50 3.94 6.37 Bit Acc Bit Acc 12.84 2.74 2.52 3.48 5.34 | 3.55 5.22 6.939 20.41 44.21 0.41 92.44 3.31 2.55 1.12 7.88 5.47 5.10 Dect Acce 18.82 0.94 2.513 2.513 2.251 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.16 8.28 9.84 8.48 2.04 7.64 PSNR 2.04 7.64 PSNR 2.04 7.64 S 8.48 8.48 8.48 8.48 2.04 7.64 S 8.29 8.48 8.48 8.48 8.48 8.48 8.48 8.49 8.49 | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ 0.20\\ 0.28\\ 0.38\\ 0.48\\ 0.38\\ 0.50\\ 0.48\\ 0.33\\ 0.26\\ 0.24\\ 0.15\\ \hline \textbf{SSIM}\\ \textbf{0.16}\\ 0.04\\ 0.13\\ 0.13\\ 0.33\\ 0.17\\ 0.10\\ \hline \textbf{0.10}\\ 0.33\\ 0.17\\ 0.10\\ 0.10\\ 0.03\\ 0.17\\ 0.00\\ 0.03\\ 0.17\\ 0.00\\ 0.03$ | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 3.94 6.37 4.76 5.47 Bit Acc 12.84 2.74 2.52 3.48 5.34 5.34 5.40 6.18 | 3.55 5.22 6.93 20.41 44.21 0.41 92.42 3.31 2.55 1.15 7.88 5.547 5.10 Dect Acc 1.89 2.89 2.51 2.89 2.51 3.22 3.2 3.2 5.57 5.22 0.94 2.59 3.25 5.22 0.94 2.59 3.25 5.22 0.94 2.59 5.22 0.94 2.51 0.04 1.00 0.04 0.00 0.04 0.00 0.00 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.16 8.28 9.16 8.28 9.16 8.28 9.16 8.28 9.16 8.204 7.64 PSNR 2.91 4.92 5.46 7.64 PSNR 2.91 4.92 5.46 7.64 PSNR 2.91 4.92 5.46 8.76 7.64 PSNR 2.91 4.92 7.64 7.64 7.64 7.64 7.64 7.64 7.64 7.64 | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ 0.20\\ 0.28\\ 0.11\\ 0.28\\ 0.48\\ 0.38\\ 0.38\\ 0.48\\ 0.11\\ 0.48\\ 0.11\\ 0.48\\ 0.11\\ 0.48\\ 0.26\\ 0.24\\ 0.15\\ \textbf{SSIM}\\ 0.16\\ 0.04\\ 0.14\\ 0.13\\ 0.33\\ 0.17\\ 0.10\\ 0.21\\ \end{array}$ | $\begin{array}{c} 2.25\\ 3.50\\ 1.55\\ 0.66\\ 0.84\\ 1.24\\ 1.56\\ 3.56\\ 4.10\\ 1.46\\ 4.50\\ 3.94\\ 6.37\\ 5.47\\ \textbf{Bit Acc}\\ 12.84\\ 2.74\\ 2.52\\ 3.48\\ 5.34\\ 5.40\\ 6.18\\ 4.24\\ \end{array}$ | 3.55 5.22 6.93 20.44 44.22 0.44 44.22 0.94 44.22 0.94 44.22 0.94 1.15 7.88 5.44 5.10 Dect Acc 18.82 0.94 2.89 25.13 22.51 11.38 5.78 9.45 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Blur | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.84 8.48 2.04 7.64 PSNR 2.91 4.92 5.46 7.68 8.74 12.66 7.68 8.74 12.66 7.68 | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ 0.20\\ 0.28\\ 0.11\\ 0.28\\ 0.38\\ 0.38\\ 0.38\\ 0.50\\ 0.48\\ 0.11\\ 0.48\\ 0.33\\ 0.26\\ 0.24\\ 0.15\\ \textbf{SSIM}\\ 0.16\\ 0.04\\ 0.14\\ 0.13\\ 0.33\\ 0.17\\ 0.10\\ 0.21\\ 0.10\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.21\\ 0.10\\ 0.10\\ 0.21\\ 0.10\\ 0.10\\ 0.21\\ 0.10\\ 0.$ | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 3.56 4.70 Bit Acc 12.84 2.74 2.52 3.48 5.34 5.34 6.84 4.54 5.40 6.18 4.54 5.40 6.18 4.54 5.40 6.18 5.40 5 | 3.55 5.22 6.93 8.77 11.00 20.41 44.22 0.44 92.44 3.31 3.2.55 1.11 7.88 5.44 5.10 Dect Acc 118.82 0.94 2.89 25.13 22.31 11.38 5.78 9.45 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic JPEG Scale Rotate Shear Piceewse Affine Piceusse Shear Piceewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.16 8.28 9.84 8.48 2.04 7.64 PSNR 2.91 4.92 5.46 PSNR 2.91 4.92 5.46 8.74 12.66 14.49 12.15 0.49 12.15 0.49 3.82 | 0.28 0.20 0.28 0.11 0.28 0.48 0.48 0.38 0.48 0.48 0.48 0.48 0.48 0.48 0.48 0.4 | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 3.94 6.37 4.76 5.47 Bit Acc 12.84 2.74 2.52 3.48 5.34 5.34 5.34 6.84 4.85 6.85 4.55 4.55 | 3.55 5.22 6.93 8.77 11.07 20.44 44.21 0.44 92.44 92.44 92.44 92.44 92.45 5.17 Dect Acc 1.85 2.59 5.47 5.47 5.47 5.47 5.47 5.47 5.47 5.47 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur United States S | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic JPEG Scale Rotate Shear Piccewse Affine Gaussian Shot Impulse Speckle Defoccus Glass Motion Zoom Snow Frost Fog | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.16 8.28 9.84 8.48 8.48 8.48 8.48 9.84 7.64 PSNR 2.91 4.92 5.46 7.68 7.68 8.76 7.68 8.76 7.68 7.68 7.6 | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.48 0.38 0.48 0.11 0.48 0.33 0.26 0.24 0.15 SIM 0.14 0.04 0.04 0.04 0.04 0.13 0.17 0.10 0.21 0.21 | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 3.94 6.37 4.76 5.47 Bit Acc 12.84 2.74 2.52 3.84 5.34 5.34 5.40 6.84 4.23 | 3.55 5.22 6.93 20.41 44.21 0.41 92.44 3.33 2.55 1.11 7.88 5.44 5.11 Dect Acc 18.82 0.94 2.89 25.13 22.51 11.88 2.0.94 2.89 25.51 20.94 2.289 25.13 11.88 5.77 0.21 12.89 22.51 11.88 20.94 22.89 22.51 11.88 20.94 22.95 23.95 25. |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Uweather | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Frost Fog Brightness | $\begin{array}{c} 20.15\\ 11.52\\ 11.52\\ 10.95\\ \hline \end{array}\\ \begin{array}{c} 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline \end{array}\\ \begin{array}{c} 6.84\\ 5.85\\ 9.16\\ 8.28\\ 9.84\\ 8.48\\ 8.48\\ 2.04\\ 7.64\\ \hline \end{array}\\ \begin{array}{c} 9.84\\ 9.84\\ 7.64\\ \hline \end{array}\\ \begin{array}{c} 9.84\\ 7.64\\ \hline \end{array}$ | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ 0.0\\ 0.28\\ 0.11\\ 0.28\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.48\\ 0.11\\ 0.48\\ 0.33\\ 0.26\\ 0.24\\ 0.15\\ \textbf{SSIM}\\ \hline \textbf{SSIM}\\ 0.16\\ 0.04\\ 0.14\\ 0.13\\ 0.33\\ 0.26\\ 0.21\\ 0.10\\ 0.28\\ 0.49\\ 0.04\\ 0.04\\ 0.04\\ 0.14\\ 0.13\\ 0.33\\ 0.04$ | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 3.56 4.70 5.47 Bit Acc 12.84 2.74 2.52 3.48 5.34 5.34 5.40 6.18 4.24 4.24 4.85 1.20 3.28 | 3.55 5.22 6.93 8.77 11.00 20.41 92.44 3.33 2.54 1.14 7.88 5.44 5.10 Dect Acc 18.82 0.94 2.89 25.13 22.31 11.38 5.78 9.45 0.21 20.30 25.19 20.30 25.19 20.30 25.19 20.30 25.19 20.30 25.19 20.30 25.19 20.30 25.19 20.30 25.19 20.30 25.19 20.30 25.19 20.30 25.19 20.30 25.19 20.30 20.30 20.4 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur United States | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic JPEG Scale Rotate Shear Picelate Shear Picease Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.84 8.48 2.04 7.68 7.04 7.68 7.68 8.74 12.65 4.92 5.46 7.68 8.74 12.65 4.92 5.46 7.68 8.74 12.65 1.449 12.15 0.49 3.82 3.466 1.449 12.15 0.49 1.449 12.15 0.49 1.44 | 0.28 0.20 0.28 0.11 0.28 0.48 0.48 0.38 0.48 0.48 0.48 0.48 0.48 0.48 0.48 0.4 | 2.25 3.50 1.55 0.66 0.84 1.24 4.10 1.46 4.10 1.46 4.50 3.94 6.37 4.76 5.47 Bit Acc 12.84 2.74 2.54 2.54 5.34 5.34 5.34 5.34 5.34 5.34 5.34 5 | 3.55 5.22 6.93 20.44 44.21 0.04 92.44 92.44 92.44 92.44 92.45 1.17 7.88 5.47 5.10 Dect Acc 1.8.82 0.94 2.89 2.5.13 2.2.31 1.138 5.78 9.45 0.21 2.2.33 2.2.31 2.2.33 2.2.31 2.2.33 2.2.33 2.2.34 2.2.33 2.2.344 2.2.3444 2.2.344444 2.2.34444444444 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Ukeather Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic | $\begin{array}{c} 20.15\\ 11.52\\ 10.95\\ \hline \\ 10.95\\ \hline \\ 4.32\\ 5.48\\ 6.32\\ \hline \\ 6.12\\ \hline \\ 6.84\\ 5.85\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.84\\ 8.48\\ 2.04\\ 7.64\\ \hline \\ \textbf{PSNR}\\ 14.92\\ 5.46\\ 7.68\\ 8.74\\ 12.66\\ 14.49\\ 12.15\\ \hline \\ 0.49\\ 3.82\\ 3.46\\ 5.60\\ \hline \\ 13.30\\ 18.82\\ \end{array}$ | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ 0.0\\ 0.28\\ 0.11\\ 0.28\\ 0.48\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.48\\ 0.11\\ 0.48\\ 0.33\\ 0.26\\ 0.24\\ 0.15\\ \textbf{SSIM}\\ 0.16\\ 0.04\\ 0.13\\ 0.17\\ 0.10\\ 0.33\\ 0.17\\ 0.10\\ 0.21\\ 0.21\\ 0.04\\ 0.24\\ 0.24\\ 0.30\\ 0.30\\ 0.24\\ 0.30\\ 0.3$ | 2.25 3.50 1.55 0.66 0.84 1.24 4.10 4.10 4.10 3.56 4.10 3.94 6.37 4.76 5.37 Bit Acc 12.84 2.74 2.52 3.48 5.34 5.34 5.34 5.40 6.18 4.22 4.22 3.48 5.34 5.40 6.18 5.40 6.18 5.40 6.18 5.40 6.18 5.40 6.18 5.40 5 | 3.55 5.22 6.93 20.41 44.21 0.41 92.42 3.33 2.55 1.15 7.88 5.47 5.17 Dect Acc 1.88 2.89 25.13 2.231 1.1.38 5.787 9.45 0.21 20.30 25.19 20.30 25.79 20.579 20.579 20.579 20.579 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Blur Uweather Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic JPEG Scale Rotate JPEG Scale Rotate Shear Piccewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic | $\begin{array}{c} 20.15\\ 11.52\\ 11.52\\ 10.95\\ \end{array}\\ \begin{array}{c} 4.32\\ 5.48\\ 6.32\\ 6.12\\ \end{array}\\ \begin{array}{c} 6.84\\ 5.85\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.20\\ \end{array}$ | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ 0.20\\ 0.28\\ 0.11\\ 0.28\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.48\\ 0.38\\ 0.11\\ 0.48\\ 0.33\\ 0.26\\ 0.24\\ 0.15\\ \textbf{SSIM}\\ 0.16\\ 0.04\\ 0.14\\ 0.13\\ 0.13\\ 0.17\\ 0.10\\ 0.21\\ 0.21\\ 0.19\\ 0.28\\ 0.49\\ 0.04\\ 0.33\\ 0.17\\ 0.10\\ 0.18\\ 0.33\\ 0.17\\ 0.10\\ 0.18\\ 0.33\\ 0.17\\ 0.10\\ 0.21\\ 0.21\\ 0.21\\ 0.24\\ 0.30\\ 0.18\\ 0.24\\ 0.30\\ 0.24\\ 0.30\\ 0.24\\ 0.30\\ 0.24\\ 0.38\\ 0.24\\ 0.30\\ 0.24\\ 0.38\\ 0.$ | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 3.94 6.37 4.76 5.47 Bit Acc 12.84 2.54 12.84 2.52 3.88 5.34 5.40 6.18 4.24 2.52 3.84 5.40 6.18 4.24 2.52 3.84 5.40 6.18 4.24 2.52 3.84 5.40 6.18 4.24 2.52 3.84 5.40 6.18 4.24 2.52 3.84 5.40 6.18 5.40 6.18 5.40 6.18 5.40 6.18 5.40 5.40 5.40 5.40 5.40 5.40 5.40 5.40 | $\begin{array}{c} 3.58\\ 5.22\\ 6.93\\ 8.76\\ 11.05\\ 20.41\\ 44.21\\ 0.041\\ 92.45\\ 3.31\\ 2.54\\ 1.15\\ 7.88\\ 5.44\\ 5.10\\ \textbf{Dect Acc}\\ 11.88\\ 2.89\\ 25.13\\ 22.31\\ 11.38\\ 5.78\\ 9.45\\ 5.78\\ 9.45\\ 5.78\\ 9.45\\ 1.12\\ 20.30\\ 25.19\\ 22.80\\ 25.79\\ 21.78\\ 6.78\\ 8.78\\ 9.78\\ 1.12\\ 1.22\\ 1.$ |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Uweather Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic JPEG Scale Rotate Shear Picelate JPEG Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Piscelate JPEG | $\begin{array}{c} 20.15\\ 11.52\\ 10.95\\ 10.95\\ \hline \\ 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline \\ 6.84\\ 5.85\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.16\\ 8.28\\ 9.48\\ 2.04\\ \hline \\ 7.68\\ 8.74\\ 12.66\\ \hline \\ 7.68\\ 8.74\\ 12.49\\ 12.15\\ \hline \\ 0.49\\ 12.15\\ \hline \\ 0.49\\ 3.82\\ 3.46\\ 5.60\\ \hline \\ 13.30\\ 18.82\\ 5.00\\ 3.92\\ \hline \end{array}$ | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ 0.20\\ 0.28\\ 0.11\\ 0.28\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.38\\ 0.48\\ 0.11\\ 0.48\\ 0.33\\ 0.26\\ 0.24\\ 0.15\\ \textbf{SSIM}\\ \textbf{0.16}\\ 0.04\\ 0.14\\ 0.13\\ 0.33\\ 0.17\\ 0.10\\ 0.21\\ 0.28\\ 0.49\\ 0.04\\ 0.24\\ 0.30\\ 0.18\\ 0.21\\ 0.18\\ 0.21\\ 0.18\\ 0.21\\ 0.18\\ 0.21\\ 0.28\\ 0.49\\ 0.04\\ 0.24\\ 0.30\\ 0.18\\ 0.21\\ 0.21\\ 0.28\\ 0.24\\ 0.30\\ 0.18\\ 0.21\\ 0.24\\ 0.30\\ 0.18\\ 0.21\\ 0.21\\ 0.21\\ 0.21\\ 0.21\\ 0.22\\$ | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 3.56 4.70 5.47 Bit Acc 5.47 Bit Acc 5.47 Bit Acc 6.37 4.76 5.47 5.40 6.18 4.22 3.48 5.34 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 4.24 5.40 6.18 5.47 5.40 6.18 5.47 5.40 6.18 5.40 6.28 5.40 6.4 | $\begin{array}{c} 3.58\\ 5.22\\ 6.93\\ 8.76\\ 11.0\\ 20.41\\ 44.21\\ 0.041\\ 92.44\\ 3.31\\ 2.54\\ 7.88\\ 5.47\\ 5.10\\ \hline \textbf{Dect Acc}\\ 11.8\\ 5.47\\ 5.10\\ \hline \textbf{Dect Acc}\\ 18.82\\ 0.94\\ 2.513\\ 22.31\\ 11.38\\ 5.78\\ 9.45\\ 5.79\\ 22.513\\ 22.31\\ 22.31\\ 22.31\\ 22.31\\ 22.31\\ 22.31\\ 22.33\\ 22.31\\ 22.31\\ 22.33\\ 22.31\\ 22.31\\ 22.33\\ 22.31\\ 22.31\\ 22.33\\ 22.31\\ 22.35\\ 5.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.78\\ 6.82\\ 25.79\\ 21.78\\ 6.78\\ 6.82\\ 25.79\\ 21.78\\ 6.78\\ 6.82\\ 25.79\\ 21.78\\ 6.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 6.82\\ 25.79\\ 21.78\\ 21.78\\ 22.59\\ 21.78\\ 22.59$ |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Uweather Digital Digital | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic JPEG Scale Rotate Shear Piceewse Affine Piceewse Affine Contrast Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Fog Brightness Contrast Elastic Fos Stale Scale | $\begin{array}{c} 20.15\\ 11.52\\ 10.95\\ 10.95\\ \hline\\ 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline\\ 6.84\\ 5.85\\ 9.16\\ 8.28\\ 9.84\\ 8.48\\ 2.04\\ 7.64\\ 8.28\\ 9.84\\ 8.48\\ 2.04\\ 7.68\\ 8.74\\ 12.66\\ 14.49\\ 12.15\\ 0.49\\ 12.15\\ 0.49\\ 12.15\\ 0.49\\ 12.15\\ 0.49\\ 12.5\\ 0.68\\ 14.49\\ 12.15\\ 0.68\\ 8.74\\ 12.66\\ 14.49\\ 12.15\\ 0.68\\ 14.49\\ 12.15\\ 0.68\\ 14.49\\ 12.15\\ 0.68\\ 14.6$ | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ 0.20\\ 0.28\\ 0.11\\ 0.28\\ 0.48\\ 0.38\\ 0.50\\ 0.48\\ 0.38\\ 0.26\\ 0.24\\ 0.24\\ 0.24\\ 0.14\\ 0.13\\ 0.33\\ 0.17\\ 0.10\\ 0.21\\ 0.19\\ 0.28\\ 0.49\\ 0.04\\ 0.24\\ 0.30\\ 0.18\\ 0.21\\ 0.40\\ \end{array}$ | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.10 1.46 4.50 3.94 6.37 Bit Acc Bit Acc 3.44 2.54 2.54 3.48 4.24 6.84 4.85 1.20 3.28 4.24 6.84 4.85 1.20 3.28 4.48 4.85 1.20 3.28 4.48 4.48 5.40 6.18 4.42 5.40 6.18 4.42 5.40 6.18 5.40 6.41 5.40 6.41 5.40 6.44 5.44 5.40 6.44 5.44 5.40 6.44 5. | 3.58 5.22 6.93 20.41 44.21 0.44 92.45 3.31 2.55 5.47 5.47 5.47 5.47 5.47 5.47 5.47 2.89 2.89 2.89 2.51 2.89 2.51 2.89 2.51 2.231 11.38 5.78 9.45 0.94 2.231 11.38 5.78 9.45 0.21 2.233 2.231 2.231 2.332 2.331 2.231 2.332 2.331 2.332 2.3 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Geomtric Gueather Digital Geomtric | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic JPEG Scale Rotate Shear Piccewse Affine Gaussian Shot Impulse Speckle Defoccus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Scale Scale Scale Scale Scale Snow Frost Fog Snow Frost Sot Snow Frost Sot Sot Snow Frost Sot Sot Shear Defocus Glass Shot Shear Defocus Glass Shot Speckle Scale | 20.15 11.52 10.95 4.32 5.48 6.32 6.12 6.84 5.85 9.16 8.28 9.16 7.64 9.16 8.28 9.16 8.28 9.16 8.28 9.16 8.28 9.16 7.64 9.28 9.28 9.26 7.64 9.28 9.26 7.64 9.28 9.28 9.28 9.28 9.28 9.28 9.28 9.28 | $\begin{array}{c} 0.28\\ 0.20\\ 0.28\\ 0.20\\ 0.28\\ 0.11\\ 0.28\\ 0.48\\ 0.38\\ 0.50\\ 0.48\\ 0.11\\ 0.48\\ 0.33\\ 0.26\\ 0.24\\ 0.15\\ \textbf{SSIM}\\ \textbf{SSIM}\\ \textbf{0.16}\\ \textbf{0.16}\\ 0.04\\ 0.14\\ 0.13\\ 0.33\\ 0.17\\ 0.10\\ 0.21\\ 0.21\\ 0.24\\ 0.30\\ 0.18\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\ 0.40\\ 0.21\\$ | 2,25 3,50 1,55 0,66 0,84 1,24 1,56 3,56 4,10 1,46 4,50 3,94 6,37 4,76 5,47 Bit Acc Bit Acc 12,84 2,74 2,52 3,48 5,34 5,34 5,34 5,34 5,34 5,40 6,87 1,29 3,28 3,45 0,04 4,14 3,88 4,94 4 | 3.55 5.22 6.93 20.41 44.21 0.44 92.42 3.33 2.54 1.15 7.88 5.47 5.10 Dect Acc 18.82 0.94 2.89 25.13 22.31 11.38 5.78 9.45 20.30 22.51 20.30 25.79 29.80 25.79 29.80 25.79 29.80 25.79 20.80 25.70 20.90 25.70 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Blur Uigital Geomtric | Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic JPEG Scale Rotate JPEG Scale Rotate Shear Piccewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fost Fost Elastic Pixelate JPEG Scale Rotate Shear Defocus Glass Motion Zoom Zoom | $\begin{array}{c} 20.15\\ 11.52\\ 10.95\\ 10.95\\ \hline\\ 4.32\\ 5.48\\ 6.32\\ 6.12\\ \hline\\ 6.84\\ 5.85\\ 9.16\\ 8.28\\ 9.84\\ 8.48\\ 2.04\\ 7.64\\ \hline\\ \textbf{PSNR}\\ \hline\\ \textbf{PSNR}\\ 2.91\\ 4.92\\ 5.46\\ \hline\\ \textbf{7.68}\\ 8.74\\ 12.66\\ \hline\\ 7.68\\ 8.74\\ 12.65\\ \hline\\ 5.60\\ 0\\ 13.30\\ 18.82\\ 3.46\\ 5.60\\ \hline\\ 0.392\\ \hline\\ 6.84\\ 2.83\\ 4.25\\ 5.00\\ \hline\end{array}$ | 0.28 0.20 0.28 0.11 0.28 0.48 0.38 0.50 0.48 0.11 0.48 0.38 0.26 0.24 0.25 SSIM 0.16 0.04 0.16 0.04 0.13 0.16 0.04 0.13 0.10 0.21 0.28 0.49 0.49 0.49 0.24 0.24 0.28 0.49 0.24 0.24 0.28 0.49 0.24 0.24 0.28 0.49 0.24 0.24 0.28 0.49 0.24 0.24 0.28 0.29 0.21 | 2.25 3.50 1.55 0.66 0.84 1.24 1.56 3.56 4.10 1.46 4.50 4.547 Bit Acc 12.84 2.74 2.52 3.48 5.34 5.40 6.18 4.24 4.85 1.20 3.28 3.45 0.04 4.14 3.88 4.94 1.94 | 3.55 5.22 6.93 8.76 11.05 20.44 44.21 0.44 9.24 3.33 2.54 1.15 7.88 5.44 5.44 2.89 25.13 22.51 11.38 5.78 9.45 5 7.88 5.78 9.45 5 7.89 25.19 22.513 11.38 5.78 9.45 5 7.88 5.78 9.45 5 7.88 5.78 9.45 5 7.88 5.78 9.45 5.79 22.57 9.21.78 6.78 6.78 6.82 0.07 3.45 5 7.35 5 7.35 5 7.35 7.35 7.35 7.35 7. |

Table <u>11</u>: LCMs image watermarks under image perturbations.

| | 0 | | | | ~8° P | er e ar s |
|---------------------|---|--|--|--|---|---|
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| | | Gaussian | 21.21 | 0.53 | 4.42 | 38.39 |
| | Noise | Shot | 17.95 | 0.45 | 2.97 | 23.52 |
| | 10000 | Impulse | 21.83 | 0.58 | 4.74 | 39.05 |
| | | Speckle | 26.15 | 0.73 | 6.71 | 56.49 |
| | | Defocus | 17.25 | 0.48 | 2.72 | 17.63 |
| | Blur | Glass | 17.17 | 0.50 | 2.70 | 16.35 |
| | | Motion | 26.21 | 0.78 | 6.80 | 53.85 |
| | | Zoom | 22.00 | 0.67 | 4.94 | 35.21 |
| DctDwtSvd-WN | ſ | Snow | 15.77 | 0.51 | 2.13 | 7.47 |
| | Weather | Frost | 20.78 | 0.67 | 4.41 | 27.84 |
| | | F Og Brightness | 15.00 | 0.54 | 2.12 | 3.04 |
| | | G | 10.07 | 0.00 | 2.10 | 15.71 |
| | | Contrast | 19.05 | 0.67 | 3.69 | 17.57 |
| | Digital | Pivelate | 8.15 | 0.37 | 0.79 | 29.81 |
| | | JPEG | 14.79 | 0.60 | 1.83 | 3.48 |
| | | Casla | 99.49 | 0.14 | 15.09 | 95.10 |
| | | Botate | 15.64 | 0.14 | 1.19 | 30.92 |
| | Geomtric | Shear | 14.58 | 0.28 | 4.05 | 55.83 |
| | | Piecewse Affine | 13.57 | 0.24 | 1.29 | 69.31 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| materia | Intuch Cutegory | a . | | 001111 | 510 1100 | 2000 1100 |
| | | Gaussian | 21.33 | 0.54 | 5.98 | 38.89 |
| | Noise | Impulse | 21.05 | 0.40 | 3.83 6.30 | 42.22 |
| | | Speckle | 21.90 26.34 | 0.59 | 9.24 | 42.90 |
| | | Deferme | 15.04 | 0.12 | 0.24 | 10.55 |
| | | Detocus | 17.32 | 0.49 | 3.37 | 19.77 |
| | Blur | Motion | 17.24 26.40 | 0.50 | 3.32 | 19.80 67 49 |
| | | Zoom | 20.40 | 0.79 | 9.28 6.54 | 07.48 46.17 |
| | | | 18.00 | 0.00 | 0.04 | 10.17 |
| RivaGAN-WM | | Snow | 15.83 | 0.51 | 2.39 | 13.68 |
| | Weather | Frost | 20.90 | 0.68 | 0.70 9.29 | 40.31 |
| | | Brightness | 15.62 | 0.54 | 2.26 | 13.85 |
| | | C i i | 10.15 | 0.00 | 1.50 | 20.00 |
| | | Contrast | 19.15 | 0.68 | 4.50 | 32.48 |
| | Digital | Pixelate | 8 99 | 0.37 | 2.03 | 19.16 |
| | | JPEG | 14.83 | 0.60 | 1.75 | 11.41 |
| | | Seele | 15.79 | 0.94 | 4.45 | 19.49 |
| | | Botate | 12.72 | 0.24 | 4.40 | 27.98 |
| | Geomtric | Shear | 13.66 | 0.18 | 2.18 | 25.54 |
| | | Piecewse Affine | 14.03 | 0.25 | 3.79 | 32.88 |
| Watermark | Attack Category | Perturbation | PSNR | SSIM | Bit Acc | Dect Acc |
| | | Caussian | 18.40 | 0.27 | 3 70 | 91.96 |
| | | Shot | 13.65 | 0.21 | 2.81 | 11.83 |
| | Noise | Impulse | 18.45 | 0.32 | 3.96 | 27.87 |
| | | Speckle | 23.86 | 0.44 | 5.23 | 45.50 |
| | | | 11.56 | 0.23 | 2.74 | 15 97 |
| | | Defocus | | 0.20 | 2.1.1 | 10.01 |
| | | Defocus Glass | 11.08 | 0.24 | 2.76 | 17.93 |
| | Blur | Defocus Glass Motion | 11.08 22.80 | 0.24 0.49 | 2.76 5.38 | 17.93 52.36 |
| | Blur | Defocus Glass Motion Zoom | 11.08 22.80 16.86 | 0.24 0.49 0.40 | 2.76 5.38 4.24 | 17.93 52.36 39.77 |
| | Blur | Defocus Glass Motion Zoom | 11.08 22.80 16.86 8.06 | 0.24 0.49 0.40 0.25 | 2.76 5.38 4.24 2.49 | 17.93 52.36 39.77 |
| SSL-WM | Blur | Defocus Glass Motion Zoom Snow Frost | 11.08 22.80 16.86 8.06 14.39 | 0.24 0.49 0.40 0.25 0.39 | 2.76 5.38 4.24 2.49 3.96 | 17.93 52.36 39.77 19.57 39.65 |
| SSL-WM | Blur Weather | Defocus Glass Motion Zoom Snow Frost Fog | 11.08 22.80 16.86 8.06 14.39 7.14 | 0.24 0.49 0.40 0.25 0.39 0.28 | 2.76 5.38 4.24 2.49 3.96 2.54 | 17.93 52.36 39.77 19.57 39.65 23.58 |
| SSL-WM | Blur | Defocus Glass Motion Zoom Snow Frost Fog Brightness | 11.08 22.80 16.86 8.06 14.39 7.14 6.65 | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 | 2.76 5.38 4.24 2.49 3.96 2.54 2.56 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 |
| SSL-WM | Blur Weather | Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast | 11.08 22.80 16.86 8.06 14.39 7.14 6.65 | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.39 | 2.76 5.38 4.24 2.49 3.96 2.54 2.56 3.59 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 |
| SSL-WM | Blur Weather | Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | $ \begin{array}{r} 11.08\\ 22.80\\ 16.86\\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ 10.93\\ 4.05\\ \end{array} $ | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.39 0.13 | 2.76 5.38 4.24 2.49 3.96 2.54 2.56 3.59 0.53 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 |
| SSL-WM | Blur Weather | Defocus Glass Motion Zoom Frost Frost Fog Brightness Contrast Elastic Pixelate | $\begin{array}{c} 11.08\\ 11.08\\ 22.80\\ 16.86\\ \hline \\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ \hline \\ 10.93\\ 4.05\\ 3.26\\ \end{array}$ | $\begin{array}{c} 0.24 \\ 0.49 \\ 0.40 \\ \hline 0.25 \\ 0.39 \\ 0.28 \\ 0.29 \\ \hline 0.39 \\ 0.13 \\ 0.16 \\ \end{array}$ | 2.76 5.38 4.24 2.49 3.96 2.54 2.56 3.59 0.53 0.82 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 8.80 |
| SSL-WM | Blur Weather Digital | Defocus Glass Motion Zoom Frost Frost Frog Brightness Contrast Elastic Pixelate JPEG | $\begin{array}{c} 11.08\\ 11.08\\ 22.80\\ 16.86\\ \hline \\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ \hline \\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ \end{array}$ | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ \hline 0.25\\ 0.39\\ 0.28\\ 0.29\\ \hline 0.39\\ 0.13\\ 0.16\\ 0.32\\ \end{array}$ | 2.76 5.38 4.24 2.49 3.96 2.54 2.56 3.59 0.53 0.82 2.51 | 17.93 52.36 39.77 19.57 23.58 25.49 40.12 3.47 8.80 31.58 |
| SSL-WM | Blur Weather Digital | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale | $\begin{array}{c} 11.08\\ 11.08\\ 22.80\\ 16.86\\ \hline \\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ \hline \\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ \hline \\ 3.44\\ \end{array}$ | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.39 0.13 0.16 0.32 0.33 | 2.76 5.38 4.24 2.49 3.96 2.54 2.56 3.59 0.53 0.82 2.51 5.85 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 8.80 31.58 26.35 |
| SSL-WM | Blur Weather Digital | Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate | $\begin{array}{c} 11.08\\ 11.08\\ 22.80\\ 16.86\\ \hline \\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ \hline \\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ \hline \\ 3.44\\ 3.85\\ \hline \end{array}$ | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.39 0.13 0.16 0.32 0.33 0.30 | $\begin{array}{r} 2.76 \\ 5.38 \\ 4.24 \\ 2.49 \\ 3.96 \\ 2.54 \\ 2.56 \\ 3.59 \\ 0.53 \\ 0.82 \\ 2.51 \\ 5.85 \\ 4.07 \end{array}$ | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 8.80 31.58 26.35 22.81 |
| SSL-WM | Blur Weather Digital Geomtric | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear | $\begin{array}{c} 11.08\\ 11.08\\ 22.80\\ 16.86\\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ 3.44\\ 3.85\\ 2.49\\ \end{array}$ | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ \hline 0.25\\ 0.39\\ 0.28\\ 0.29\\ \hline 0.39\\ 0.13\\ 0.16\\ 0.32\\ \hline 0.33\\ 0.30\\ 0.18\\ \end{array}$ | $\begin{array}{c} 2.76 \\ 5.38 \\ 4.24 \\ \hline \\ 2.49 \\ 3.96 \\ 2.54 \\ 2.56 \\ \hline \\ 3.59 \\ 0.53 \\ 0.82 \\ 2.51 \\ \hline \\ 5.85 \\ 4.07 \\ 4.72 \end{array}$ | $\begin{array}{c} 17.93\\ 52.36\\ 39.77\\ 19.57\\ 39.65\\ 23.58\\ 25.49\\ 40.12\\ 3.47\\ 8.80\\ 31.58\\ 26.35\\ 22.81\\ 0.00\\ \end{array}$ |
| SSL-WM | Blur Weather Digital Geomtric | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine | $\begin{array}{c} 11.08\\ 11.08\\ 22.80\\ 16.86\\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ 3.44\\ 3.85\\ 2.49\\ 5.84\\ \end{array}$ | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ \hline 0.25\\ 0.39\\ 0.28\\ 0.29\\ \hline 0.39\\ 0.13\\ 0.16\\ 0.32\\ \hline 0.33\\ 0.30\\ 0.18\\ 0.29\\ \end{array}$ | $\begin{array}{c} 2.76\\ 5.38\\ 4.24\\ \hline \\ 2.49\\ 2.54\\ 2.56\\ \hline \\ 3.59\\ 0.53\\ 0.82\\ 2.51\\ \hline \\ 5.85\\ 4.07\\ 4.72\\ 3.47\\ \end{array}$ | $\begin{array}{c} 17.93\\ 52.36\\ 39.77\\ 19.57\\ 39.65\\ 23.58\\ 25.49\\ 40.12\\ 3.47\\ 8.80\\ 31.58\\ 26.35\\ 22.81\\ 0.00\\ 0.00\\ \end{array}$ |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation | 11.08 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.84 3.44 3.84 9.584 PSNR | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.33 0.16 0.32 0.33 0.30 0.18 0.29 SSIM | 2.76 5.38 4.24 2.39 2.54 2.56 3.59 0.53 0.82 2.51 5.85 4.07 4.72 3.47 Bit Acc | 17.93 52.36 39.77 19.57 23.58 25.49 40.12 3.47 8.80 31.58 22.81 0.00 0.000 0.000 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category | Defocus Glass Motion Zom Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian | 11.08 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.85 2.49 5.84 PSNR | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.33 0.16 0.32 0.33 0.30 0.18 0.29 SSIM 0.49 | 2.76 5.38 4.24 2.49 3.96 2.54 2.54 3.59 0.53 0.82 2.51 5.85 4.07 4.72 3.77 Bit Acc 1 80 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 8.80 31.58 22.81 0.00 0.000 Dect Acc 0.00 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot | 11.08 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.85 2.49 5.84 PSNR PSNR 6.60 | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.39 0.13 0.16 0.32 0.33 0.30 0.13 0.30 0.129 SSIM 0.49 0.10 | 2.76 5.38 4.24 2.49 3.96 2.54 2.56 3.59 0.53 0.82 2.51 5.85 4.07 4.72 3.47 Bit Acc 1.89 1.59 | 17.93 52.36 39.77 19.57 39.65 23.58 225.49 40.12 3.47 8.80 31.58 22.81 0.00 0.00 Dect Acc 0.00 0.00 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Defocus Glass (Glass Motion Zoom Frost Fog Brightness Contrast Elastic Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Piecewse Affine Gaussian Shot Impulse | 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.26 4.08 3.44 3.84 9.5.84 PSNR 5.66 6.000 6.92 | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.39 0.13 0.16 0.32 0.33 0.30 0.18 0.29 SSIM 0.49 0.15 | 2.76 5.38 4.24 3.96 2.54 2.54 3.59 0.53 0.82 2.51 5.85 4.07 4.07 4.07 4.07 4.07 Bit Acc 1.89 1.50 3.45 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 8.80 31.58 22.81 0.00 0.00 0.00 0.00 0.00 0.00 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle | 11.08 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.85 2.49 5.84 PSNR 5.66 6.00 6.92 8.00 | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.33 0.16 0.32 0.33 0.30 0.18 0.29 SSIM 0.49 0.15 0.15 0.19 | 2.76 5.38 4.24 2.49 3.96 2.54 2.54 2.54 2.51 5.85 4.07 4.72 3.47 Bit Acc 1.89 1.50 3.49 1.50 3.49 | 17.93 52.36 39.77 19.57 39.65 23.58 22.549 40.12 34.78 8.80 31.58 22.81 0.00 0.00 0.00 Dect Acc 0.00 0.00 0.00 0.000 0.550 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus | 11.08 11.08 22.80 16.86 8.06 14.39 7.14 6.65 3.26 4.05 3.26 4.05 3.26 4.05 3.26 4.05 3.26 4.05 3.26 4.05 3.44 3.85 2.49 5.87 PSNR 5.87 6.60 6.00 6.92 8.00 7.88 | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.13 0.16 0.32 0.33 0.30 0.18 0.32 0.33 0.30 0.18 0.32 0.33 0.30 0.18 0.29 0.55 0.39 0.49 0.40 0.10 0.55 0.39 0.40 0.40 0.55 0.39 0.40 0.40 0.55 0.39 0.40 0.40 0.40 0.40 0.55 0.39 0.40 0.40 0.40 0.40 0.40 0.40 0.40 0.4 | 2.76 5.88 4.24 2.54 2.54 2.54 2.55 3.59 0.53 0.82 2.51 5.85 4.07 4.72 3.47 Bit Acc 1.89 1.89 1.89 3.45 3.45 4.49 | 17.93 52.36 39.77 19.57 39.65 23.58 225.49 40.12 3.47 8.80 31.58 226.35 226.35 226.35 226.35 226.35 226.35 226.35 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.0000 0.000000 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Dur | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass | 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.85 2.49 5.84 PSNR 5.66 6.92 8.00 7.88 12.30 | 0.24 0.49 0.40 0.25 0.39 0.28 0.28 0.39 0.13 0.16 0.32 0.33 0.30 0.18 0.29 SSIM 0.49 0.10 0.15 0.19 0.32 | 2.76 5.38 4.24 2.54 2.54 2.54 2.55 3.59 0.83 2.51 5.85 4.07 4.72 3.47 Bit Acc 1.89 1.50 3.45 4.49 4.41 4.90 | 17.93 52.36 39.77 19.57 39.65 23.58 225.49 40.12 3.47 8.80 31.58 22.81 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Picewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion | 11.08 22.80 16.86 8.06 14.39 7.14 6.03 4.05 3.26 4.08 3.44 3.85 2.49 5.84 PSNR PSNR 5.86 6.00 6.92 8.00 7.88 12.30 | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.39 0.13 0.16 0.32 0.33 0.30 0.18 0.29 SSIM 0.49 0.10 0.15 0.19 0.32 0.33 0.38 | 2.76 5.38 4.24 2.54 2.54 2.55 0.53 0.53 0.82 2.51 4.07 4.72 3.77 Bit Acc 1.89 1.50 3.55 4.49 4.41 4.41 4.90 5.88 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 8.80 31.58 22.81 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom | 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.84 9.84 9.84 9.84 9.84 9.84 9.80 6.60 6.92 8.00 0.7.88 12.30 12.78 13.42 | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ \end{array}\\ \hline$ | 2.76 5.38 4.24 2.54 2.54 2.54 2.55 3.59 0.53 0.82 2.51 5.85 4.07 4.72 3.47 Bit Acc 1.80 1.50 3.45 4.49 1.50 3.45 4.49 | 17.93 52.36 39.77 19.57 39.65 23.58 225.49 40.12 3.47 8.80 31.58 22.81 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow | 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.85 2.49 5.84 PSNR 5.86 6.00 6.92 8.00 6.92 8.00 12.78 12.30 12.78 12.30 12.78 12.30 12.78 12.42 3.42 | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.39 0.13 0.30 0.32 0.33 0.30 0.18 0.29 SSIM 0.49 0.15 0.19 0.15 0.19 0.33 0.33 0.33 0.33 0.33 0.33 0.33 0.3 | 2.76 5.38 4.24 2.54 2.54 2.54 2.55 3.59 0.53 0.82 2.51 5.85 4.07 3.47 Bit Acc 1.89 1.50 3.345 4.49 4.43 4.49 5.98 4.43 | 17.93 52.36 39.77 19.57 39.65 23.58 225.49 40.12 3.47 8.80 31.58 22.81 0.00 0.00 0.0000 0.0000 0.000000 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Weather | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Picewse Affine Picewse Affine Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost | 11.08 22.80 16.86 8.06 14.39 7.14 6.05 3.26 4.08 3.44 3.85 2.49 5.84 PSNR PSNR 5.84 PSNR 5.66 6.000 6.92 8.000 7.88 12.30 12.78 13.42 3.42 2.04 | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ 0.25\\ 0.39\\ 0.28\\ 0.29\\ 0.39\\ 0.13\\ 0.16\\ 0.32\\ 0.30\\ 0.18\\ 0.30\\ 0.18\\ 0.30\\ 0.18\\ 0.00\\ 0.15\\ 0.19\\ 0.32\\ 0.38\\ 0.12\\ 0.38\\ 0.12\\ 0.42\\$ | 2.76 5.38 4.24 2.54 2.54 2.55 0.53 0.82 2.51 5.55 4.07 Bit Acc 1.89 1.50 3.55 4.49 4.41 4.41 4.49 4.41 4.99 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 8.80 31.58 22.81 20.00 0.00 0.00 0.00 0.00 0.00 0.00 0. |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Weather | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piccewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Frost Fog | 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.85 5.84 PSNR 5.84 PSNR 5.60 6.00 6.92 8.00 7.88 12.30 12.78 13.42 2.30 12.78 | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ 0.25\\ 0.39\\ 0.28\\ 0.29\\ 0.39\\ 0.13\\ 0.16\\ 0.32\\ 0.33\\ 0.16\\ 0.32\\ 0.33\\ 0.18\\ 0.29\\ \textbf{SIM}\\ 0.49\\ 0.10\\ 0.15\\ 0.19\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.31\\ 0.41\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.13\\ 0.41\\ 0.13\\ 0.51\\ 0.13\\ 0.51\\ 0.13\\ 0.51\\ 0.13\\ 0.51\\ 0.5$ | 2.76 5.38 4.24 2.54 2.54 2.55 3.59 0.53 0.82 2.51 5.85 4.07 4.72 3.47 Bit Acc Bit Acc 3.45 4.49 1.50 3.45 4.49 4.41 4.90 5.598 4.43 | 17.93 52.36 39.77 19.57 39.65 23.58 225.49 40.12 3.47 8.80 31.58 22.81 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Weather | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piecewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness | $\begin{array}{c} 11.08\\ 22.80\\ 16.86\\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ 3.44\\ 3.85\\ 2.49\\ 5.84\\ \hline \textbf{PSNR}\\ \hline \textbf{PSNR}\\ 5.66\\ 6.00\\ 6.92\\ 8.00\\ 6.92\\ 8.00\\ 12.78\\ 13.42\\ 2.04\\ 3.42\\ 2.04\\ 3.28\\ 5.52\\ \hline \end{array}$ | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ 0.25\\ 0.39\\ 0.28\\ 0.29\\ 0.39\\ 0.13\\ 0.30\\ 0.32\\ 0.33\\ 0.30\\ 0.18\\ 0.29\\ \textbf{SSIM}\\ 0.49\\ 0.10\\ 0.15\\ 0.19\\ 0.10\\ 0.15\\ 0.13\\ 0.30\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.41\\ \textbf{SSIM}\\ 0.10\\ 0.15\\ 0.10\\ 0.15\\ 0.10\\ 0.15\\ 0.10\\ 0.15\\ 0.10\\ 0.15\\ 0.10\\ 0.32\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.41\\ \textbf{SSIM}\\ 0.10\\ 0.15\\ 0.$ | $\begin{array}{c} 2.76 \\ 5.38 \\ 4.24 \\ 2.59 \\ 2.54 \\ 2.56 \\ 3.59 \\ 0.53 \\ 0.82 \\ 2.51 \\ 5.85 \\ 4.07 \\ 4.72 \\ 3.47 \\ \mathbf{Bit} \ \mathbf{Acc} \\ \mathbf{Bit} \ \mathbf{Acc} \\ 1.89 \\ 1.89 \\ 1.89 \\ 1.89 \\ 1.49 \\ 4.49 \\ 4.90 \\ 5.98 \\ 4.49 \\ 4.90 \\ 5.98 \\ 4.48 \\ 4.48 \\ 4.48 \\ 4.48 \\ 4.48 \\ \end{array}$ | 17.93 52.36 39.77 19.57 39.65 23.58 225.49 40.12 3.47 8.80 31.58 22.635 22.81 0.00 0.000 Dect Acc 0.00 0.000 0.000 19.93 11.98 4.19 4.28 4.19 4.28 3.21.48 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Weather | Delocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Contrast Elastic Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixelate JPEG Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness | $\begin{array}{c} 11.08\\ 22.80\\ 16.86\\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ 3.44\\ 3.85\\ 2.49\\ 5.84\\ \hline \textbf{PSNR}\\ \textbf{PSNR}\\ \hline \textbf{PSNR}\\ 5.66\\ 6.00\\ 6.92\\ 8.00\\ 12.78\\ 13.42\\ 2.04\\ 3.28\\ 5.52\\ 2.04\\ 3.55\\ 5.52\\ 10.92\\ \hline \textbf{10.92}\\ \end{array}$ | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ 0.25\\ 0.39\\ 0.28\\ 0.29\\ 0.39\\ 0.13\\ 0.16\\ 0.32\\ 0.30\\ 0.18\\ 0.30\\ 0.18\\ 0.30\\ 0.18\\ 0.00\\ 0.15\\ 0.19\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.41\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.00\\ 0.01\\ 0.01\\ 0.01\\ 0.01\\ 0.00\\ 0.01\\ 0.01\\ 0.01\\ 0.00\\ 0.01\\ 0.00\\ 0.01\\ 0.00\\ 0.01\\ 0.00\\$ | 2.76 5.38 4.24 2.54 2.54 2.55 0.53 0.82 2.51 5.55 4.07 4.72 3.47 Bit Acc 1.89 1.50 3.45 4.49 4.41 4.49 4.41 4.49 4.43 4.44 4.41 4.49 4.43 4.44 4.41 4.41 4.41 4.41 4.41 4.41 | 17.93 52.36 39.977 19.57 39.65 23.58 25.49 40.12 3.47 8.80 31.58 26.35 22.81 20.00 0.00 0.00 0.00 0.00 0.00 0.00 0. |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Weather Dirital | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEC Scale Rotate Shear Pixelate JPEC Scale Rotate Shear Pixelate JPEC Brightness Contrast Elastic Pixelate JPEC Scale Rotate Shear Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic | $\begin{array}{c} 11.08\\ 22.80\\ 16.86\\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ 3.44\\ 3.85\\ 2.49\\ 5.84\\ \hline \textbf{PSNR}\\ \hline \textbf{PSNR}\\ 5.64\\ 6.00\\ 6.92\\ 8.00\\ \hline \textbf{0}.7.88\\ 12.30\\ 12.78\\ 13.42\\ 3.42\\ 3.42\\ 3.42\\ 3.42\\ 3.42\\ 3.65\\ 1.52\\ \hline \textbf{0}.32\\ \hline \textbf{0}.$ | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ 0.25\\ 0.39\\ 0.28\\ 0.29\\ 0.39\\ 0.13\\ 0.16\\ 0.32\\ 0.33\\ 0.16\\ 0.32\\ 0.33\\ 0.18\\ 0.30\\ 0.18\\ 0.32\\ 0.33\\ 0.10\\ 0.15\\ 0.19\\ 0.32\\ 0.33\\ 0.12\\ 0.33\\ 0.12\\ 0.33\\ 0.41\\ 0.28\\$ | 2.76 5.38 4.24 2.54 2.54 2.55 3.59 0.53 2.51 5.55 4.07 4.72 3.47 Bit Acc 1.89 1.50 3.45 4.49 1.50 3.45 4.49 4.41 4.90 5.98 4.43 4.43 4.29 4.43 4.43 | 17.93 52.36 39.77 19.57 39.65 23.58 225.49 40.12 3.47 8.80 31.58 22.81 22.81 22.81 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Ueather Digital Digital | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixelate JPEG Scale Rotate Shear Pixelate JPEG Contrast Elastic Contrast Contrast Elastic Contrast Contrast Elastic Contrast Contrast Elastic Contrast Elastic Contrast Elastic Contrast Elastic Contrast Co | $\begin{array}{c} 11.08\\ 22.80\\ 16.86\\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ 3.44\\ 3.85\\ 2.49\\ 5.84\\ \hline \textbf{PSNR}\\ \hline \textbf{PSNR}\\ 5.66\\ 6.00\\ 6.92\\ 8.00\\ 6.92\\ 8.12.30\\ 12.78\\ 13.42\\ 2.04\\ 3.28\\ 5.52\\ 10.92\\ 0.32\\ 1.82\\ 1.$ | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ 0.25\\ 0.39\\ 0.28\\ 0.29\\ 0.39\\ 0.13\\ 0.30\\ 0.16\\ 0.32\\ 0.33\\ 0.30\\ 0.18\\ 0.29\\ \textbf{SSIM}\\ 0.49\\ 0.10\\ 0.15\\ 0.15\\ 0.15\\ 0.15\\ 0.12\\ 0.33\\ 0.38\\ 0.32\\ 0.33\\ 0.30\\ 0.12\\ 0.01\\ 0.07\\ 0.42\\ 0.13\\ 0.41\\ 0.01\\ 0.28\\ 0.44\\ 0.01\\ 0.28\\ 0.01\\ 0.01\\ 0.01\\ 0.02\\ 0.01\\ 0.$ | $\begin{array}{c} 2.76 \\ 5.38 \\ 4.24 \\ 2.59 \\ 2.54 \\ 2.56 \\ 3.59 \\ 0.53 \\ 0.82 \\ 2.51 \\ 5.85 \\ 4.07 \\ 4.72 \\ 3.47 \\ 8 \\ 1.89 $ | 17.93 52.36 39.77 19.57 39.65 23.58 225.49 40.12 3.47 8.80 31.58 226.35 226.35 226.35 22.54 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000000 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Weather Digital Digital | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Picewse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Snow Frost Fog Brightness Contrast Elastic Pixelate JPEG | $\begin{array}{c} 11.08\\ 22.80\\ 16.86\\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ 3.44\\ 3.85\\ 2.49\\ 5.84\\ \hline \textbf{PSNR}\\ \textbf{PSNR}\\ \hline \textbf{PSNR}\\ 5.66\\ 6.00\\ 0.09\\ 8.00\\ 12.78\\ 13.42\\ 2.04\\ 3.28\\ 5.52\\ 10.92\\ 0.32\\ 1.82\\ 2.04\\ 3.28\\ 5.52\\ 10.92\\ 0.32\\ 1.82\\ 4.18\\ \end{array}$ | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ 0.25\\ 0.39\\ 0.28\\ 0.29\\ 0.39\\ 0.28\\ 0.29\\ 0.39\\ 0.39\\ 0.39\\ 0.39\\ 0.39\\ 0.39\\ 0.30\\ 0.18\\ 0.30\\ 0.18\\ 0.30\\ 0.18\\ 0.30\\ 0.19\\ 0.10\\ 0.15\\ 0.19\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.33\\ 0.38\\ 0.12\\ 0.38\\ 0.44\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.14\\ 0.14\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\$ | 2.76 5.38 4.24 2.54 2.54 2.55 0.53 0.82 2.51 5.55 4.07 Bit Acc 1.89 1.50 3.45 4.41 4.49 4.41 4.49 4.41 4.49 4.49 4.49 | 17.93 52.36 339.77 19.57 33.65 23.58 25.49 40.12 3.47 8.80 31.58 22.81 22.81 22.81 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Uweather Digital Digital | Delocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Perturbation Gaussian Shot Impulse Speckle Defocus Glass Speckle Spec | 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.85 5.84 PSNR 5.84 PSNR 5.84 PSNR 5.84 12.30 6.92 8.00 7.88 13.42 3.42 2.04 4.32 3.42 2.04 4.32 5.52 10.92 1.278 1.342 3.42 3.42 3.42 3.42 3.42 3.42 3.42 | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.33 0.16 0.32 0.33 0.30 0.18 0.30 0.18 0.30 0.18 0.30 0.18 0.32 0.33 0.30 0.19 0.32 0.33 0.33 0.49 0.10 0.15 0.32 0.33 0.30 0.15 0.29 0.33 0.30 0.32 0.33 0.49 0.10 0.29 0.49 0.49 0.49 0.49 0.49 0.40 0.40 0.4 | 2.76 5.38 4.24 2.54 2.54 2.55 3.59 0.53 0.82 2.51 5.55 4.07 4.72 3.47 Bit Acc 1.89 1.50 3.45 4.90 5.98 4.43 4.41 4.90 5.98 4.43 4.43 4.43 4.43 4.43 4.43 4.43 4.4 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 8.80 31.58 22.81 22.81 22.81 22.81 22.81 22.81 22.81 22.81 1.98 4.19 4.28 2.42 18.14 2.83 21.48 22.42 18.14 2.83 21.48 22.42 2.439 7.58 4.92 2.40 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Attack Category Noise Blur Ueather Digital Geomtric | Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Piceawse Affine Perturbation Gaussian Shot Impulse Speckle Defocus Glass Motion Zoom Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Scale Rotate | 11.08 22.80 16.86 8.06 14.39 7.14 6.65 10.93 4.05 3.26 4.08 3.44 3.85 2.49 5.84 PSNR 5.84 PSNR 5.84 PSNR 5.84 2.49 5.84 PSNR 5.84 2.49 5.84 2.49 5.84 2.40 6.92 8.20 6.92 8.20 12.78 13.42 2.04 3.24 2.04 3.28 5.52 10.92 0.32 2.1.82 4.18 3.42 3.42 3.42 3.42 3.42 3.42 3.42 3.42 | $\begin{array}{c} 0.24\\ 0.49\\ 0.40\\ 0.25\\ 0.39\\ 0.28\\ 0.29\\ 0.39\\ 0.13\\ 0.16\\ 0.32\\ 0.33\\ 0.30\\ 0.18\\ 0.29\\ \textbf{SIM}\\ 0.40\\ 0.10\\ 0.18\\ 0.29\\ \textbf{SIM}\\ 0.40\\ 0.10\\ 0.13\\ 0.41\\ 0.01\\ 0.07\\ 0.42\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.33\\ 0.41\\ 0.01\\ 0.01\\ 0.28\\ 0.44\\ 0.14\\ 0.14\\ 0.14\\ 0.14\\ 0.32\\ 0.24\\ 0$ | 2.76 5.38 4.24 2.54 2.54 2.55 3.59 0.53 2.51 5.85 4.07 4.72 3.47 Bit Acc 1.89 1.50 3.45 4.49 4.41 4.90 5.98 4.43 4.43 4.43 4.43 4.43 4.43 4.43 4.4 | 17.93 52.36 39.77 19.57 39.65 23.58 25.49 40.12 3.47 8.80 31.58 22.81 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| SSL-WM Watermark | Blur Weather Digital Geomtric Noise Blur Weather Digital Geomtric | Defocus Glass Motion Zoom Frost Frog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Picewse Affine Picewse Affine Picewse Affine Defocus Glass Motion Zoom Shot Impulse Speckle Defocus Glass Motion Zoom Sonw Frost Fog Brightness Contrast Elastic Pixelate JPEG Scale Rotate Shear Pixelate JPEG | $\begin{array}{c} 11.08\\ 22.80\\ 16.86\\ 8.06\\ 14.39\\ 7.14\\ 6.65\\ 10.93\\ 4.05\\ 3.26\\ 4.08\\ 3.44\\ 3.85\\ 2.49\\ 5.84\\ \hline \textbf{PSNR}\\ \textbf{PSNR}\\ \textbf{PSNR}\\ 5.66\\ 6.00\\ 6.92\\ 8.00\\ 12.78\\ 13.42\\ 2.04\\ 3.28\\ 5.52\\ 10.92\\ 0.32\\ 1.82\\ 4.18\\ 4.30\\ 1.83\\ 4.23\\ 4.23\\ \end{array}$ | 0.24 0.49 0.40 0.25 0.39 0.28 0.29 0.39 0.13 0.16 0.32 0.30 0.18 0.30 0.18 0.30 0.18 0.30 0.18 0.30 0.19 0.13 0.33 0.38 0.19 0.13 0.32 0.33 0.38 0.12 0.32 0.33 0.34 0.13 0.42 0.42 0.42 0.42 0.42 0.42 0.42 0.42 | 2.76 5.38 4.24 2.54 2.54 3.96 2.54 4.07 4.72 3.47 Bit Acc 1.89 1.50 3.45 4.40 1.89 1.50 3.45 4.41 4.41 4.49 4.43 4.43 4.43 4.43 4.43 4.43 4.43 | 17.93 52.36 339.77 19.57 33.65 23.58 25.49 40.12 3.47 8.80 31.58 22.81 22.81 22.81 22.81 4.19 4.19 4.28 2.48 2.48 2.48 2.43 2.48 2.43 2.44 2.44 |

Table 12: RPG image watermarks under image perturbations.

| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
|--|---|--|---|--|--|--|
| | | Keyboard | 0.40 | 57.96 | 65.00 | 17.70 |
| | | OCR | 0.58 | 74.09 | 65.22 | 17.01 |
| | Character-level | Character Insert (CI) | 0.42 | 58.15 | 65.77 | 18.37 |
| | | Character Replace (CR) Character Swap (CS) | 0.40 | 58.15 61.40 | 68.17 | 18.37 |
| | | Character Delete (CD) | 0.47 | 58.17 | 66.30 | 15.09 |
| | | Synonym Replacement (SR) | 0.54 | 62.54 | 68.48 | 24.83 |
| | | Word Insertion (WI) | 0.53 | 76.60 | 64.02 | 25.87 |
| KGW-WM | Word-level | Word Swap (WS) | 0.54 | 59.88 | 67.62 | 31.01 |
| | | Insert Punctuation (IP) | 0.50 | 6.99 | 53.77 | 26.49 |
| | | Formal | 0.02 | 0.46 | 50.43 | 17.72 |
| | | Casual | 0.01 | 2.44 | 50.28 | 18.83 |
| | | Passive | 0.07 | 7.43 | 53.74 | 17.07 |
| | Sentence-level | Active | 0.07 | 8.16 | 54.86 | 14.88 |
| | | SCPN | 0.79 | 2.15 | 44.82 | 17.05 |
| | | Bart | 0.00 | 3.66 | 41.06 | 16.74 |
| | | Dipper | 0.04 | 2.75 | 42.78 | 17.89 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| | | Keyboard | 0.39 | 63.88 | 64.88 | 18.67 |
| | | OCR Character Insert (CI) | 0.56 | 77.77 | 65.15 64.70 | 19.43 |
| | Character-level | Character Replace (CR) | 0.41 | 64.04 | 64.74 | 19.60 |
| | | Character Swap (CS) | 0.49 | 66.66 | 66.43 | 22.99 |
| | | Character Delete (CD) | 0.46 | 64.17 | 65.72 | 17.90 |
| | | Synonym Replacement (SR) | 0.44 | 53.98 | 66.24 | 26.73 |
| | Word lovel | Word Insertion (WI) Word Swap (WS) | 0.45 | 70.53 56.77 | 63.42 65.67 | 28.01 |
| KTH-WM | word-lever | Word Deletion (WD) | 0.47 | 68.20 | 63.13 | 27.60 |
| | | Insert Punctuation (IP) | 0.17 | 4.83 | 54.08 | 29.04 |
| | | Formal | 0.05 | 0.19 | 17.69 | 9.08 |
| | | Casual | 0.04 | 0.52 | 14.61 | 6.63 |
| | | Passive Active | 0.18 | 2.88 | 55.40 55.40 | 25.02 23.52 |
| | Sentence-level | Back Translation | 0.64 | 72.46 | 71.33 | 23.19 |
| | | SCPN | 0.00 | 23.62 | 20.89 | 19.70 |
| | | Bart Dire an | 0.02 | 13.77 | 21.75 | 18.64 |
| | | Dipper | 0.00 | 15.64 | 22.01 | 14.75 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| Watermark | Attack Category | Perturbation Keyboard | BLEURT 0.42 | ROUGE 65.78 | Bit Acc 81.13 | Dect Acc 41.82 |
| Watermark | Attack Category | Perturbation Keyboard OCR | 0.42 0.59 | 65.78 79.28 | Bit Acc 81.13 82.75 | Dect Acc 41.82 50.98 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) | BLEURT 0.42 0.59 0.44 | 65.78 79.28 66.00 | Bit Acc 81.13 82.75 68.85 | Dect Acc 41.82 50.98 40.73 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) | BLEURT 0.42 0.59 0.44 0.42 0.53 | ROUGE 65.78 79.28 66.00 66.00 68.98 | Bit Acc 81.13 82.75 68.85 81.24 81.33 | Dect Acc 41.82 50.98 40.73 41.02 42.39 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 | ROUGE 65.78 79.28 66.00 66.00 66.03 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 | ROUGE 65.78 79.28 66.00 66.00 68.98 66.03 66.35 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 | ROUGE 65.78 79.28 66.00 66.00 68.98 66.03 66.35 82.30 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WD) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.56 | ROUGE 65.78 79.28 66.00 66.00 66.98 66.03 66.35 82.30 63.71 78.22 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 20.57 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.52 0.52 0.12 | ROUGE 65.78 79.28 66.00 66.00 66.98 66.03 66.35 82.30 66.35 82.30 63.71 78.23 7.78 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.55 0.52 0.12 | ROUGE 65.78 79.28 66.00 66.00 66.98 66.03 66.35 82.30 66.35 82.30 63.71 78.23 7.78 4.88 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.54 0.52 0.12 0.03 0.02 | ROUGE 65.78 79.28 66.00 66.03 66.35 82.30 66.37 78.23 7.78 4.88 4.20 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 53.68 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | BLEURT 0.42 0.59 0.44 0.53 0.48 0.55 0.54 0.56 0.52 0.12 0.02 0.02 0.02 | ROUGE 65.78 79.28 66.00 66.00 66.00 66.35 82.30 63.71 78.23 7.78 4.88 4.20 7.55 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 53.68 55.483 53.68 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Book Translotion | BLEURT 0.42 0.59 0.44 0.53 0.48 0.55 0.54 0.56 0.52 0.12 0.02 0.02 0.08 0.02 0.08 0.13 | ROUGE 65.78 79.28 66.00 66.00 68.98 66.03 66.35 82.30 63.71 78.23 7.78 4.88 4.20 7.55 8.72 69.22 69.22 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 53.68 55.48 55.59 67.96 67.97 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 0.00 0.00 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.55 0.52 0.12 0.03 0.02 0.03 0.02 0.08 0.13 0.74 0.04 | ROUGE 65.78 79.28 66.00 66.00 66.03 66.35 82.30 63.71 78.23 7.78 4.88 4.20 7.55 8.72 69.22 5.36 | Bit Acc \$1.13 \$2.75 \$68.85 \$1.24 \$1.33 \$69.65 \$67.89 \$64.64 \$67.91 \$64.25 \$64.83 \$54.83 \$55.48 \$55.59 \$67.96 \$33.85 \$5.59 \$67.96 \$33.85 \$5.59 \$67.96 \$33.85 \$5.59 \$67.96 \$33.85 \$5.59 \$67.96 \$33.85 \$5.59 \$67.96 \$33.85 \$5.59 \$67.96 \$33.85 \$5.59 \$67.96 \$5.59 \$67.96 \$5.59 \$67.96 \$5.59 \$67.96 \$6.55 \$5.59 \$67.96 \$6.55 \$5.59 \$67.96 \$6.55 \$5.59 \$6.555 \$6.55 \$6.55 \$6.555 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 0.00 0.00 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.55 0.52 0.12 0.03 0.02 0.03 0.02 0.08 0.13 0.74 0.03 | ROUGE 65.78 79.28 66.00 66.00 66.03 66.35 82.30 63.71 78.23 7.78 4.88 4.20 7.55 8.72 69.22 5.36 4.72 | $\begin{array}{c} \textbf{Bit Acc} \\ \$1.13 \\ \$2.75 \\ \$68.85 \\ \$1.24 \\ \$1.33 \\ 69.65 \\ \hline \\ $67.89 \\ $64.64 \\ $67.91 \\ $64.26 \\ $54.83 \\ $53.88 \\ $55.59 \\ $67.89 \\ $54.83 \\ $55.59 \\ $67.96 \\ $55.59 \\ $67.96 \\ $33.85 \\ $55.53 \\ $33.85 \\ 3 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 0.00 0.00 0.000 0.000 0.000 0.000 0.000 0.21.48 22.34 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.08 0.13 0.74 0.03 | ROUGE 65.78 79.28 66.00 66.00 66.03 66.35 82.30 66.37 82.30 66.37 7.78 4.88 4.20 7.55 8.72 69.22 5.36 4.72 3.58 | $\begin{array}{c} \textbf{Bit Acc} \\ \$1.13 \\ \$2.75 \\ \$68.85 \\ \$1.24 \\ \$1.33 \\ 69.65 \\ \hline \\ $67.89 \\ $64.64 \\ $67.91 \\ $64.26 \\ $54.83 \\ $53.48 \\ $55.59 \\ $67.89 \\ $54.83 \\ $55.59 \\ $67.96 \\ $53.88 \\ $55.59 \\ $67.96 \\ $33.85 \\ $54.127 \\ $39.27 \\ \hline \end{array}$ | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 0.00 0.00 0.000 0.000 0.000 0.000 0.21.78 22.34 22.34 20.19 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.08 0.13 0.74 0.04 0.03 0.07 BLEURT | ROUGE 65.78 79.28 66.00 66.00 66.03 66.03 66.03 66.03 7.78 7.78 4.88 4.20 7.55 8.72 69.22 5.36 4.72 3.58 ROUGE 8 | Bit Acc \$ 81.13 \$ \$ 82.755 \$ \$ 82.855 \$ \$ 81.24 \$ \$ 81.33 \$ \$ 62.656 \$ \$ 67.89 \$ \$ 64.20 \$ \$ 64.20 \$ \$ 54.83 \$ \$ 55.48 \$ \$ 55.59 \$ \$ 67.96 \$ \$ 33.855 \$ \$ 41.27 \$ \$ 32.27 \$ Bit Acc | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 0.00 0.00 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.56 0.52 0.12 0.03 0.03 0.02 0.08 0.13 0.74 0.04 0.03 0.07 BLEURT 0.31 0.37 | ROUGE 65.78 79.28 66.00 66.00 66.03 66.35 82.30 66.35 82.30 63.71 77.82 7.78 4.88 4.20 7.55 8.72 69.22 5.36 4.72 3.58 ROUGE 44.98 51.62 51.62 | Bit Acc \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Sentence-level Attack Category Character level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.03 0.03 0.07 BLEURT 0.31 0.37 0.31 | ROUGE 65.78 79.28 66.00 66.00 66.00 66.03 66.03 66.03 66.03 70.55 8.20 7.78 4.88 4.20 7.55 8.72 66.9.22 5.36 4.72 3.58 ROUGE 44.98 51.62 45.10 | Bit Acc \$1.13 \$2.75 \$68.85 \$1.24 \$1.33 \$69.65 \$67.89 \$64.64 \$67.91 \$64.20 \$54.25 \$64.83 \$53.68 \$55.48 \$55.59 \$67.96 \$33.85 \$55.59 \$67.96 \$33.85 \$41.27 \$39.27 Bit Acc \$55.12 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 0.01 0.01 0.01 0.01 0.01 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.01 0.01 0.01 0.00 0.01 0.01 0.00 0.00 0.01 0.00 0.00 0.00 0.01 0.01 0.01 0.01 0.01 0.00 0.00 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.01 0.00 0.00 0.01 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.08 0.13 0.74 0.04 0.03 0.07 BLEURT 0.31 0.37 0.31 0.31 0.31 0.31 0.31 0.31 0.31 0.31 | ROUGE 65.78 79.28 79.28 66.00 66.03 66.35 866.03 66.35 82.30 66.37 66.37 78.23 7.8 3.23 7.78 4.20 7.55 8.72 66.25 5.36 4.20 7.55 8.72 3.58 ROUGE 44.98 51.62 45.10 45.10 45.10 | Bit Acc \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CD) | BLEURT 0.42 0.59 0.44 0.53 0.48 0.55 0.54 0.56 0.52 0.12 0.03 0.02 0.03 0.02 0.03 0.07 BLEURT 0.31 0.37 0.31 0.35 0.34 | ROUGE 65.78 79.28 66.00 66.03 66.35 82.30 66.37 82.30 63.71 78.23 7.78 4.20 7.55 8.72 66.25 5.36 4.20 7.55 8.72 5.36 4.22 5.36 ROUGE 44.98 51.62 45.10 45.10 46.68 45.80 | Bit Acc \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 425.92 30.57 0.00 0.0 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CD) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.08 0.13 0.02 0.08 0.13 0.07 BLEURT 0.31 0.37 0.31 0.37 0.31 0.35 0.34 0.34 | ROUGE 65.78 79.28 66.00 66.03 66.35 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 7.78 84.20 7.55 8.72 69.22 5.36 4.72 3.58 ROUGE 44.98 51.62 45.10 46.68 45.86 96.71 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 55.69 67.96 33.85 54.88 55.48 55.59 67.96 33.85 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 54.82 55.08 55.21 55.21 55.08 55.21 55.2 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 425.92 30.57 0.00 0.0 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | BLEURT 0.42 0.59 0.44 0.43 0.53 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.08 0.13 0.02 0.08 0.13 0.07 BLEURT 0.31 0.37 0.31 0.37 0.31 0.35 0.34 0.32 0.33 | ROUGE 65.78 70.28 66.00 66.03 66.35 82.30 66.37 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 7.78 8.88 4.20 7.55 8.72 50.86 60.22 5.36 4.72 3.58 ROUGEE 44.98 51.62 44.98 51.62 45.10 46.68 45.80 26.71 50.89 | Bit Acc \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 425.92 30.57 0.00 0.0 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Character-level Word-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | BLEURT 0.42 0.59 0.44 0.43 0.53 0.48 0.55 0.54 0.52 0.12 0.02 0.02 0.02 0.02 0.02 0.03 0.07 BLEURT 0.31 0.31 0.31 0.31 0.31 0.31 0.33 0.32 0.33 | ROUGE 65.78 79.28 66.00 66.00 66.01 66.03 66.35 82.30 66.35 82.30 66.37 82.30 66.38 7.78 4.88 4.88 4.88 4.88 4.22 5.36 4.72 5.36 4.72 3.58 ROUGEE 44.98 45.10 45.10 45.10 45.16 45.86 26.71 50.89 48.00 | Bit Acc \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.02 0.02 0.02 0.02 0.02 0.03 0.02 0.03 0.04 0.04 0.04 0.04 0.03 0.07 0.31 0.31 0.31 0.31 0.35 0.34 0.32 0.33 0.33 0.33 0.34 | ROUGE 65.78 79.28 79.28 66.00 66.00 66.03 66.03 82.30 66.35 82.30 66.37 82.30 66.37 82.30 7.78 4.88 4.20 7.78 9.22 5.36 4.72 5.36 4.72 5.36 4.72 5.36 4.5.88 4.5.86 45.10 45.10 45.60 26.71 50.89 48.00 55.84 2.54 | Bit Acc \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Sentence-level Attack Category Character-level Word-level Uord-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.02 0.02 0.03 0.02 0.03 0.02 0.03 0.07 BLEURT 0.31 0.31 0.31 0.31 0.35 0.34 0.33 0.33 0.33 0.33 0.33 0.33 0.33 | ROUGE 65.78 79.28 66.00 66.00 66.03 66.35 82.30 66.37 82.30 66.37 82.30 66.37 82.30 66.37 82.30 7.78 4.88 4.20 7.55 8.72 69.22 5.36 4.72 3.58 ROUGE 44.88 45.10 45.10 46.68 26.71 50.89 48.00 55.84 0.25 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 55.68 85.548 85.548 85.548 85.559 67.96 67.96 63.885 41.27 55.108 54.82 55.08 54.82 55.08 54.82 55.01 55.21 55.31 53.91 53.60 54.53 53.22 55.13 53.22 54.33 53.22 55.13 53.22 54.33 53.22 55.13 5 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Understand | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.08 0.13 0.74 0.04 0.03 0.07 BLEURT 0.31 0.31 0.31 0.31 0.31 0.31 0.32 0.33 0.34 0.33 0.34 0.33 0.34 0.33 0.34 0.30 0.10 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 65.78 79.28 66.00 66.00 66.03 86.88 66.03 82.30 66.35 82.30 66.37 82.30 66.37 82.30 66.37 82.30 66.37 82.30 66.37 82.30 66.37 82.30 66.37 8.72 69.22 5.36 4.72 3.58 ROUGE 44.98 51.62 45.10 45.86 26.71 50.89 48.00 55.84 0.48 0.22 0.20 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 55.68 55.48 55.59 67.96 33.85 41.27 55.12 55.12 55.12 55.12 55.12 55.12 55.12 55.12 55.12 55.12 55.12 55.12 55.13 53.91 53.60 54.53 53.22 55.13 14.90 13.91 14.90 13.91 14.90 13.91 14.90 13.91 14.90 13.91 14.90 13.91 14.90 13.91 14.90 13.91 14.90 13.91 14.90 13.91 14.90 13.91 14.90 14.90 14.91 14.90 14.91 14.90 14.91 14.90 14.91 14.90 14.91 14.90 14.91 14.90 14.91 14.90 14.91 14.90 14.91 14.90 14.91 14.90 14.91 14.90 14.91 | $\begin{array}{c} \textbf{Dect Acc} \\ 41.82 \\ 50.98 \\ 40.73 \\ 41.02 \\ 42.39 \\ 39.87 \\ 24.18 \\ 30.04 \\ 25.92 \\ 30.57 \\ 0.00 \\$ |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Word-level Sentence-level Character-level Word-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | BLEURT 0.42 0.59 0.44 0.43 0.43 0.43 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.08 0.13 0.02 0.03 0.02 0.03 0.02 0.03 0.03 0.0 | ROUGE 65.78 79.28 66.00 66.03 66.03 66.03 66.03 66.03 66.03 66.03 66.03 66.03 66.03 66.03 66.03 67.78 8.23 7.78 4.20 7.55 8.72 60.22 5.36 4.20 45.10 44.98 51.62 45.10 45.80 26.71 50.89 48.00 55.84 0.28 0.24 0.20 0.28 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 55.69 67.96 33.85 54.84 55.59 Bit Acc 55.12 55.12 55.08 55.42 55.08 55.42 55.06 55.21 55.31 53.91 53.60 54.82 55.39 153.60 54.83 53.92 55.13 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 425.92 30.57 0.00 |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Formal Casual Passive Active | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.02 0.03 0.07 BLEURT 0.31 0.37 0.31 0.37 0.31 0.33 0.33 0.33 0.33 0.33 0.33 0.33 | ROUGE 65.78 79.28 66.00 66.03 66.35 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.37 82.30 66.37 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.31 82.32 7.78 8.72 60.22 5.36 4.20 7.55 8.72 66.22 5.36 4.72 3.58 ROUGE 44.98 51.62 45.10 45.10 46.68 45.80 50.89 48.80 50.48 0.22 0.20 0.98 <td>Bit Acc \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$</td> <td>Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 425.92 30.57 0.00 0.0</td> | Bit Acc \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 425.92 30.57 0.00 0.0 |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Replace (CR) Character New (CS) Character New (CS) New | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.52 0.12 0.03 0.02 0.08 0.13 0.74 0.04 0.04 0.04 0.04 0.04 0.04 0.07 BLEURT 0.31 0.37 0.31 0.37 0.31 0.35 0.34 0.33 0.33 0.33 0.33 0.33 0.33 0.34 0.55 0.52 0.52 0.52 0.52 0.52 0.52 0.52 | ROUGE 65.78 79.28 66.00 66.03 66.35 82.30 66.37 82.30 66.33 82.30 66.33 82.30 66.35 82.30 66.37 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.33 82.30 66.32 82.31 7.78 84.20 7.55 8.60 26.71 50.89 48.00 55.84 0.22 0.20 0.98 0.57 36.25 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 53.68 55.48 55.48 55.59 67.96 33.85 41.27 39.27 Bit Acc 55.12 55.08 54.82 55.08 54.82 55.09 67.96 55.12 55.08 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.69 67.90 67.90 67.90 67.90 67.90 67.90 67.90 67.90 55.12 55.08 54.82 55.08 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 53.68 54.83 55.12 55.08 54.83 54.83 55.21 55.31 53.62 54.83 53.22 55.51 53.61 53.62 54.53 53.22 55.51 54.53 53.22 55.51 54.53 54.54 54.55 54.54 54.55 55.55 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 42.39 39.87 0.00 |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Melaecement (SR) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Disact Translation SCPN Bart Disact Pusculation SCPN Back Translation <td>BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.56 0.52 0.12 0.03 0.02 0.08 0.13 0.74 0.04 0.03 0.07 BLEURT 0.31 0.37 0.31 0.37 0.31 0.37 0.31 0.33 0.34 0.33 0.34 0.33 0.34 0.33 0.34 0.33 0.34 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35</td> <td>ROUGE 65.78 79.28 66.00 66.00 66.03 86.98 66.03 82.30 66.35 82.30 66.37 82.30 66.37 82.30 66.37 82.30 67.78 8.22 5.36 4.20 7.55 8.72 69.22 5.36 44.98 51.62 45.10 45.10 45.10 45.86 26.71 50.89 48.00 55.84 0.22 0.20 0.98 0.57 36.25 0.77 0.84</td> <td>Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 53.68 55.48 55.59 67.96 33.85 41.27 33.85 41.27 33.85 41.27 55.08 55.50 55.521 55.08 54.82 55.50 55.521 55.53 55.55</td> <td>Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00</td> | BLEURT 0.42 0.59 0.44 0.42 0.53 0.48 0.55 0.54 0.56 0.52 0.12 0.03 0.02 0.08 0.13 0.74 0.04 0.03 0.07 BLEURT 0.31 0.37 0.31 0.37 0.31 0.37 0.31 0.33 0.34 0.33 0.34 0.33 0.34 0.33 0.34 0.33 0.34 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 | ROUGE 65.78 79.28 66.00 66.00 66.03 86.98 66.03 82.30 66.35 82.30 66.37 82.30 66.37 82.30 66.37 82.30 67.78 8.22 5.36 4.20 7.55 8.72 69.22 5.36 44.98 51.62 45.10 45.10 45.10 45.86 26.71 50.89 48.00 55.84 0.22 0.20 0.98 0.57 36.25 0.77 0.84 | Bit Acc 81.13 82.75 68.85 81.24 81.33 69.65 67.89 64.64 67.91 64.20 54.25 54.83 53.68 55.48 55.59 67.96 33.85 41.27 33.85 41.27 33.85 41.27 55.08 55.50 55.521 55.08 54.82 55.50 55.521 55.53 55.55 | Dect Acc 41.82 50.98 40.73 41.02 42.39 39.87 24.18 30.04 25.92 30.57 0.00 |

| Table 13: | NExT-GPT | text | watermarks | under | text | perturbations. |
|-----------|----------|-----------------------|------------|-------|-----------------------|----------------|
|-----------|----------|-----------------------|------------|-------|-----------------------|----------------|

| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
|--|---|--|---|--|--|--|
| | | Keyboard | 0.38 | 65.71 | 93.15 | 36.38 |
| | | OCR | 0.53 | 79.63 | 95.93 | 34.20 |
| | Character-level | Character Insert (CI) | 0.39 | 65.90 | 68.77 | 35.20 |
| | | Character Swap (CS) | 0.38 | 69.28 | 93.84 92.96 | 36.06 |
| | | Character Delete (CD) | 0.45 | 65.97 | 69.68 | 36.30 |
| | - | Synonym Replacement (SR) | 0.52 | 62.00 | 71.67 | 34.72 |
| | | Word Insertion (WI) | 0.53 | 75.65 | 67.62 | 37.74 |
| KGW-WM | Word-level | Word Swap (WS) | 0.57 | 62.39 | 71.87 | 39.82 |
| | | Word Deletion (WD) | 0.54 | 74.70 | 69.19 52.86 | 39.40 50.54 |
| | | Insert Functuation (IF) | 0.05 | 0.00 | 53.00 | 10.04 |
| | | Formal | 0.05 | 0.02 | 53.30 50.20 | 48.00 |
| | | Passive | 0.03 | 8.67 | 55.03 | 40.20 |
| | Sontonco lovol | Active | 0.03 | 0.21 | 55.32 | 41.10 |
| | Sentence-level | Back Translation | 0.69 | 68.60 | 70.88 | 29.30 |
| | | SCPN Bart | 0.06 | 0.00 | 50.08 50.31 | 28.53 |
| | | Dipper | 0.00 | 0.33 | 55.79 | 23.35 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| | | Keyboard | 0.38 | 72.63 | 85.55 | 37.58 |
| | | OCR | 0.52 | 82.97 | 87.04 | 36.26 |
| | Character-level | Character Insert (CI) | 0.39 | 72.74 | 67.63 | 37.76 |
| | | Character Replace (CR) | 0.38 | 72.74 | 85.85 | 37.70 |
| | | Character Delete (CD) | 0.48 | 73.23 | 68.19 | 36.64 |
| | | Superior Benjacement (SB) | 0.44 | 57.01 | 69 99 | 27.70 |
| | | Word Insertion (WI) | 0.44 | 72.00 | 65.96 | 43.46 |
| LTH WM | Word-level | Word Swap (WS) | 0.49 | 58.95 | 69.11 | 31.66 |
| KIN-WM | | Word Deletion (WD) | 0.46 | 71.44 | 66.08 | 32.18 |
| | | Insert Punctuation (IP) | 0.08 | 0.02 | 53.65 | 36.22 |
| | | Formal | 0.08 | 0.02 | 54.96 | 33.60 |
| | | Casual | 0.08 | 0.28 2.67 | 54.94 54.82 | 32.50 |
| | G ()) | Active | 0.00 | 0.51 | 54.83 | 33.10 |
| | Sentence-level | Back Translation | 0.63 | 67.48 | 68.33 | 29.60 |
| | | SCPN | 0.03 | 2.84 | 54.89 | 28.44 |
| | | Bart Dipper | 0.07 | 2.18 | 60.03 53.83 | 27.45 |
| | | 11 | | | | |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| Watermark | Attack Category | Perturbation Keyboard | BLEURT 0.39 | ROUGE 61.86 | Bit Acc 82.67 | Dect Acc 49.04 |
| Watermark | Attack Category | Perturbation Keyboard OCR | BLEURT 0.39 0.53 | ROUGE 61.86 74.36 | Bit Acc 82.67 84.14 | Dect Acc 49.04 58.80 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Burdess (CD) | BLEURT 0.39 0.53 0.40 0.20 | 61.86 74.36 61.96 61.98 | Bit Acc 82.67 84.14 69.04 | Dect Acc 49.04 58.80 47.20 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) | BLEURT 0.39 0.53 0.40 0.39 0.49 | ROUGE 61.86 74.36 61.96 61.98 65.19 | Bit Acc 82.67 84.14 69.04 82.58 83.16 | Dect Acc 49.04 58.80 47.20 47.68 52.24 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) | BLEURT 0.39 0.53 0.40 0.39 0.49 0.45 | ROUGE 61.86 74.36 61.96 61.98 65.19 62.07 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | BLEURT 0.39 0.53 0.40 0.39 0.49 0.45 0.52 | ROUGE 61.86 74.36 61.96 61.98 65.19 62.07 64.62 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 45.52 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | BLEURT 0.39 0.53 0.40 0.39 0.49 0.45 0.52 0.53 | ROUGE 61.86 74.36 61.96 61.98 65.19 62.07 64.62 79.48 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 45.52 61.32 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | BLEURT 0.39 0.53 0.40 0.39 0.49 0.45 0.52 0.52 0.53 0.58 | ROUGE 61.86 74.36 61.96 61.98 65.19 62.07 64.62 79.48 64.81 77.25 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 72.34 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 45.52 61.32 38.62 52.92 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | BLEURT 0.39 0.53 0.40 0.39 0.49 0.45 0.52 0.53 0.53 0.58 0.53 0.04 | ROUGE 61.86 74.36 61.96 65.19 62.07 64.62 79.48 64.81 77.35 0.25 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.72 54 28 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Earmol | BLEURT 0.39 0.53 0.40 0.39 0.49 0.45 0.52 0.53 0.53 0.58 0.53 0.04 | ROUGE 61.86 74.36 61.96 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.21 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.72 54.28 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | BLEURT 0.39 0.53 0.40 0.39 0.49 0.45 0.52 0.53 0.53 0.58 0.53 0.04 0.04 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.25 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.72 54.28 55.96 55.68 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 61.32 38.62 53.86 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | BLEURT 0.39 0.53 0.40 0.39 0.45 0.52 0.53 0.58 0.53 0.53 0.04 0.04 0.04 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.25 0.01 2.33 8.23 | $\begin{array}{c} \textbf{Bit Acc} \\ 82.67 \\ 84.14 \\ 69.04 \\ 82.58 \\ 83.16 \\ 69.88 \\ 72.19 \\ 68.94 \\ 72.34 \\ 69.72 \\ 54.28 \\ 55.68 \\ 55.58 \end{array}$ | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 61.32 38.62 53.86 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active | BLEURT 0.39 0.53 0.40 0.39 0.45 0.52 0.53 0.53 0.53 0.04 0.04 0.04 0.04 0.02 0.02 | ROUGE 61.86 61.96 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 8.23 0.12 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.72 54.28 55.66 55.58 55.87 | Dect Acc 49.04 49.04 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Oelete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | BLEURT 0.39 0.53 0.40 0.39 0.45 0.52 0.53 0.53 0.53 0.53 0.04 0.04 0.04 0.04 0.02 0.02 0.02 0.02 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.81 77.35 0.01 2.33 8.23 0.12 64.88 9.05 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.72 54.28 55.66 55.58 55.58 55.87 68.75 40.21 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | BLEURT 0.39 0.53 0.40 0.39 0.45 0.52 0.53 0.53 0.53 0.53 0.53 0.04 0.04 0.04 0.04 0.02 0.02 0.02 0.67 0.01 0.00 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.72 54.28 55.96 55.58 55.87 68.75 68.75 49.21 50.78 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 61.32 38.62 53.86 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper | BLEURT 0.39 0.53 0.40 0.39 0.49 0.45 0.52 0.53 0.53 0.53 0.04 0.04 0.03 0.02 0.02 0.67 0.01 0.00 0.04 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 | Bit Acc \$2,67 \$4,14 \$69,04 \$2,58 \$3,16 \$69,88 \$72,19 \$68,94 \$72,34 \$69,72 \$54,28 \$55,96 \$55,88 \$55,87 \$68,75 \$49,21 \$50,78 \$55,49 | Dect Acc 49.04 58.80 47.20 47.68 52.24 48.72 61.32 38.62 53.86 0.000 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WD) Mord Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation | BLEURT 0.39 0.53 0.40 0.49 0.45 0.53 0.53 0.53 0.53 0.04 0.04 0.03 0.02 0.02 0.02 0.07 0.01 0.00 0.04 BLEURT | ROUGE 61.86 74.36 61.98 65.19 62.07 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.84 72.34 69.84 72.34 65.568 55.86 55.86 55.87 68.75 49.21 50.78 85.549 Bit Acc | Dect Acc 49.04 47.20 47.68 52.24 48.72 61.32 38.62 53.86 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard | BLEURT 0.39 0.53 0.40 0.49 0.45 0.53 0.53 0.53 0.53 0.04 0.04 0.04 0.03 0.02 0.02 0.02 0.07 0.01 0.00 0.04 BLEURT 0.28 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE 40.48 | Bit Acc \$2,67 \$4,14 \$6,04 \$2,58 \$3,16 \$69,94 \$72,19 \$68,94 \$72,34 \$69,28 \$55,96 \$55,88 \$55,87 \$55,88 \$55,87 \$55,89 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,87 \$55,49 Bit Acc \$65,05 | Dect Acc 49.04 47.20 47.68 52.24 48.72 61.32 38.62 53.86 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Cheventer Leve (CD) | BLEURT 0.39 0.49 0.49 0.45 0.52 0.53 0.53 0.04 0.04 0.04 0.03 0.02 0.02 0.02 0.02 0.01 0.001 0.001 0.001 0.004 BLEURT 0.28 0.42 0.28 0.42 0.28 0.42 0.28 0.42 0.48 0.44 0.44 0.44 0.44 0.44 0.44 0.44 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE 40.48 53.15 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 72.42 55.96 55.58 55.58 55.59 49.21 50.78 55.49 Bit Acc 665.05 67.04 40.01 | Dect Acc 49.04 49.04 458.80 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 0. |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Formubation Keyboard OCR Character Replace (CR) | BLEURT 0.39 0.53 0.40 0.39 0.45 0.52 0.53 0.58 0.53 0.04 0.04 0.04 0.03 0.02 0.02 0.07 0.01 0.00 0.04 BLEURT 0.28 0.42 0.30 0.28 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 0.12 64.88 3.05 4.66 2.89 ROUGE 40.48 40.51 40.56 40.56 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.84 72.42 65.96 55.68 55.58 55.57 68.55.87 68.55.49 Bit Acc 67.04 49.84 65.04 49.48 15.00 | Dect Acc 49.04 49.04 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.000 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) | BLEURT 0.39 0.53 0.40 0.45 0.52 0.53 0.53 0.54 0.64 0.04 0.03 0.02 0.02 0.02 0.02 0.02 0.02 0.01 0.00 0.04 BLEURT 0.28 0.42 0.30 0.28 0.37 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.011 2.33 8.23 0.12 64.88 3.05 4.666 2.89 ROUGE 40.48 53.15 40.56 40.58 40.58 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.88 55.96 55.96 55.58 55.58 55.58 55.58 55.58 55.58 55.59 68.75 49.21 50.78 55.49 Bit Acc 65.05 67.04 49.84 65.04 64.33 | Dect Acc 49.04 49.04 47.08 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 Dect Acc 2.21 1.10 0.000 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Formal Casual Casua Casual Casual Casua Ca | BLEURT 0.39 0.53 0.40 0.45 0.52 0.53 0.53 0.54 0.53 0.04 0.04 0.03 0.02 0.02 0.02 0.02 0.02 0.02 0.02 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE 40.48 53.15 40.56 40.58 40.56 40.56 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.72 54.28 55.96 55.58 55.58 55.58 55.58 55.58 55.58 55.58 55.58 55.59 68.75 49.21 50.78 55.49 Bit Acc 67.04 49.84 65.04 64.33 50.75 | Dect Acc 49.04 49.04 47.08 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.000 0.00 0. |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Oelete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Oeletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) | BLEURT 0.39 0.53 0.49 0.45 0.52 0.53 0.53 0.53 0.04 0.04 0.04 0.04 0.02 0.02 0.02 0.02 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE 40.56 40.56 40.62 40.58 43.63 40.62 40.64 40.65 40.62 40.64 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.42 69.72 54.28 55.56 55.58 55.58 55.58 55.58 55.58 55.58 55.58 55.58 55.59 Bit Acc 67.04 49.84 65.05 67.04 49.84 65.04 64.33 50.75 53.28 | Dect Acc 49.04 49.04 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Oletion (WD) Insert Punctuation (IP) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | BLEURT 0.39 0.53 0.40 0.49 0.45 0.52 0.53 0.53 0.53 0.04 0.04 0.04 0.03 0.02 0.02 0.02 0.02 0.02 0.02 0.02 | ROUGE 61.86 74.36 61.98 65.19 62.07 79.48 64.81 79.48 64.81 70.42 0.01 2.33 8.23 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGEE 40.48 53.15 40.58 40.58 40.58 40.62 40.58 40.63 40.64 40.58 40.63 40.62 40.63 40.62 40.63 40.63 40.63 40.63 40.62 40.63 40.63 40.63 40.63 40.63 50.98 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.84 72.34 65.548 55.58 55.58 55.587 68.75 49.21 9.51 9.51 9.51 9.51 9.51 9.51 9.51 9.52 9.53 9.54 9.54 9.54 9.54 9.54 9.55 9. | Dect Acc 49.04 45.880 47.20 47.68 52.24 48.72 61.32 38.62 53.86 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Attack Category Word-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Belete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Susertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | BLEURT 0.39 0.43 0.40 0.49 0.45 0.52 0.53 0.53 0.53 0.53 0.04 0.04 0.04 0.04 0.02 0.02 0.02 0.02 | ROUGE 61.86 74.36 61.98 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE 40.48 53.15 40.56 40.58 43.63 40.62 57.98 49.13 58.57 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.72 54.28 55.69 55.68 55.58 55.57 49.21 50.78 55.49 Bit Acc 68.75 67.04 49.84 65.05 67.04 49.84 65.05 67.04 49.84 50.75 53.49 53.49 55.40 | Dect Acc 49.04 49.04 47.68 47.20 47.68 52.24 48.72 45.52 61.32 33.62 53.86 0.000 0.00 0. |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Formal Keyboard OCR Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character (CI) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | BLEURT 0.39 0.49 0.45 0.52 0.53 0.58 0.53 0.04 0.04 0.04 0.03 0.02 0.02 0.02 0.07 0.01 0.00 0.04 BLEURT 0.28 0.28 0.33 0.28 0.37 0.33 0.40 0.41 0.43 0.43 0.43 0.42 0.43 0.41 0.43 0.43 0.02 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 3.233 0.12 64.62 79.38 3.8.23 0.12 64.62 70.35 8.233 0.12 64.62 8.305 40.48 53.15 40.56 40.56 40.52 40.53 40.54 40.55 40.56 40.52 40.53 40.54 40.55 40.56 40.57 40.57 40.913 55.53 1.94 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.84 72.19 68.94 72.32 54.28 55.56 55.68 55.57 68.75 68.75 49.21 50.78 55.49 Bit Acc 65.05 67.04 49.84 65.05 65.05 67.04 49.84 55.10 53.28 49.88 55.10 53.43 36.91 54.28 | Dect Acc 49.04 458.80 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 0.0 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Forturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) | BLEURT 0.39 0.49 0.45 0.52 0.53 0.53 0.54 0.53 0.04 0.04 0.04 0.03 0.02 0.02 0.07 0.01 0.00 0.04 BLEURT 0.28 0.42 0.30 0.28 0.37 0.33 0.40 0.41 0.41 0.49 0.43 0.02 0.02 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 0.12 64.88 3.05 4.66 2.89 ROUGE 40.48 3.15 40.58 40.58 40.58 40.62 40.43 57.98 49.13 58.53 1.94 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.34 69.84 72.42 54.28 55.68 55.58 55.58 55.57 68.75 68.75 68.75 68.75 68.75 68.75 69.78 55.49 Bit Acc 67.04 49.84 65.04 67.04 49.84 65.05 53.28 49.84 55.10 53.28 49.84 55.10 53.43 36.93 63.93 63.93 63.94 55.10 53.28 49.84 55.10 53.28 49.84 55.10 53.43 36.93 55.10 53.43 36.93 55.10 53.43 55.10 53.43 55.10 53.43 55.10 53.43 55.10 53.43 55.10 53.43 55.10 53.43 55.10 53.43 55.10 53.43 55.10 53.43 55.10 53.28 55.10 55.10 55.28 55.10 55.28 55.28 55.28 55.28 55.28 55.28 55.49 | Dect Acc 49.04 49.04 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.000 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Insert (CI) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | BLEURT 0.39 0.43 0.44 0.45 0.52 0.53 0.53 0.04 0.04 0.04 0.03 0.02 0.02 0.02 0.02 0.02 0.02 0.02 | ROUGE 61.86 74.36 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE 40.56 40.56 40.56 40.56 40.58 3.05 57.98 49.13 58.53 1.94 3.06 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.84 72.19 68.94 72.34 65.96 55.96 55.87 55.87 68.75 49.21 50.78 55.49 Bit Acc 65.04 65.04 65.04 64.33 50.75 53.28 49.84 65.04 64.33 50.75 53.28 49.88 55.10 53.43 36.91 53.43 36.91 | Dect Acc 49.04 49.04 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.000 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Uord-level | Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | BLEURT 0.39 0.43 0.40 0.49 0.45 0.52 0.53 0.53 0.04 0.04 0.03 0.02 0.02 0.02 0.02 0.02 0.02 0.02 | ROUGE 61.86 74.36 61.98 61.98 65.19 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE 40.48 53.15 40.56 40.56 40.57 53.15 54.53 40.62 57.98 49.13 58.53 1.94 0.54 3.06 3.06 3.05 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.84 72.19 68.94 72.219 54.28 55.96 55.58 55.58 55.58 55.76 68.75 49.21 50.78 67.04 49.84 65.04 64.33 50.75 53.28 49.84 65.04 64.33 50.75 53.28 49.88 55.10 53.43 36.91 39.65 39.86 39.85 | Dect Acc 49.04 49.04 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Formal Casual Passive Active Back Translation SCPN Bace Translation SCPN Character Scenter CS Character Delete (CD) | BLEURT 0.39 0.53 0.40 0.45 0.53 0.53 0.53 0.53 0.04 0.04 0.04 0.03 0.02 0.02 0.02 0.02 0.02 0.02 0.02 | ROUGE 61.86 74.36 61.98 65.19 62.07 79.48 64.42 79.48 64.62 79.48 64.61 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE 40.62 40.62 40.62 57.98 40.62 58.53 1.94 0.54 3.75 2.93 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 72.19 68.94 72.44 69.72 54.28 55.58 55.58 55.58 55.58 55.58 55.58 55.58 68.75 49.21 50.78 55.49 Bit Acc 67.04 49.84 65.05 67.04 49.84 65.04 64.33 50.75 53.28 49.88 55.14 30.65 53.43 30.65 53.93 63.94 13.93 63.94 13.93 13.93 13.93 13.93 13.93 13.93 13.93 13.95 13.95 13.97 14.15 | Dect Acc 49.04 49.04 47.20 47.68 52.24 48.72 61.32 38.62 53.86 0.000 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Word-level Sentence-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Belete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Replace (CR) Character Repla | BLEURT 0.39 0.53 0.40 0.49 0.45 0.53 0.53 0.53 0.53 0.04 0.04 0.04 0.04 0.02 0.02 0.02 0.02 | ROUGE 61.86 74.36 61.98 61.98 62.07 64.62 79.48 64.81 77.35 0.25 0.01 2.33 8.23 0.12 64.88 3.05 4.66 2.89 ROUGE 40.48 53.15 40.56 40.58 43.63 40.59 9.798 49.33 57.98 49.3 70.54 3.06 3.75 2.93 44.35 3.28 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.894 72.19 68.94 72.34 69.72 54.28 55.56 55.58 55.57 49.21 50.78 55.49 81t Acc 665.05 67.04 49.84 63.05 67.04 49.84 55.10 53.43 53.43 36.91 39.36 39.85 39.71 54.19 38.48 | Dect Acc 49.04 49.04 458.80 47.20 47.68 52.24 48.72 45.52 61.32 53.86 0.00 0.0 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Replace (CR) Character Neglace (CR) Character Replace | BLEURT 0.39 0.53 0.49 0.45 0.52 0.53 0.58 0.53 0.04 0.04 0.04 0.03 0.02 0.02 0.02 0.02 0.03 0.04 BLEURT 0.28 0.33 0.33 0.33 0.33 0.33 0.33 0.33 0.40 0.41 0.42 0.30 0.41 0.43 0.42 0.30 0.41 0.43 0.42 0.30 0.41 0.43 0.42 0.30 0.41 0.43 0.53 0.53 0.40 0.41 0.43 0.53 0.53 0.53 0.53 0.53 0.53 0.53 0.5 | ROUGE 61.86 74.36 61.98 61.98 62.07 64.62 79.48 64.81 77.35 0.25 0.01 3.233 0.12 64.82 3.05 4.66 2.89 ROUGE 40.48 53.15 40.56 40.58 43.63 40.62 49.13 55.53 1.94 0.54 3.06 3.75 2.93 44.35 3.28 1.13 | Bit Acc 82.67 84.14 69.04 82.58 83.16 69.88 69.84 72.19 68.94 72.42 55.96 55.68 55.58 55.58 68.75 49.21 50.78 55.59 65.05 67.04 49.84 65.05 65.05 67.04 49.84 55.10 53.28 49.88 36.91 39.36 39.365 39.71 54.19 38.48 | Dect Acc 49.04 458.80 47.20 47.68 52.24 48.72 45.52 61.32 38.62 53.86 0.00 0.0 |

Table 14: Fuyu-8B text watermarks under text perturbations.

| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
|--|--|--|--|--|---|--|
| | | Keyboard | 0.42 | 64.78 | 87.40 | 37.38 |
| | | OCR | 0.59 | 81.32 | 90.33 | 1.42 |
| | Character-level | Character Insert (CI) | 0.44 | 65.00 | 68.48 | 37.20 |
| | Character-level | Character Replace (CR) | 0.42 | 65.01 | 87.67 | 36.02 |
| | | Character Swap (CS) | 0.51 | 69.47 | 86.48 | 16.52 |
| | | Character Delete (CD) | 0.44 | 65.00 | 69.07 | 36.08 |
| | | Synonym Replacement (SR) | 0.44 | 51.76 | 63.31 | 2.88 |
| | | Word Insertion (WI) | 0.48 | 60.34 | 61.11 | 1.76 |
| KGW-WM | Word-level | Word Swap (WS) | 0.57 | 47.94 | 63.61 | 15.94 |
| | | Incort Pupetnotion (WD) | 0.48 | 0.02 | 52.09 | 20.80 |
| | | msert i unctuation (ii) | 0.05 | 0.00 | 55.02 | 0.00 |
| | | Formal | 0.09 | 0.00 | 54.90 | 3.70 |
| | | Casual De series | 0.08 | 0.00 | 54.99 | 0.20 |
| | | Activo | 0.07 | 0.00 | 54.00 54.73 | 10.80 |
| | Sentence-level | Back Translation | 0.52 | 38.10 | 65.04 | 0.00 |
| | | SCPN | 0.04 | 1.05 | 50.17 | 20.16 |
| | | Bart | 0.06 | 0.00 | 52.24 | 15.86 |
| | | Dipper | 0.05 | 0.00 | 50.00 | 14.95 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| | | Keyboard | 0.40 | 69.21 | 89.42 | 39.54 |
| | | OCR | 0.49 | 77.41 | 85.36 | 40.66 |
| | Character lovel | Character Insert (CI) | 0.35 | 71.69 | 80.02 | 42.85 |
| | CHARACTELEVEL | Character Replace (CR) | 0.34 | 70.78 | 77.80 | 37.42 |
| | | Character Swap (CS) | 0.33 | 68.33 | 62.53 | 29.55 |
| | | Character Delete (CD) | 0.36 | 80.41 | 23.31 | 31.86 |
| | | Synonym Replacement (SR) | 0.41 | 76.90 | 84.36 | 37.64 |
| | | Word Insertion (WI) | 0.47 | 41.31 | 85.74 | 40.89 |
| KTH-WM | Word-level | Word Swap (WS) | 0.55 | 50.78 | 86.93 | 42.93 |
| | | Word Deletion (WD) | 0.31 | 55.72 | 75.43 | 48.80 |
| | | Insert Functuation (IF) | 0.02 | 1.51 | 49.21 | 34.04 |
| | | Formal | 0.03 | 0.03 | 45.67 | 32.28 |
| | | Casual | 0.09 | 0.00 | 44.04 | 29.37 |
| | | Passive | 0.02 | 0.01 | 36.96 50.20 | 28.63 |
| | Sentence-level | Back Translation | 0.00 | 55.81 | 66 77 | 10.76 |
| | | SCPN | 0.00 | 2.64 | 0.00 | 20.02 |
| | | Bart | 0.02 | 1.85 | 21.56 | 20.06 |
| | | Dipper | 0.01 | 0.03 | 33.76 | 19.94 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| | | Keyboard | 0.38 | 52.26 | 65.34 | 26.35 |
| | | OCR | 0.53 | 62.64 | 66.43 | 21.90 |
| | | Character Insert (CI) | 0.41 | 52.30 | 54.57 | 26.97 |
| | Character lovel | | | 50.04 | 65.91 | 07.70 |
| | Character-level | Character Replace (CR) | 0.33 | 52.34 | 05.21 | 21.12 |
| | Character-level | Character Replace (CR) Character Swap (CS) | 0.33 0.52 | 52.34 55.08 | 65.68 | 26.41 |
| | Character-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) | 0.33 0.52 0.48 | 52.34 55.08 52.41 | 65.68 55.23 | 26.41 25.21 |
| | Character-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | 0.33 0.52 0.48 0.21 | 52.34 55.08 52.41 54.67 | 65.68 55.23 56.89 | 24.09 |
| | Character-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | 0.33 0.52 0.48 0.21 0.55 | 52.34 55.08 52.41 54.67 68.21 | 65.21 65.68 55.23 56.89 55.02 | 21.12 26.41 25.21 24.09 21.36 |
| Blackbox-WM | Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | 0.33 0.52 0.48 0.21 0.55 0.55 | 52.34 55.08 52.41 54.67 68.21 54.49 | 65.21 65.68 55.23 56.89 55.02 56.96 | 21.12 26.41 25.21 24.09 21.36 24.33 |
| Blackbox-WM | Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | 0.33 0.52 0.48 0.21 0.55 0.55 0.55 0.51 | $52.34 \\ 55.08 \\ 52.41 \\ 54.67 \\ 68.21 \\ 54.49 \\ 65.18 \\ 0.21 \\ $ | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 | 21.12 26.41 25.21 24.09 21.36 24.33 22.02 33.26 |
| Blackbox-WM | Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | 0.33 0.52 0.48 0.21 0.55 0.55 0.55 0.51 0.08 | 52.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 | 65.21 65.68 55.23 56.89 55.02 56.96 55.05 42.78 | 21.12 26.41 25.21 24.09 21.36 24.33 22.02 33.36 |
| Blackbox-WM | Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal | 0.33 0.52 0.48 0.21 0.55 0.55 0.55 0.51 0.08 0.07 | 52.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 | 65.21 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 | 21.12 26.41 25.21 24.09 21.36 24.33 22.02 33.36 33.14 |
| Blackbox-WM | Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | 0.33 0.52 0.48 0.21 0.55 0.55 0.55 0.51 0.08 0.07 0.05 | 52.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.05 | 65.21 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.97 43.80 | 21.12 26.41 25.21 24.09 21.36 24.33 22.02 33.36 33.14 28.23 21.45 |
| Blackbox-WM | Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.01 0.00 | 52.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 | $\begin{array}{c} 63.21\\ 65.68\\ 55.23\\ \hline 56.89\\ 55.02\\ 55.05\\ 55.05\\ 42.78\\ \hline 44.19\\ 43.97\\ 43.89\\ 44.12\\ \end{array}$ | 21.12 26.41 25.21 24.09 21.36 24.33 22.02 33.36 33.14 28.25 21.45 22.45 22.45 |
| Blackbox-WM | Character-level Word-level Sentence-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation | $\begin{array}{c} 0.33\\ 0.52\\ 0.48\\ 0.21\\ 0.55\\ 0.55\\ 0.51\\ 0.08\\ \hline 0.07\\ 0.05\\ 0.01\\ 0.00\\ 0.52\\ \end{array}$ | 52.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 54.77 | $\begin{array}{c} 65.21\\ 65.68\\ 55.23\\ 56.89\\ 55.02\\ 56.96\\ 55.05\\ 42.78\\ 44.19\\ 43.97\\ 43.89\\ 44.12\\ 54.29\end{array}$ | 21.12 26.41 25.21 24.09 21.33 22.02 33.33 22.02 33.34 28.22 21.45 22.80 32.38 |
| Blackbox-WM | Character-level Word-level Sentence-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | $\begin{array}{c} 0.33\\ 0.52\\ 0.48\\ 0.21\\ 0.55\\ 0.55\\ 0.55\\ 0.51\\ 0.08\\ 0.07\\ 0.05\\ 0.01\\ 0.00\\ 0.52\\ 0.05\\ \end{array}$ | 52.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 54.77 0.16 | $\begin{array}{c} 65.21\\ 65.68\\ 55.23\\ 55.02\\ 55.02\\ 55.05\\ 42.78\\ 44.19\\ 43.97\\ 43.89\\ 44.12\\ 54.29\\ 42.87\end{array}$ | 24.12 26.41 25.21 24.09 21.36 24.33 22.02 33.36 33.14 28.22 21.45 22.86 32.38 20.31 |
| Blackbox-WM | Character-level Word-level Sentence-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | $\begin{array}{c} 0.33\\ 0.52\\ 0.48\\ 0.21\\ 0.55\\ 0.55\\ 0.51\\ 0.08\\ \hline 0.07\\ 0.05\\ 0.01\\ 0.00\\ 0.52\\ 0.05\\ 0.00\\ \hline 0.00\\ 0.00\\ \hline \end{array}$ | $\begin{array}{c} 52.34\\ 55.08\\ 52.41\\ 54.67\\ 68.21\\ 54.49\\ 65.18\\ 0.21\\ 0.01\\ 1.97\\ 6.95\\ 0.10\\ 54.77\\ 0.16\\ 0.21\\ \end{array}$ | $\begin{array}{c} 65.21\\ 65.68\\ 55.23\\ \hline 56.89\\ 55.02\\ 56.96\\ 55.05\\ 42.78\\ \hline 44.19\\ 43.97\\ 43.89\\ 44.12\\ 54.29\\ 42.87\\ 44.68\end{array}$ | 21.12 26.41 25.21 24.09 21.36 24.33 22.02 33.36 33.14 28.23 21.45 22.86 32.38 20.31 21.74 |
| Blackbox-WM | Character-level Word-level Sentence-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper | $\begin{array}{c} 0.33\\ 0.52\\ 0.48\\ 0.21\\ 0.55\\ 0.55\\ 0.51\\ 0.08\\ 0.07\\ 0.05\\ 0.01\\ 0.00\\ 0.52\\ 0.05\\ 0.00\\ 0.00\\ 0.00\\ 0.07\\ \end{array}$ | $\begin{array}{c} 52.34\\ 55.08\\ 52.41\\ 54.67\\ 68.21\\ 54.99\\ 65.18\\ 0.21\\ 0.01\\ 1.97\\ 6.95\\ 0.10\\ 54.77\\ 0.16\\ 0.21\\ 1.41\\ \end{array}$ | $\begin{array}{c} 65.21\\ 65.68\\ 55.23\\ \hline 56.89\\ 55.02\\ 55.05\\ 42.78\\ \hline 44.19\\ 43.97\\ 43.89\\ 44.12\\ 54.29\\ 42.87\\ 44.68\\ 45.03\\ \end{array}$ | 24.12 26.41 25.21 24.09 21.33 22.00 33.36 33.14 28.22 21.44 22.80 32.38 20.31 21.74 22.83 |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.01 0.00 0.52 0.05 0.00 0.00 0.00 0.007 BLEURT | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.9.5 0.10 54.77 0.16 0.21 1.41 ROUGE | 65.68 55.23 56.89 55.02 55.05 42.78 44.19 43.89 44.12 54.29 44.12 54.29 42.87 44.68 45.03 Bit Acc | 21.12 26.41 25.21 24.09 21.36 24.33 22.00 33.36 33.14 28.23 21.45 22.80 32.38 20.31 21.47 22.83 Dect Acc |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.01 0.00 0.52 0.05 0.00 0.00 0.00 0.00 0.00 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 0.41 7.0.16 0.21 1.41 ROUGE | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.97 43.89 44.12 54.29 42.87 42.87 42.87 42.87 42.87 42.87 54.20 54.20 54.20 54.20 54.20 54.20 54.20 55.21 55.22 42.78 43.99 55.22 54.22 54.22 55.25 54.25 55.55 55.55 55.55 55.25 55.25 55.55 55.25 55.25 55.55 | 21.12 26.41 25.21 24.05 21.36 24.33 22.02 33.36 33.14 28.23 21.45 22.80 32.38 20.31 21.74 22.80 32.38 20.31 21.74 22.80 32.38 20.31 21.74 22.80 32.38 20.31 21.74 22.80 32.38 20.31 21.74 22.80 32.32 21.74 22.80 32.36 21.75 |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR | 0.33 0.52 0.48 0.55 0.55 0.51 0.08 0.07 0.05 0.01 0.00 0.52 0.05 0.00 0.07 BLEURT 0.29 0.29 0.40 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 54.77 0.16 0.21 1.41 ROUGE 55.21 44.99 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.97 43.89 44.12 54.29 42.87 44.68 45.03 Bit Acc 70.93 68.87 | 26.41 26.41 25.21 24.05 21.36 24.33 22.00 33.36 33.14 28.23 21.44 28.23 21.44 28.23 20.31 21.74 22.83 20.31 22.83 20.000 |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category Character-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Back | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.02 0.05 0.00 0.07 BLEURT 0.29 0.40 0.22 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 0.7 1.97 0.16 0.21 1.97 0.17 1.97 0.12 1.97 0.14 ROUGE 55.21 44.99 40.84 70.65 1.97 1 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.89 43.89 43.89 43.89 43.89 44.12 54.29 42.87 44.68 55.03 Bit Acc 70.93 68.87 69.21 69.21 | 26.41 26.41 25.21 24.05 21.36 24.33 22.02 33.36 33.14 28.23 21.45 22.88 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.38 32.39 33.39 32.39 |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category Character-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CC) | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.52 0.00 0.00 0.07 BLEURT 0.29 0.40 0.22 0.21 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 0.21 1.41 ROUGE 55.21 44.99 40.84 39.90 92.22 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.97 43.89 44.12 54.29 42.87 44.68 45.03 Bit Acc 70.93 68.87 69.21 60.30 60.30 | 26.41 26.41 25.21 24.05 21.36 24.33 22.02 33.36 33.14 28.22 21.44 22.88 32.88 32.38 32.38 32.38 32.38 20.31 21.74 22.83 Dect Acc 0.00 0.000 0.000 |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category Character-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) | 0.33 0.52 0.48 0.21 0.55 0.51 0.08 0.07 0.05 0.00 0.00 0.00 0.00 0.00 0.00 | 32.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 0.47 0.16 0.21 1.41 ROUGE 55.21 44.99 40.84 39.90 39.36 37.12 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.89 44.12 54.29 42.87 44.503 Bit Acc 70.93 68.87 69.21 60.30 59.26 59.26 | 26.41 26.41 25.21 24.05 21.36 24.33 22.00 33.34 28.22 21.44 22.88 30.33 21.47 22.88 Dect Acc 0.00 0.000 0.000 0.000 0.000 0.000 |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category Character-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Synonym Replacement (SR) Word Insertion (WI) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.52 0.05 0.00 0.07 BLEURT 0.29 0.40 0.22 0.21 0.30 0.41 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 54.77 0.16 0.21 1.41 ROUGE 55.21 44.99 40.84 39.90 39.36 39.36 27.12 28.65 29.65 20.65 20.65 20.65 20.65 20.75 20 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.89 44.12 54.29 42.87 44.68 Bit Acc 70.93 68.87 69.21 60.21 60.21 60.21 70.93 55.21 70.93 70.94 70.95 | 26.41 26.41 25.21 24.05 21.36 24.33 22.06 33.31 428.22 21.44 22.86 32.35 20.33 21.74 22.86 32.35 20.33 21.74 22.86 0.00 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category Character-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Swap (CS) | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.02 0.05 0.00 0.05 0.00 0.07 0.22 0.21 0.29 0.40 0.22 0.21 0.21 0.29 0.40 0.22 0.21 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 1.97 6.95 0.10 54.77 0.16 0.21 1.41 ROUGE 55.21 44.99 40.84 39.90 39.36 37.12 38.00 42.11 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.97 43.89 44.12 54.29 42.87 44.68 45.03 Bit Acc 70.93 68.87 69.21 69.21 69.21 69.26 55.21 70.64 6°.27 | 26.41 26.41 25.21 24.05 21.36 24.33 22.02 33.34 22.02 33.34 22.02 21.45 22.85 20.31 21.74 22.85 20.00 0.00 0.000 0.000 0.000 0.000 2.21 1.10 2.21 2.21 |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.02 0.05 0.00 0.07 BLEURT 0.29 0.29 0.29 0.20 0.40 0.30 0.30 0.31 0.32 0.51 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 54.77 0.16 0.21 1.97 0.16 0.21 1.41 8.00 1.99 0.33 3.63 3.712 3.8.00 4.2.11 4.3.55 5.2.11 4.3.55 5.2.11 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.89 44.12 54.278 66.80 67.02 60.01 60.02 60.02 60.03 59.26 55.21 70.64 68.27 39.21 | 26.41 26.41 25.21 24.05 21.36 24.33 22.02 33.33 22.02 33.34 28.22 22.45 22.85 20.31 21.47 22.85 20.31 21.77 22.85 Dect Acc 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000000 |
| Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.00 0.01 0.00 0.02 0.00 0.07 BLEURT 0.29 0.40 0.22 0.21 0.30 0.41 0.39 0.32 0.51 0.51 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 0.47 0.16 0.21 1.41 ROUGE 55.21 44.99 40.84 39.90 39.36 37.12 38.00 38.30 42.11 43.51 44.98 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.89 44.12 54.29 42.87 44.287 44.287 44.503 Bit Acc 70.93 68.87 69.21 60.30 59.26 55.21 60.30 59.26 55.21 69.21 60.30 59.26 55.21 69.21 60.30 59.26 55.21 69.21 60.30 59.26 50.21 60.30 59.26 50.21 60 | 26.41 26.41 25.21 24.05 21.36 24.33 22.02 33.34 28.22 21.44 22.88 32.38 20.31 21.74 22.88 Dect Acc 0.00 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000000 |
| Blackbox-WM Watermark | Character-level Word-level Sentence-level Character-level Word-level Word-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insert Punctuation (IP) | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.02 0.05 0.00 0.07 BLEURT 0.29 0.40 0.22 0.21 0.30 0.41 0.39 0.32 0.32 0.32 0.32 0.32 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 54.77 0.16 0.21 1.41 ROUGE 55.21 44.99 40.84 39.90 39.36 37.12 38.00 42.11 43.51 44.98 0.21 | 65.21 65.68 55.23 56.99 55.02 56.96 55.05 42.78 44.19 43.97 43.89 44.12 54.29 42.87 44.63 Bit Acc 70.93 68.87 69.21 60.21 70.64 68.27 39.21 39.84 36.85 | 26.41 26.41 25.21 24.05 21.36 24.33 22.00 33.34 22.80 33.34 22.80 32.35 20.33 21.44 22.86 32.35 20.33 21.74 22.86 0.00 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000000 |
| Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.02 0.05 0.00 0.07 BLEURT 0.29 0.40 0.22 0.21 0.30 0.41 0.30 0.41 0.39 0.32 0.51 0.30 0.41 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 1.97 6.95 0.10 54.7 0.16 0.21 1.41 ROUGE 55.21 44.99 40.84 39.90 39.36 37.12 38.00 42.11 43.51 44.98 0.21 1.97 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.97 43.89 44.12 54.29 42.87 44.68 45.03 Bit Acc 70.93 68.87 69.21 60.30 55.26 55.21 70.64 68.27 10.64 68.27 10.64 10.59 10.64 10.59 10.64 10.59 10.64 10.59 10.64 10.59 10.64 10.59 10.59 10.55 | 26.41 26.41 25.21 24.05 21.30 24.33 22.00 33.34 22.00 33.34 22.00 33.34 22.85 20.31 21.74 22.85 20.31 21.74 22.85 20.31 21.74 22.85 20.31 21.74 20.31 20.31 21.74 20.31 21.74 20.31 21.74 20.31 21.74 20.31 21.74 20.31 21.74 20.31 21.74 20.31 21.74 20.31 21.74 20.31 20.31 21.74 20.31 20.00 0.00 0.0000 0.0000 0.0000 0.000000 |
| Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.02 0.05 0.00 0.07 BLEURT 0.29 0.29 0.29 0.21 0.30 0.40 0.32 0.31 0.32 0.31 0.32 0.31 0.32 0.31 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | 2.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 0.21 1.97 6.95 0.10 0.21 1.41 ROUGE 55.21 44.99 40.84 39.90 39.36 37.12 38.00 42.11 44.99 0.21 1.12 1.62 | 65.21 65.68 55.23 56.89 55.02 65.68 55.02 42.78 44.19 43.97 43.89 44.12 54.29 42.87 44.68 45.03 Bit Acc 70.93 68.87 69.21 60.30 59.26 55.21 70.64 68.27 39.84 36.85 30.02 30.58 | 26.41 26.41 25.21 24.05 21.36 24.33 22.05 33.36 33.14 28.25 21.47 22.88 20.33 21.77 22.88 Dect Acc 0.00 0.000 0.000 0.211 1.10 2.12 0.62 0.000 0.000 |
| Blackbox-WM Watermark | Character-level Word-level Sentence-level Character-level Word-level Word-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.00 0.02 0.07 BLEURT 0.29 0.40 0.22 0.21 0.30 0.41 0.32 0.31 0.32 0.51 0.32 0.51 0.32 0.51 0.03 | 32.34 55.08 52.41 54.67 68.21 54.49 65.18 0.21 0.01 1.97 6.95 0.10 0.21 1.41 ROUGE 55.21 44.99 40.84 39.90 39.36 37.12 38.00 42.11 43.51 45.551 45.5551 45.5515515515555555555 | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.89 44.12 54.29 42.87 44.503 Bit Acc 70.93 68.87 69.21 70.64 55.21 66.30 59.26 55.21 70.64 39.84 36.85 30.02 30.58 29.21 | 26.41 26.41 25.21 24.05 24.33 22.02 33.34 28.22 21.44 22.86 32.33 20.33 20.33 20.33 20.33 20.33 20.33 20.44 22.86 0.03 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.00000 0.00000 0.00000 0.000000 0.00000000 |
| Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Character-level Word-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.02 0.05 0.00 0.07 BLEURT 0.29 0.40 0.22 0.21 0.30 0.41 0.32 0.32 0.31 0.32 0.31 0.32 0.31 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 | $\begin{array}{c} 32.34\\ 55.08\\ 52.41\\ 54.67\\ 68.21\\ 54.49\\ 65.18\\ 0.21\\ 0.01\\ 1.97\\ 6.95\\ 0.10\\ 54.77\\ 0.16\\ 0.21\\ 1.41\\ \textbf{ROUGE}\\ \textbf{55.21}\\ 44.99\\ 40.84\\ 39.90\\ 39.36\\ 37.12\\ 38.00\\ 42.11\\ 43.51\\ 44.98\\ 0.21\\ 1.12\\ 1.63\\ 2.75\\ 3.88\\ \end{array}$ | 65.21 65.68 55.23 56.99 55.02 56.96 55.05 42.78 44.19 43.97 43.89 44.12 54.29 42.87 44.63 Bit Acc 70.93 68.87 69.21 60.21 60.21 60.21 39.84 36.85 30.02 30.58 29.21 30.64 | 26.41 26.41 25.21 24.05 24.33 22.05 33.34 22.85 22.85 22.85 22.85 22.85 22.85 20.33 21.44 22.85 20.33 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.03 21.74 22.85 20.00 0.0000 0.00000 0.0000 0.00000 0.00000 0.00000 0.00000 0.00 |
| Blackbox-WM | Character-level Word-level Sentence-level Character-level Word-level Sentence-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.52 0.05 0.00 0.07 BLEURT 0.29 0.40 0.22 0.21 0.30 0.41 0.32 0.51 0.31 | $\begin{array}{c} 32.34\\ 55.08\\ 52.41\\ 54.67\\ 68.21\\ 54.49\\ 65.18\\ 0.21\\ 0.01\\ 1.97\\ 6.95\\ 0.10\\ 54.7\\ 0.16\\ 0.21\\ 1.41\\ \textbf{ROUGE}\\ 55.21\\ 44.99\\ 40.84\\ 39.90\\ 39.36\\ 37.12\\ 38.00\\ 42.11\\ 43.51\\ 44.98\\ 0.21\\ 1.63\\ 32.75\\ 3.88\\ 3$ | 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.97 43.89 44.12 54.29 42.87 44.68 45.03 Bit Acc 70.93 68.87 69.21 60.30 59.26 55.21 70.64 68.57 30.21 39.84 36.85 30.058 29.21 30.58 29.21 30.58 29.21 | 26.41 26.41 25.21 24.09 21.36 24.33 22.02 33.36 3.3.14 28.23 21.45 22.80 32.38 20.31 21.74 22.80 32.38 20.31 21.74 22.80 0.00 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.00000 0.00000 0.00000 0.00000000 |
| Blackbox-WM Watermark | Character-level Word-level Sentence-level Word-level Character-level Sentence-level | Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | 0.33 0.52 0.48 0.21 0.55 0.55 0.55 0.05 0.00 0.01 0.00 0.02 0.00 0.07 BLEURT 0.29 0.29 0.21 0.30 0.30 0.31 0.32 0.51 0.30 0.41 0.39 0.32 0.51 0.51 0.40 0.40 0.41 0.39 0.32 0.51 0.51 0.40 0.41 0.30 0.51 0.55 0.05 0.05 0.05 0.05 0.05 0.0 | $\begin{array}{c} 32.34\\ 55.08\\ 52.41\\ 54.67\\ 68.21\\ 54.49\\ 65.18\\ 0.21\\ 0.01\\ 1.97\\ 6.95\\ 0.10\\ 0.54.77\\ 0.16\\ 0.021\\ 1.41\\ \hline \textbf{ROUGE}\\ \hline \textbf{ROUGE}\\ \hline \textbf{ROUGE}\\ 39.90\\ 39.36\\ 39.90\\ 39.36\\ 37.12\\ 38.00\\ 42.11\\ 44.98\\ 0.21\\ 1.43\\ 55.21\\ 38.80\\ 42.11\\ 43.51\\ 44.98\\ 0.21\\ 1.12\\ 1.63\\ 2.75\\ 3.88\\ 41.86\\ 1.21\\ 1.63\\ 2.75\\ 3.88\\ 41.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.21\\ 1.86\\ 1.86\\ 1.21\\ 1.86\\ 1.8$ | 65.21 65.68 55.23 56.89 55.05 42.78 44.12 54.29 42.87 44.68 45.03 Bit Acc 60.30 59.26 55.21 60.30 59.26 55.21 70.64 68.27 39.84 30.68 29.21 30.64 44.44 44.65 | 26.41 26.41 24.00 21.36 24.03 22.02 33.36 33.34 22.83 22.83 20.83 22.83 20.83 22.83 20.83 22.83 20.83 21.45 22.88 20.83 20.83 20.72 20.83 20.83 20.72 20.83 20.72 20.83 20.72 20.83 20.72 20.83 20.72 20.83 20.72 20.83 20.72 20 |
| Blackbox-WM Watermark | Character-level Word-level Sentence-level Word-level Character-level Sentence-level | Character Replace (CR) Character Swap (CS) Character Swap (CS) Synonym Replacement (SR) Word Insertion (WI) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | 0.33 0.52 0.48 0.21 0.55 0.55 0.51 0.08 0.07 0.05 0.00 0.52 0.00 0.07 BLEURT 0.29 0.40 0.22 0.21 0.30 0.41 0.32 0.51 0.21 0.32 0.51 0.21 0.32 0.51 0.21 0.32 0.51 0.21 0.32 0.51 0.21 0.32 0.51 0.21 0.32 0.55 0.00 0.01 0.32 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.5 | $\begin{array}{c} 32.34\\ 55.08\\ 52.41\\ 54.67\\ 68.21\\ 54.49\\ 65.18\\ 0.21\\ 0.01\\ 1.97\\ 6.95\\ 0.10\\ 54.77\\ 0.16\\ 55.21\\ 44.99\\ 40.84\\ 39.90\\ 39.36\\ 37.12\\ 38.00\\ 39.36\\ 37.12\\ 1.41\\ 143.51\\ 44.98\\ 0.21\\ 1.12\\ 1.63\\ 2.75\\ 3.88\\ 41.86\\ 1.21\\ 1.77\\ \end{array}$ | 65.61 65.68 55.23 56.89 55.02 56.96 55.05 42.78 44.19 43.89 44.12 54.29 42.87 44.60 68.87 69.21 70.93 68.87 69.21 70.93 68.87 69.21 70.93 68.87 69.21 30.84 48.85 30.02 30.64 44.67 30.64 44.67 30.64 | 26.41 26.41 24.63 24.33 22.02 33.34 22.02 33.34 22.02 33.34 22.80 32.35 20.33 20.31 21.74 22.80 32.35 20.31 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 32.35 20.03 21.74 22.80 0.0000 0.00000 0.0000 0.0000 0.000000 0.000000 0.00000000 |

Table 15: InternLM-X Composer text watermarks under text perturbations.

| water mark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
|--|---|---|---|--|--|--|
| | | Keyboard | 0.44 | 0.00 | 88.15 | 42.06 |
| | | OCR | 0.52 | 0.00 | 88.16 | 57.58 |
| | Character-level | Character Insert (CI) | 0.45 | 0.00 | 79.20 | 22.44 |
| | | Character Replace (CR) Character Swap (CS) | 0.41 | 0.00 58.32 | 85.04 98.74 | 25.84 58.32 |
| | | Character Delete (CD) | 0.77 | 0.00 | 83.59 | 68.40 |
| | - | Synonym Replacement (SR) | 0.00 | 0.00 | 0.00 | 0.00 |
| | | Word Insertion (WI) | 0.20 | 0.00 | 55.26 | 0.00 |
| KGW-WM | Word-level | Word Swap (WS) | 0.00 | 0.00 | 0.00 | 0.00 |
| | | Word Deletion (WD) Insort Punctuation (IP) | 0.00 | 0.00 | 0.00 | 0.00 |
| | | E-mail | 0.03 | 0.00 | 40.00 | 00.00 |
| | | Casual | 0.30 | 0.00 | 52.38 | 88.00 52.00 |
| | | Passive | 0.37 | 0.00 | 52.63 | 0.00 |
| | Sentence-level | Active | 0.37 | 0.00 | 52.63 | 0.00 |
| | | Back Translation | 0.00 | 0.00 | 0.00 | 0.00 |
| | | Bart | 0.00 | 0.00 | 41.47 | 0.00 |
| | | Dipper | 0.17 | 0.00 | 50.00 | 0.00 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| | | Keyboard | 0.46 | 21.19 | 84.59 | 39.20 |
| | | OCR | 0.57 | 25.72 | 85.93 | 46.38 |
| | Character-level | Character Insert (CI) | 0.47 | 21.21 | 73.82 | 29.44 |
| | | Character Replace (CR) | 0.44 | 21.23 | 83.18 | 30.26 |
| | | Character Delete (CD) | 0.66 | 29.33 | 77.36 | 42.42 |
| | | Synonym Replacement (SR) | 0.14 | 9.49 | 26.41 | 13.46 |
| | | Word Insertion (WI) | 0.22 | 11.17 | 55.82 | 13.32 |
| KTH-WM | Word-level | Word Swap (WS) | 0.16 | 9.52 | 26.12 | 14.66 |
| 1111-1111 | | Word Deletion (WD) | 0.14 | 10.85 | 23.56 | 10.04 |
| | | Deployment Punctuation (IP) | 0.10 | 0.91 | 40.20 | 50.00 |
| | | Formal Casual | 0.22 | 1.35 | 53.55 53.45 | 53.60 48.40 |
| | | Passive | 0.21 | 1.62 | 53.51 | 57.00 |
| | Sontonco lovol | Active | 0.23 | 1.39 | 53.56 | 57.80 |
| | Sentence-level | Back Translation | 0.82 | 32.82 | 87.31 | 60.10 |
| | | SCPN | 0.37 | 21.38 | 30.68 | 10.66 |
| | | Dipper | 0.25 | 32.79 | 34.00 | 14.95 |
| XX7 / 1 | Attack Catogory | Perturbation | BLEURT | BOUGE | Bit Acc | Dect Acc |
| watermark | Attack Category | | DEDCIU | 10000L | | |
| watermark | Attack Category | Keyboard | 0.47 | 50.46 | 90.56 | 45.86 |
| watermark | Attack Category | Keyboard OCR | 0.47 0.63 | 50.46 55.15 | 90.56 81.44 | 45.86 45.76 |
| watermark | Character-level | Keyboard OCR Character Insert (CI) | 0.47 0.63 0.49 | 50.46 55.15 49.56 | 90.56 81.44 83.63 | 45.86 45.76 45.77 |
| Watermark | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swan (CS) | 0.47 0.63 0.49 0.45 0.58 | 50.46 55.15 49.56 56.78 62.32 | 90.56 81.44 83.63 85.85 77.42 | 45.86 45.76 45.77 44.89 31.86 |
| watermark | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) | 0.47 0.63 0.49 0.45 0.58 0.51 | 50.46 55.15 49.56 56.78 62.32 64.12 | 90.56 81.44 83.63 85.85 77.42 77.32 | $\begin{array}{r} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\end{array}$ |
| watermark | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 | 50.46 55.15 49.56 56.78 62.32 64.12 64.99 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 |
| watermark | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 | 50.46 55.15 49.56 56.78 62.32 64.12 64.99 66.46 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 |
| Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | $\begin{array}{c} 0.47\\ 0.63\\ 0.49\\ 0.45\\ 0.58\\ 0.51\\ \hline 0.60\\ 0.57\\ 0.62\\ 0.57\\ 0.5$ | 50.46 55.15 49.56 56.78 62.32 64.12 64.99 66.46 62.31 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 27.72 |
| Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | $\begin{array}{c} 0.47\\ 0.63\\ 0.49\\ 0.45\\ 0.58\\ 0.51\\ \hline 0.60\\ 0.57\\ 0.62\\ 0.59\\ 0.15\\ \end{array}$ | 50.46 55.15 49.56 56.78 62.32 64.12 64.99 66.46 62.31 62.56 2.12 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 37.33 0.00 |
| Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 | 50.46 55.15 49.56 56.78 62.32 64.12 64.99 66.46 62.31 62.56 2.12 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 37.33 0.00 |
| Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | $\begin{array}{c} 0.47\\ 0.63\\ 0.49\\ 0.45\\ 0.58\\ 0.51\\ \hline 0.60\\ 0.57\\ 0.62\\ 0.59\\ 0.15\\ \hline 0.05\\ 0.06\\ \hline \end{array}$ | 50.46 55.15 49.56 56.78 62.32 64.12 64.99 66.46 62.31 62.56 2.12 0.000 0.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 37.33 0.00 0.00 0.00 |
| Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | $\begin{array}{c} 0.47\\ 0.63\\ 0.63\\ 0.49\\ 0.45\\ 0.58\\ 0.51\\ 0.62\\ 0.59\\ 0.15\\ 0.05\\ 0.06\\ 0.11\\ \end{array}$ | 50.46 55.15 49.56 56.78 62.32 64.12 64.99 66.46 62.31 62.56 2.12 0.00 0.00 0.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 30.25 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ \end{array}$ |
| Blackbox-WM | Character-level Word-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Book Translotion | $\begin{array}{c} 0.47\\ 0.63\\ 0.63\\ 0.49\\ 0.45\\ 0.58\\ 0.51\\ \hline 0.60\\ 0.57\\ 0.62\\ 0.59\\ 0.15\\ \hline 0.62\\ 0.59\\ 0.15\\ \hline 0.06\\ 0.11\\ 0.18\\ 0.78\\ \hline 0.78\\ 0.7$ | 100 0000 50.46 55.15 49.56 56.78 62.32 64.12 64.99 66.46 62.31 62.56 2.12 0.00 0.00 0.00 0.00 0.00 0.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 30.25 29.36 | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 37.33 0.00 0.00 0.00 0.00 0.00 0.00 |
| Blackbox-WM | Character-level Word-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | $\begin{array}{c} 0.47\\ 0.63\\ 0.63\\ 0.49\\ 0.45\\ 0.58\\ 0.51\\ \hline 0.60\\ 0.57\\ 0.62\\ 0.59\\ 0.15\\ \hline 0.05\\ 0.06\\ 0.11\\ 0.18\\ 0.78\\ 0.04\\ \end{array}$ | 100 50.46 50.515 49.56 56.78 66.36 66.32 64.12 64.99 66.46 62.32 64.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 30.25 29.36 53.81 21.56 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 1.11\\ 41.55\\ 0.00\\ \end{array}$ |
| Blackbox-WM | Character-level Word-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | $\begin{array}{c} 0.47\\ 0.63\\ 0.63\\ 0.45\\ 0.58\\ 0.51\\ 0.60\\ 0.57\\ 0.62\\ 0.59\\ 0.15\\ 0.05\\ 0.05\\ 0.06\\ 0.11\\ 0.18\\ 0.78\\ 0.04\\ 0.00\\ \end{array}$ | 50.46 55.15 49.56 56.78 62.32 64.12 64.46 62.31 62.56 62.72 0.00 0.00 0.00 0.00 77.91 0.00 0.00 | $\begin{array}{c} 90.56\\ 81.44\\ 83.63\\ 85.85\\ 77.42\\ 77.32\\ 74.36\\ 64.58\\ 32.18\\ 44.73\\ 39.47\\ 36.64\\ 37.33\\ 30.25\\ 29.36\\ 53.81\\ 21.56\\ 22.61\\ \end{array}$ | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 1.11\\ 41.55\\ 0.00\\ 0.124\\ \end{array}$ |
| Blackbox-WM | Character-level Word-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper | $\begin{array}{c} 0.47\\ 0.63\\ 0.63\\ 0.49\\ 0.45\\ 0.58\\ 0.51\\ 0.62\\ 0.59\\ 0.15\\ 0.62\\ 0.59\\ 0.15\\ 0.05\\ 0.06\\ 0.11\\ 0.18\\ 0.78\\ 0.04\\ 0.00\\ 0.08\\ \end{array}$ | 50.46 55.15 49.56 56.78 62.32 64.12 64.36 62.31 62.36 62.31 62.32 64.46 62.31 62.32 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 | $\begin{array}{c} 90.56\\ 81.44\\ 83.63\\ 85.85\\ 77.42\\ 77.32\\ 74.36\\ 64.58\\ 32.18\\ 44.73\\ 39.47\\ 36.64\\ 37.33\\ 30.25\\ 29.36\\ 53.81\\ 21.56\\ 22.61\\ 28.49\\ \end{array}$ | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.111\\ 41.55\\ 0.00\\ 1.24\\ 4.88\end{array}$ |
| Blackbox-WM | Character-level Word-level Sentence-level Attack Category | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.05 0.05 0.05 0.05 0.06 0.11 0.18 0.78 0.04 0.08 0.08 0.08 0.08 0.08 0.08 | 1.1 50.46 55.15 49.56 45.7 56.78 64.92 64.46 62.31 62.31 62.32 64.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 30.25 29.36 53.81 21.56 22.61 28.49 Bit Acc | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 37.33 0.00 0.00 0.00 0.00 0.00 0.00 0.0 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard | 0.47 0.63 0.49 0.45 0.58 0.51 0.62 0.57 0.62 0.59 0.15 0.05 0.05 0.05 0.06 0.01 0.08 0.78 0.04 0.08 0.08 0.08 0.08 | 1.1 50.46 55.15 49.56 55.75 49.56 56.78 64.99 66.46 62.31 62.22 64.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 30.25 29.36 53.81 21.56 22.61 28.49 Bit Acc | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 37.33 0.00 0.0000 0.0000 0.0000 0.000000 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Cherseter Levet (CD) | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.05 0.06 0.11 0.18 0.78 0.04 0.00 0.08 BLEURT 0.41 0.49 0.42 0.41 0.49 0.45 0.45 0.45 0.58 0.59 0.55 0.05 0.5 0. | 1.1 50.44 50.44 55.15 49.56 56.78 66.4 22 64.12 64.99 66.4 62.31 62.52 2.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 44.73 39.47 36.64 44.73 39.47 36.64 53.81 21.56 22.61 22.61 22.61 28.49 Bit Acc | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 37.33 0.00 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.111 41.55 0.000 1.24 4.88 Dect Acc 28.03 18.74 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) | 0.47 0.63 0.49 0.45 0.58 0.51 0.62 0.57 0.62 0.59 0.15 0.05 0.05 0.05 0.05 0.05 0.05 0.05 | 100 50.44 50.46 55.15 49.56 56.78 66.49 66.46 62.32 64.12 64.99 66.46 62.31 62.56 2.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 32.08 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 30.25 29.36 53.81 21.56 22.61 22.61 22.61 28.49 Bit Acc 85.08 85.33 80.92 84.69 | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 37.33 0.00 0.00 0.00 0.00 0.00 0.00 0.0 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Derturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) | 0.47 0.63 0.49 0.45 0.58 0.51 0.62 0.59 0.15 0.05 0.06 0.06 0.11 0.15 0.05 0.06 0.04 0.04 0.04 0.04 0.04 0.39 0.39 0.39 0.54 | 1000000000000000000000000000000000000 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 30.25 29.36 53.81 21.56 22.61 22.61 22.61 22.61 22.61 28.49 Bit Acc 85.03 85.53 80.92 84.69 | 45.86 45.76 45.77 44.89 31.86 32.75 28.64 30.32 39.42 37.33 0.00 0.00 0.00 0.00 0.00 0.00 0.0 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.05 0.06 0.11 0.18 0.78 0.04 0.04 0.04 0.04 0.04 0.39 0.39 0.39 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.55 0.05 0.55 0.05 0.55 0.05 0.55 0.05 0.55 0.05 0.55 0.05 0.55 0.05 0.55 0.05 0.55 0 | 1.1 50.44 5.5 15 49.56 55.75 49.56 56.78 62.32 64.12 64.46 62.31 62.56 2.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 32.67 35.33 32.20 32.08 51.68 32.39 51.68 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 39.47 39.47 30.25 29.36 53.81 21.56 22.61 28.49 Bit Acc 85.33 80.92 84.69 85.71 82.58 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 1.11\\ 41.55\\ 0.00\\ 1.24\\ 4.88\\ \hline \textbf{Dect Acc}\\ 28.03\\ 18.74\\ 21.46\\ 23.46\\ 24.28\\ 22.48\\ \end{array}$ |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCharacter Insert (CI) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.05 0.06 0.11 0.18 0.78 0.04 0.00 0.08 BLEURT 0.41 0.49 0.39 0.39 0.39 0.51 0.51 0.15 0.62 0.57 0.62 0.05 0.5 0. | 11.5 50.44 55.15 49.56 45.75 56.78 56.78 56.78 64.49 66.44 66.46 62.31 62.32 64.12 0.00 0.00 0.01 0.00 0.02 0.00 0.03 0.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 30.25 29.36 53.81 21.56 22.61 28.49 Bit Acc 85.08 85.03 85.03 85.03 85.33 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0$ |
| Watermark Blackbox-WM Watermark | Attack Category Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CD) Synonym Replacement (SR) Word Insertion (WI) | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.06 0.11 0.18 0.78 0.04 0.00 0.08 BLEURT 0.41 0.49 0.39 0.39 0.39 0.51 0.51 0.62 0.57 0.62 0.58 0.62 0.57 0.62 0.57 0.62 0.58 0.62 0.57 0.62 0.57 0.62 0.58 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.57 0.62 0.58 0.62 0.58 0.62 0.58 0.63 0.58 0.53 0.55 0. | 11.5 50.46 55.15 49.56 55.15 49.56 56.78 66.46 64.12 64.49 66.46 62.31 62.22 64.12 0.00 0.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 30.25 29.36 53.81 21.56 22.61 28.49 Bit Acc 85.08 85.33 80.92 84.69 85.71 82.58 84.69 85.71 82.58 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0$ |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level Word-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replacement (SR) Word Insertion (WI) Word Swap (WS) | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.05 0.05 0.06 0.11 0.18 0.78 0.04 0.39 0.39 0.39 0.54 0.51 0.17 0.17 0.17 0.17 | 1.1 50.44 50.4 55.15 49.56 56.78 64.99 66.46 62.32 64.12 64.99 66.46 2.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 32.67 32.20 32.08 51.68 32.39 13.92 19.70 17.10 19.60 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 44.73 39.47 36.64 44.73 39.47 36.64 43.7.33 30.25 29.36 53.81 21.56 29.36 53.81 21.56 28.49 Bit Acc 85.08 85.53 80.92 84.69 85.71 82.58 83.2.84 33.12 30.92 30.92 20.92 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.111\\ 41.55\\ 0.00\\ 0.124\\ 4.88\\ \hline \textbf{Dect Acc}\\ \hline 28.03\\ 18.74\\ 4.88\\ \hline \textbf{Dect Acc}\\ 28.03\\ 18.74\\ 21.46\\ 23.46\\ 24.28\\ 22.48\\ 22.48\\ 17.97\\ 17.76\\ 15.64\\ 15.04\\ \hline \end{array}$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Character-level Word-level Word-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Synonym Replacement (SR) Word Insertion (WD) Insert Punctuation (IP) | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.05 0.05 0.06 0.11 0.18 0.78 0.04 0.39 0.39 0.39 0.54 0.51 0.17 0.17 0.17 | 11.0 50.44 50.44 55.15 49.56 56.75 49.56 56.78 64.12 64.99 66.46 62.31 62.32 64.12 64.99 66.46 62.31 62.56 2.12 0.00 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.001 0.000 0.002 0.001 0.003 2.008 32.068 51.68 32.39 13.92 19.70 17.10 19.92 1.00 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.48 44.73 39.47 36.64 44.73 39.47 36.64 44.73 39.47 36.64 22.18 44.73 30.25 29.36 53.81 21.56 29.36 53.81 21.56 29.36 53.81 21.56 28.49 85.53 80.92 85.58 85.53 80.92 85.58 85.53 80.92 85.58 85.53 80.92 85.585 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Character-level Word-level Word-level Word-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WT) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.05 0.17 0.17 0.12 0.12 | 11.0 0.04 50.44 50.45 45.51 54.56 55.15 49.56 56.73 49.56 64.12 64.99 66.46 62.31 62.56 2.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 132.08 51.68 32.39 13.92 19.70 17.10 19.92 1.00 1.36 1.36 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 53.81 21.56 22.61 22.61 22.61 22.61 22.61 28.49 Bit Acc 85.08 85.33 80.92 84.69 85.71 82.58 32.84 33.12 30.92 29.88 49.966 31.85 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Character-level Character-level Word-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | 0.47 0.63 0.43 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.60 0.05 0.06 0.15 0.05 0.061 0.11 0.18 0.78 0.041 0.49 0.39 0.39 0.54 0.51 0.17 0.18 0.17 0.17 0.12 0.12 | 11.0 50.44 55.15 49.56 55.15 49.56 56.78 62.32 64.12 64.49 66.46 62.31 62.32 66.46 62.31 62.32 60.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 32.267 32.208 32.48 51.68 32.39 13.92 19.70 17.10 19.92 1.00 1.43 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 30.25 29.36 53.81 21.56 22.61 28.49 Bit Acc 85.33 80.92 84.69 85.78 85.28 32.84 33.12 30.92 29.88 49.66 31.85 31.85 | $\begin{array}{c} 45.86\\ 45.76\\ 44.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 1.11\\ 41.55\\ 0.000\\ 1.24\\ 4.88\\ \hline \textbf{Dect Acc}\\ 28.03\\ 18.74\\ 21.46\\ 23.46\\ 24.28\\ 22.48\\ 17.97\\ 17.76\\ 15.64\\ 15.64\\ 15.64\\ 15.64\\ 15.68\\ 16.58\\ 16.58\\ \hline extreme the term that the term term term term term term term ter$ |
| Watermark Blackbox-WM Watermark | Character-level Word-level Attack Category Character-level Word-level Word-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | 0.47 0.63 0.47 0.63 0.49 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.05 0.06 0.11 0.18 0.78 0.04 0.00 0.08 BLEURT 0.41 0.49 0.39 0.39 0.54 0.51 0.17 0.17 0.17 0.17 0.17 0.17 0.12 0.12 0.12 0.11 0.11 | 11.6 50.44 55.15 49.56 45.75 56.78 56.78 56.78 64.99 66.44 62.32 64.12 60.00 0.00 13.22.08 51.68 51.68 51.69 19.92 1.00 1.43 1.49 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 30.64 37.33 30.25 29.36 53.81 21.56 22.61 28.49 Bit Acc 85.08 85.09 84.69 85.78 32.84 33.12 30.92 29.88 49.66 31.85 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 39.42\\ 37.33\\ 0.00\\ $ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Word-level Sentence-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Usert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.05 0.06 0.11 0.18 0.78 0.04 0.00 0.08 BLEURT 0.41 0.49 0.39 0.39 0.51 0.17 0.17 0.17 0.17 0.17 0.12 0.11 0.11 0.33 | 11.5 51.44 55.15 49.56 55.15 49.56 56.75 49.56 56.78 64.12 64.49 66.46 62.31 62.31 62.32 64.12 0.00 0.00 13.92 1.68 1.43 1.48 27.74 1.48 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 32.18 44.73 39.47 36.64 37.33 30.25 29.36 53.81 21.56 22.61 28.49 Bit Acc 85.08 85.03 85.03 85.03 85.03 84.69 85.71 82.58 32.84 33.12 30.92 84.69 85.71 82.58 31.85 31.88 31.96 31.98 31.98 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0$ |
| Watermark Blackbox-WM Unigram-WM | Character-level Word-level Sentence-level Word-level Sentence-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.60 0.17 0.18 0.48 0.49 0.49 0.39 0.54 0.51 0.00 0.00 0.18 0.78 0.41 0.49 0.39 0.54 0.51 0.17 0.17 0.17 0.17 0.12 0.11 0.11 0.32 0.03 | 1.1 50.46 55.15 49.56 55.15 49.56 56.75 64.99 66.46 62.31 62.32 64.12 64.99 66.46 62.31 62.56 2.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 13.92 19.70 1.43 1.43 1.49 1.48 2.7.74 1.31 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.58 44.73 30.25 29.36 53.81 21.56 22.61 28.49 Bit Acc 85.08 85.08 85.33 80.92 84.69 85.71 82.58 83.2.84 33.12 30.92 84.69 85.71 82.58 83.2.84 33.12 30.92 84.69 85.71 82.58 83.2.84 33.12 30.92 84.69 85.71 82.58 83.2.84 33.12 30.92 84.69 85.71 82.58 83.2.84 33.12 30.92 84.69 85.71 82.58 83.2.84 33.12 30.92 83.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.88 33.86 33.88 33.86 33.88 33.88 33.88 33.88 33.88 33.86 33.88 33.86 33.88 33.88 33.88 33.88 33.88 33.88 33.89 33.88 33.88 33.88 33.89 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Word-level Character-level Word-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | 0.47 0.63 0.49 0.45 0.58 0.51 0.60 0.57 0.62 0.59 0.15 0.60 0.17 0.18 0.48 0.78 0.04 0.00 0.11 0.18 0.78 0.04 0.09 0.39 0.54 0.51 0.17 0.17 0.17 0.17 0.12 0.11 0.12 0.12 0.11 0.32 0.038 0.18 | 1.1 51.44 55.15 49.56 55.15 49.56 56.7 49.56 56.7 49.56 56.7 49.56 64.99 66.46 62.31 62.56 2.12 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 1.20 1.68 32.39 1.36 1.43 1.48 27.74 1.31 1.89 | 90.56 81.44 83.63 85.85 77.42 77.32 74.36 64.48 32.18 44.73 39.47 36.64 437.33 30.25 29.36 53.81 21.56 29.36 53.81 21.56 28.49 Bit Acc 85.08 85.53 80.92 84.69 85.71 82.58 84.69 85.71 82.58 83.284 33.12 30.92 29.88 31.98 31.85 31.98 31.98 31.98 31.98 31.98 31.98 31.98 31.98 31.98 32.64 | $\begin{array}{c} 45.86\\ 45.76\\ 45.77\\ 44.89\\ 31.86\\ 32.75\\ 28.64\\ 30.32\\ 39.42\\ 37.33\\ 0.00\\ 0$ |

Table 16: Instruct-BLIP text watermarks under text perturbations.

| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
|--|---|--|--|---|--|--|
| | | Keyboard | 0.45 | 68.64 | 93.56 | 56.34 |
| | | OCR | 0.58 | 79.10 | 96.48 | 91.60 |
| | Character-level | Character Insert (CI) | 0.47 | 68.75 68.75 | 67.49 | 61.82 |
| | | Character Replace (CR) Character Swap (CS) | 0.45 | 68.75 72.15 | 94.45 03.07 | 58.26 49.66 |
| | | Character Delete (CD) | 0.53 | 68.75 | 68.11 | 64.62 |
| | | Synonym Replacement (SR) | 0.61 | 64.58 | 71.94 | 39.74 |
| | | Word Insertion (WI) | 0.56 | 75.15 | 69.27 | 91.44 |
| KGW-WM | Word-level | Word Swap (WS) | 0.61 | 58.91 | 74.68 | 53.88 |
| | | Word Deletion (WD) | 0.56 | 71.80 | 70.69 | 60.94 |
| | | E l | 0.00 | 0.00 | 54.40 | 72.10 |
| | | Casual | 0.05 | 1.81 | 54.49 54.76 | 73.00 58.70 |
| | | Passive | 0.04 | 7.07 | 54.67 | 99.50 |
| | Sentence-level | Active | 0.06 | 0.15 | 55.01 | 0.00 |
| | beneoneo iever | Back Translation | 0.83 | 90.32 | 67.23 | 0.00 |
| | | Bart | 0.00 | 2.51 | 48.31 44.86 | 11.88 53.64 |
| | | Dipper | 0.03 | 4.51 | 60.75 | 72.33 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| - | | Keyboard | 0.44 | 59.05 | 81.25 | 33.06 |
| | | OCR | 0.56 | 70.54 | 82.74 | 34.70 |
| Character-lev | Character-level | Character Insert (CI) | 0.46 | 59.03 | 66.30 | 35.10 |
| | | Character Swap (CS) | 0.45 | 59.09 62.00 | 80.74 81.44 | 33.30 33.74 |
| | | Character Delete (CD) | 0.49 | 59.14 | 67.24 | 33.18 |
| | | Synonym Replacement (SR) | 0.44 | 37.64 | 67.30 | 32.80 |
| | | Word Insertion (WI) | 0.45 | 44.25 | 65.47 | 34.92 |
| KTH-WM | Word-level | Word Swap (WS) | 0.47 | 37.09 | 66.82 | 35.62 |
| | | Insert Punctuation (IP) | 0.45 | 42.82 | 53.94 | 37.02 |
| | | Formal | 0.09 | 0.57 | 55.63 | 35.40 |
| | | Casual | 0.08 | 0.49 | 55.61 | 38.00 |
| | | Passive | 0.07 | 2.05 | 55.31 | 35.10 |
| | Sentence-level | Active | 0.08 | 0.90 | 55.50 | 37.90 |
| | | SCPN | 0.68 | 00.43 1.21 | 72.95 54.67 | 36.50 |
| | | Bart | 0.00 | 0.00 | 50.31 | 39.45 |
| | | Dipper | 0.09 | 0.31 | 55.10 | 39.30 |
| | | | | | | |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| Watermark | Attack Category | Perturbation Keyboard OCB | 0.41 0.60 | 65.80 | Bit Acc 81.00 83.00 | Dect Acc 41.70 51.05 |
| Watermark | Attack Category | Perturbation Keyboard OCR Character Insert (CI) | 0.41 0.60 0.45 | ROUGE 65.80 79.50 66.20 | Bit Acc 81.00 83.00 68.50 | Dect Acc 41.70 51.05 40.55 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) | 0.41 0.60 0.45 0.43 | ROUGE 65.80 79.50 66.20 69.13 | Bit Acc 81.00 83.00 68.50 81.50 | Dect Acc 41.70 51.05 40.55 41.25 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Deltr (CD) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 | Bit Acc 81.00 83.00 68.50 81.50 81.75 60.50 | Dect Acc 41.70 51.05 40.55 41.25 42.62 42.62 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 | Bit Acc 81.00 83.00 68.50 81.50 81.75 69.50 67.00 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 63.90 | Bit Acc 81.00 83.00 68.50 81.50 81.75 69.50 67.00 64.00 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 |
| Watermark | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 63.90 78.30 | Bit Acc 81.00 83.00 68.50 81.50 81.75 69.50 67.00 64.00 68.00 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 | ROUGE 65.80 79.50 66.20 66.13 66.10 66.40 82.50 63.90 78.30 58.77 | Bit Acc 81.00 83.00 68.50 81.50 81.75 69.50 67.00 64.00 68.00 64.50 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 | ROUGE 65.80 79.50 66.20 66.13 66.10 66.40 82.50 63.90 78.30 58.77 7.90 | Bit Acc 81.00 83.00 68.50 81.50 81.75 69.50 64.00 64.00 64.00 64.50 54.00 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Caraval | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 63.90 78.30 58.77 7.90 4.90 | Bit Acc 81.00 83.00 68.50 81.50 81.75 69.50 67.00 64.00 64.00 64.00 64.50 54.00 54.00 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.57 0.59 0.51 0.14 0.05 0.04 0.05 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 63.90 78.30 58.77 7.90 4.30 4.30 7.60 | Bit Acc 81.00 83.00 68.50 81.50 81.75 69.50 67.00 64.00 64.00 64.50 54.00 55.00 56.12 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.05 0.04 0.10 | ROUGE 65.80 79.50 66.20 66.40 66.40 82.50 63.90 78.30 58.77 7.90 4.30 7.60 8.80 | Bit Acc \$81.00 \$83.00 \$85.00 \$81.50 \$81.75 \$69.50 \$67.00 \$64.00 \$64.50 \$64.50 \$54.00 \$54.00 \$54.00 \$64.20 \$68.94 | Dect Acc 41.70 51.05 40.55 41.25 42.62 224.33 30.22 226.03 30.85 0.00 0.00 0.00 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation GODW | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.05 0.04 0.11 0.11 0.16 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 78.30 78.30 78.30 7.90 4.90 4.30 7.60 8.80 69.40 | Bit Acc \$\$1.00 \$\$3.00 \$\$65.00 \$\$81.50 \$\$81.50 \$\$81.50 \$\$81.50 \$\$65.50 \$\$65.00 \$\$65.00 \$\$65.00 \$\$65.00 \$\$65.00 \$\$65.00 \$\$55.00 \$\$55.00 \$\$61.12 \$\$68.94 \$\$47.31 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 0.00 0.00 0.00 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.05 0.04 0.01 0.11 0.16 0.00 0.00 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 63.90 78.30 78.30 78.30 78.30 88.00 8.80 9.400 4.90 4.90 4.90 4.90 4.90 4.90 4.90 8.80 9.40 0.00 | Bit Acc \$1.00 \$3.00 \$68.50 \$1.50 \$1.50 \$69.50 \$69.50 \$69.50 \$69.50 \$69.50 \$64.00 \$64.00 \$64.00 \$54.00 \$54.00 \$54.00 \$54.00 \$64.50 \$54.00 \$64.50 \$64.73 \$65.91 \$ | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 0.00 0.00 0.00 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.000000 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.05 0.04 0.11 0.16 0.00 0.00 0.00 0.00 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 63.90 78.30 78.30 78.30 78.30 88.00 8.80 09.40 0.00 1.84 0.83 | Bit Acc \$\$1.00 \$\$3.00 \$\$6.50 \$\$8.50 \$\$8.50 \$\$8.50 \$\$8.50 \$\$6.50 \$\$6.700 \$\$64.00 \$\$64.00 \$\$64.00 \$\$64.00 \$\$64.00 \$\$64.00 \$\$65.00 \$\$66.12 \$\$68.94 \$\$47.31 \$\$36.60 \$\$17.58 \$\$35.62 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 0.00 0.00 0.00 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.05 0.04 0.10 0.11 0.16 0.00 0.00 0.01 BLEURT | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 63.90 78.30 58.77 7.90 4.30 7.60 8.80 69.40 0.00 1.84 0.83 ROUGE | Bit Acc \$1.00 \$3.00 \$68.50 \$81.50 \$81.50 \$81.50 \$81.50 \$69.50 \$67.00 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$65.00 \$55.00 \$54.50 \$66.94 \$47.31 \$35.62 Bit Acc | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 26.03 30.85 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.59 0.51 0.14 0.05 0.04 0.10 0.11 0.16 0.00 0.01 BLEURT 0.44 0.44 0.44 0.44 0.44 0.44 0.44 0.4 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 63.90 78.30 58.77 7.90 4.30 7.60 8.80 69.40 0.00 1.84 0.83 ROUGE 80.42 | Bit Acc \$1.00 \$3.00 \$68.50 \$81.50 \$81.50 \$81.50 \$81.50 \$69.50 \$67.00 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$65.00 \$54.00 \$54.00 \$68.94 \$47.31 \$35.62 Bit Acc 71.23 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CD) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.59 0.51 0.14 0.05 0.04 0.10 0.11 0.16 0.00 0.01 BLEURT 0.48 0.57 0.47 0.47 0.48 0.57 0.47 0.41 0.58 0.59 0.51 0.59 0.51 0.54 0.54 0.55 0.57 0.59 0.51 0.54 0.55 0.55 0.57 0.59 0.51 0.54 0.55 0.57 0.59 0.59 0.57 0.59 0.57 0.59 0.57 0.59 0.57 0.59 0.57 0.59 0. | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 82.50 63.90 78.30 78.30 78.30 7.90 4.30 7.60 8.80 69.40 0.00 1.84 0.83 ROUGE 80.42 84.97 90.42 | Bit Acc \$1.00 \$3.00 \$6.50 \$1.55 \$6.50 \$6.700 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$65.00 \$54.00 \$55.00 \$54.10 \$56.12 \$69.44 \$7.123 \$71.46 \$67.06 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 30.85 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.04 0.00 0.01 0.01 0.01 0.01 0.0 | ROUGE 65.80 79.50 66.20 69.13 66.40 66.20 63.30 78.30 58.77 7.90 4.30 4.30 4.30 66.40 60.40 8.80 60.40 8.80 8.80 8.80 8.80 8.80 8.81 8.82 8.80 8.80 8.80 8.81 8.82 8.82 8.83 ROUGE 80.42 80.42 80.42 80.40 80.36 | Bit Acc \$\$1,00 \$\$3,00 \$\$68,50 \$\$81,50 \$\$69,50 \$\$67,00 \$\$64,00 \$\$64,00 \$\$64,00 \$\$64,00 \$\$64,00 \$\$64,00 \$\$64,00 \$\$65,00 \$\$64,00 \$\$65,00 \$\$54,50 \$\$56,12 \$\$68,94 \$\$47,31 \$\$36,60 \$\$175 \$\$35,62 Bit Acc \$\$71,23 \$\$71,46 \$\$67,08 \$\$70,89 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.05 0.04 0.10 0.11 0.16 0.00 0.01 BLEURT 0.48 0.57 0.47 0.47 0.56 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.20 63.90 78.30 58.77 7.90 4.90 4.30 7.60 8.80 69.40 0.00 8.81 8.82 8.80 9.40 8.81 8.82 8.82 8.84 8.82 8.82 8.82 8.83 8.84 8.84 8.84 8.84 8.84 8.84 8.84 8.84 8.84 8.84 8.84 8.84 8.84 8.85 8.86 8.87 8.80 8.81 8.81 8.82 8.8 | Bit Acc \$\$1,00 \$\$3,00 \$\$68,50 \$\$1,50 \$\$69,50 \$\$67,00 \$\$64,00 \$\$64,00 \$\$64,00 \$\$64,00 \$\$55,00 \$\$55,00 \$\$55,00 \$\$\$66,12 \$\$\$\$68,94 \$\$\$\$\$\$47,31 \$ | Dect Acc 41.70 51.05 40.55 41.25 42.62 26.03 30.85 0.000 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Delete (CD) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.10 0.10 0.11 0.16 0.00 0.00 0.01 BLEURT 0.48 0.57 0.47 0.47 0.47 0.56 0.54 | ROUGE 65.80 79.50 66.20 66.13 66.10 66.20 63.90 78.30 58.77 7.90 4.90 4.30 7.60 8.80 69.40 0.00 1.84 0.03 80.42 80.42 80.40 80.36 81.57 80.54 | Bit Acc \$\$1.00 \$\$3.00 \$\$68.50 \$\$1.50 \$\$69.50 \$\$67.00 \$\$64.00 \$\$68.00 \$\$64.00 \$\$64.00 \$\$65.00 \$\$5.00 \$\$55.00 \$\$65.00 \$\$55.00 \$\$64.50 \$\$55.00 \$\$55.00 \$\$\$64.731 \$\$36.60 \$\$\$\$\$175.83 \$\$\$\$762 \$\$\$\$\$\$\$\$\$172.33 \$\$\$\$\$\$71.23 \$\$\$\$\$\$71.23 \$\$\$\$\$\$70.89 \$\$\$\$\$71.24 \$\$\$\$\$70.89 \$\$\$\$\$71.42 | Dect Acc 41.70 51.05 40.55 41.25 42.62 226.03 30.85 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Insert (CI) Synonym Replacement (SR) | BLEURT 0.41 0.60 0.45 0.43 0.51 0.51 0.58 0.57 0.59 0.51 0.14 0.10 0.10 0.11 0.16 0.00 0.00 0.01 BLEURT 0.48 0.57 0.47 0.46 0.57 0.47 0.56 0.54 0.34 0.34 0.34 0.34 0.34 0.34 0.34 0.3 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.20 63.90 78.30 58.77 7.90 4.90 4.30 7.60 8.80 69.40 0.00 0.880 80.42 80.42 80.40 80.57 80.54 37.30 | Bit Acc \$\$1.00 \$\$3.00 \$\$68.50 \$\$1.50 \$\$69.50 \$\$67.00 \$\$64.00 \$\$64.00 \$\$64.00 \$\$64.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$\$562 \$\$\$89.44 \$\$\$47.31 \$\$33.60 \$\$\$\$\$172 \$\$\$\$61.22 \$\$\$\$\$\$\$00 \$ | Dect Acc 41.70 51.05 41.25 42.62 226.03 30.85 0.000 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Sentence-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.57 0.59 0.51 0.14 0.05 0.04 0.10 0.11 0.16 0.00 0.00 0.01 BLEURT 0.48 0.48 0.48 0.57 0.47 0.47 0.47 0.47 0.47 0.54 0.54 0.34 0.34 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 68.250 63.90 78.30 58.77 7.90 4.90 4.30 7.60 8.80 69.40 0.00 1.84 0.83 ROUGE 80.42 80.42 80.42 80.54 37.30 55.48 47.33 | Bit Acc \$1.00 \$3.00 \$68.50 \$1.50 \$69.50 \$67.00 \$64.00 \$64.50 \$54.00 \$55.00 \$54.00 \$55.00 \$61.20 \$61.21 \$62.82 \$71.46 \$67.08 \$71.42 \$65.512 \$65.12 | Dect Acc 41.70 51.05 41.25 42.62 226.03 30.22 26.03 30.85 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.57 0.59 0.51 0.14 0.05 0.04 0.10 0.11 0.16 0.00 0.00 0.01 BLEURT 0.48 0.57 0.47 0.47 0.47 0.47 0.47 0.47 0.47 0.4 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 78.30 78.30 58.77 7.90 4.90 4.30 7.60 8.80 66.40 0.00 0.83 ROUGE 80.42 84.97 80.40 80.36 81.57 37.30 55.48 47.33 | Bit Acc \$1.00 \$3.00 \$6.50 \$1.50 \$6.950 \$6.950 \$6.950 \$6.10 \$5.00 \$5.00 \$5.00 \$5.400 \$7.123 \$7.146 \$6.500 \$6.512 \$6.512 \$6.520 \$6.520 \$6.520 \$6.520 \$7.420 \$6.520 \$7.420 \$6.520 \$7.420 \$6.520 \$7.420 \$6.520 \$7.420 \$6.520 \$7.420 \$6.520 \$7.420 \$6.520 \$7.420 \$6.520 \$7.420 \$6.520 \$7.420 \$6.5200 \$6.5200 \$6.5200 \$6.5200 \$ | Dect Acc 41.70 51.05 41.25 42.62 24.33 30.22 26.03 30.85 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Sentence-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.59 0.51 0.14 0.05 0.04 0.10 0.01 0.11 0.16 0.00 0.00 0.01 BLEURT 0.48 0.57 0.47 0.47 0.47 0.47 0.47 0.47 0.56 0.54 0.34 0.35 0.35 0.35 0.35 0.36 0.21 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.40 66.40 78.30 58.77 7.90 4.90 4.30 7.60 8.80 69.40 0.83 ROUGE 80.42 84.97 80.40 80.36 81.57 80.54 37.30 55.48 47.33 56.26 0.44 | Bit Acc \$1.00 \$3.00 \$68.50 \$81.50 \$81.50 \$81.50 \$69.50 \$67.00 \$64.50 \$55.00 \$54.00 \$55.00 \$54.50 \$56.12 \$68.94 \$47.31 \$35.62 Bit Acc \$71.42 \$67.08 \$70.89 \$71.42 \$65.12 \$63.27 \$65.2 \$65.12 \$63.27 \$65.12 \$63.27 \$65.12 \$63.27 \$65.12 \$63.24 | Dect Acc 41.70 51.05 41.25 42.62 24.33 30.22 26.03 30.85 0.00 0.02 0.42 5.84 1.42 1.42 1.42 1.42 0.54 1.42 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Formal Formal | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.05 0.04 0.00 0.01 BLEURT BLEURT 0.48 0.57 0.47 0.47 0.56 0.54 0.44 0.57 0.47 0.47 0.56 0.51 0.24 0.51 0.55 0.54 0.55 0.54 0.55 0.54 0.55 | ROUGE 65.80 79.50 66.20 66.31 66.40 66.40 66.40 66.40 66.40 66.40 66.40 66.40 66.40 68.40 68.77 7.90 4.30 4.30 4.30 4.30 0.00 8.80 69.40 0.83 ROUGE 80.42 84.97 80.40 80.36 81.57 80.54 37.30 35.548 47.33 55.48 47.33 56.26 0.44 0.47 | Bit Acc \$\$1.00 \$\$3.00 \$\$8.100 \$\$8.50 \$\$8.50 \$\$8.50 \$\$8.50 \$\$69.50 \$\$67.00 \$\$64.00 \$\$64.00 \$\$65.00 \$\$54.50 \$\$56.12 \$\$68.94 \$\$47.31 \$\$36.60 \$\$1758 \$\$35.62 Bit Acc \$\$7.89 \$\$71.42 \$\$67.65 \$\$65.30 \$\$62.71 \$\$63.30 \$\$62.71 \$\$63.34 \$\$62.71 \$\$63.34 \$\$62.71 \$\$63.34 \$\$62.71 \$\$63.34 \$\$63.34 \$\$62.71 \$\$63.34 \$\$63.34 \$\$63.34 \$\$63.34 \$\$63.34 \$\$63.34 \$\$63.34 \$\$63.34 \$\$63.34 \$\$63.34 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.25 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Word-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Formal Casual Passive Formal Casual Passive P | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.04 0.00 0.01 0.01 0.01 0.01 0.0 | ROUGE 65.80 79.50 66.20 66.31 66.40 66.20 63.30 78.30 58.77 7.90 4.30 4.30 4.30 66.40 60.40 8.80 60.40 8.80 80.42 84.97 80.42 84.97 80.42 84.97 80.54 7.30 55.48 47.33 56.26 0.44 0.47 0.54 | Bit Acc \$1.00 \$3.00 \$68.50 \$1.50 \$69.50 \$69.50 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$64.00 \$54.50 \$54.50 \$54.50 \$54.50 \$54.50 \$54.50 \$54.50 \$54.50 \$74.58 \$71.23 \$71.46 \$67.08 \$70.89 \$71.42 \$67.65 \$65.20 \$65.27 \$65.30 \$65.37 \$65.37 \$65.30 \$65.37 \$65.37 \$65.30 \$65.37 | Dect Acc 41.70 51.05 40.55 41.25 42.62 40.02 24.33 30.22 26.03 30.85 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Casual Passive Active | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.05 0.04 0.10 0.11 0.16 0.00 0.00 0.00 0.01 BLEURT 0.47 0.47 0.47 0.47 0.47 0.47 0.47 0.47 | ROUGE 65.80 79.50 66.20 69.13 66.10 66.20 63.30 78.30 58.77 7.90 4.90 4.300 7.600 8.80 60.40 0.830 ROUGE 80.42 80.42 80.43 80.40 80.43 80.54 37.30 55.48 47.33 56.26 0.44 0.47 0.54 | Bit Acc \$\$1.00 \$\$3.00 \$\$8.100 \$\$8.100 \$\$8.100 \$\$8.100 \$\$8.100 \$\$8.100 \$\$8.150 \$\$6.950 \$\$67.00 \$\$64.00 \$\$64.00 \$\$64.00 \$\$65.00 \$\$65.00 \$\$65.00 \$\$65.01 \$\$68.94 \$\$47.31 \$\$36.60 \$\$175 \$\$36.61 \$\$175 \$175 \$175 \$175 <td>Dect Acc 41.70 51.05 41.25 42.62 26.03 30.85 0.00 0.103 25.84 10.44 3.63 5.14 3.31 4.27 4.21 9.34 2.97 6.12 4.29 7.46 7.86 2.67 3.07</td> | Dect Acc 41.70 51.05 41.25 42.62 26.03 30.85 0.00 0.103 25.84 10.44 3.63 5.14 3.31 4.27 4.21 9.34 2.97 6.12 4.29 7.46 7.86 2.67 3.07 |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character | BLEURT 0.41 0.60 0.45 0.43 0.56 0.51 0.58 0.57 0.59 0.51 0.14 0.00 0.01 0.11 0.16 0.00 0.00 0.01 BLEURT 0.48 0.57 0.47 0.56 0.54 0.34 0.35 0.35 0.36 0.21 0.21 0.21 0.21 0.22 0.57 | ROUGE 65.80 79.50 66.20 66.13 66.40 66.20 63.90 78.30 58.77 7.90 4.90 4.30 7.60 8.80 69.40 0.00 0.880 69.40 0.00 0.80 8.80 69.40 0.00 8.80 69.40 0.00 0.880 8.80 60.40 80.54 37.30 55.44 47.33 56.26 0.44 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 0.54 | Bit Acc \$\$1.00 \$\$3.00 \$\$8.100 \$\$8.100 \$\$8.100 \$\$8.100 \$\$8.100 \$\$8.100 \$\$8.150 \$\$69.50 \$\$67.00 \$\$64.00 \$\$64.00 \$\$64.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$55.00 \$\$56.12 \$\$65.20 \$\$65.12 \$\$63.20 \$\$2.71 \$\$3.44 \$\$4.59 \$\$4.59 \$\$4.59 \$\$4.59 \$\$4.59 \$\$4.67 | Dect Acc 41.70 51.05 41.25 42.62 26.03 30.85 0.00 0.1.03 25.84 10.44 3.82 3.63 5.14 3.31 4.27 4.21 9.34 2.97 6.12 4.297 6.267 6.277 6.277 6.277 6.277 6.277 6.277 6.277 |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character S | BLEURT 0.41 0.60 0.45 0.43 0.57 0.59 0.51 0.14 0.05 0.04 0.10 0.10 0.11 0.16 0.00 0.00 0.01 BLEURT 0.48 0.57 0.47 0.56 0.54 0.34 0.35 0.36 0.21 0.21 0.21 0.21 0.22 0.57 0.48 0.57 0.47 0.56 0.54 0.54 0.54 0.55 0.55 0.55 0.55 0.55 | ROUGE 65.80 79.50 66.20 66.13 66.10 66.40 82.50 63.90 78.30 58.77 7.90 4.90 4.30 7.60 8.80 69.40 0.00 0.880 69.40 0.00 8.497 80.42 84.97 80.54 37.30 55.48 47.33 56.26 0.44 0.95 0.72 66.62 0.72 66.62 1.37 | Bit Acc \$81.00 \$83.00 \$83.00 \$83.00 \$85.00 \$81.50 \$81.50 \$69.50 \$67.00 \$64.00 \$64.50 \$54.00 \$55.00 \$67.00 \$64.50 \$64.50 \$65.00 \$65.00 \$65.00 \$65.12 \$67.08 \$71.23 \$71.23 \$71.23 \$71.23 \$71.23 \$71.23 \$71.23 \$71.24 \$67.55 \$65.12 \$63.27 \$64.67 \$54.58 \$54.59 \$64.67 \$72.57 | Dect Acc 41.70 51.05 41.25 42.62 22.6.03 30.85 0.00 |

Table 17: LLaVA 1.6 text watermarks under text perturbations.

| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
|--|---|--|--|--|---|---|
| | | Keyboard | 0.64 | 85.94 | 70.63 | 22.68 |
| | | OCR | 0.47 | 64.38 | 65.31 | 19.69 |
| | Character-level | Character Insert (CI) | 0.63 | 83.52 | 70.57 | 23.40 |
| | | Character Replace (CR) Character Swap (CS) | 0.82 | 65.23 51.51 | 70.50 62.83 | 27.54 19.27 |
| | | Character Delete (CD) | 0.36 | 48.14 | 62.24 | 19.28 |
| | - | Synonym Replacement (SR) | 0.77 | 96.73 | 75.15 | 27.83 |
| | | Word Insertion (WI) | 0.56 | 70.10 | 68.52 | 24.01 |
| KGW-WM | Word-level | Word Swap (WS) | 0.25 | 31.28 | 58.72 | 18.19 |
| | | Word Deletion (WD) | 0.47 | 56.91 24.71 | 65.66 57.58 | 22.97 |
| | | E-mail | 0.21 | 24.71 | 56.07 | 10.24 |
| | | Casual | 0.19 | 38.18 | 61.65 | 21.58 |
| | | Passive | 0.19 | 26.94 | 45.01 | 11.44 |
| | Sentence-level | Active | 0.17 | 24.92 | 45.83 | 12.33 |
| | | Back Translation | 0.09 | 5.02 | 53.89 | 17.82 |
| | | Bart | 0.19 | 10.63 | 32.85 | 10.80 |
| | | Dipper | 0.17 | 11.58 | 35.57 | 12.75 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| | | Keyboard | 0.57 | 80.81 | 76.41 | 24.59 |
| | | OCR | 0.44 | 68.70 | 64.65 | 20.53 |
| | Character-level | Character Insert (CI) | 0.56 | 88.03 | 75.94 | 25.64 |
| | | Character Replace (CR) | 0.70 | 88.03 52.20 | 88.69 58.79 | 31.32 |
| | | Character Delete (CD) | 0.38 | 49.24 | 57.26 | 20.03 |
| | | Synonym Replacement (SR) | 0.66 | 99.27 | 85.23 | 31.81 |
| | | Word Insertion (WI) | 0.50 | 70.87 | 70.60 | 26.61 |
| KTH-WM | Word-level | Word Swap (WS) | 0.27 | 29.77 | 49.07 | 18.68 |
| 1111-11 10 | | Word Deletion (WD) | 0.43 | 55.86 | 64.03 | 25.24 |
| | | De la | 0.24 | 21.00 | 40.20 | 10.00 |
| | | Formal | 0.22 | 17.44 34.44 | 44.76 54.79 | 18.82 23.43 |
| | | Passive | 0.06 | 34.09 | 18.36 | 9.57 |
| | Sentence-level | Active | 0.05 | 32.62 | 19.96 | 10.82 |
| | Sentence-iever | Back Translation | 0.14 | 2.03 | 37.37 | 18.36 |
| | | SCPN | 0.07 | 3.79 | 18.77 | 21.99 |
| | | Dipper | 0.00 | 3.72 | 13.75 | 19.58 |
| | Attack Category | Porturbation | DIFUDT | DOLICE | Bit Acc | Doct Acc |
| Watermark | Attack Category | 1 er tur bation | DLEURI | ROUGE | DII ACC | Dett Att |
| Watermark | Attack Category | Keyboard | 0.65 | 95.92 | 85.39 | 58.32 |
| Watermark | Attack Category | Keyboard OCR | 0.65 0.49 | 95.92 72.82 | 85.39 77.19 | 58.32 43.55 |
| Watermark | Character-level | Keyboard OCR Character Insert (CI) Character Boplace (CB) | 0.65 0.49 0.64 0.82 | 95.92 72.82 92.24 74.33 | 85.39 77.19 83.34 90.40 | 58.32 43.55 54.34 66.74 |
| Watermark | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) | 0.65 0.49 0.64 0.82 0.41 | 95.92 72.82 92.24 74.33 57.66 | 85.39 77.19 83.34 90.40 70.85 | 58.32 43.55 54.34 66.74 31.78 |
| Watermark | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) | 0.65 0.49 0.64 0.82 0.41 0.39 | 95.92 72.82 92.24 74.33 57.66 53.56 | 85.39 77.19 83.34 90.40 70.85 69.07 | 58.32 43.55 54.34 66.74 31.78 28.43 |
| Watermark | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | 0.65 0.49 0.64 0.82 0.41 0.39 0.77 | 95.92 72.82 92.24 74.33 57.66 53.56 73.71 | 85.39 77.19 83.34 90.40 70.85 69.07 85.60 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 |
| Watermark | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 | 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 21.22 | 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 |
| Watermark Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) | 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 | 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 | 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 |
| Watermark Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 | ROUGE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 | 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 |
| Watermark Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal | 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 | ROUGE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 | 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 |
| Watermark Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 | ROUGE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 39.10 | Bit Acc 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 | $\begin{array}{c} 58.32\\ 43.55\\ 54.34\\ 66.74\\ 31.78\\ 28.43\\ 57.70\\ 39.74\\ 14.14\\ 29.00\\ 7.55\\ 4.16\\ 0.00\\ \end{array}$ |
| Watermark Blackbox-WM | Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active | 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 | ROUGE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 39.10 29.48 27.04 | 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.80 27.01 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.00 0.000 |
| Watermark Blackbox-WM | Character-level Word-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation | BLEORI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.15 0.15 0.10 | ROUGEE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 60.40 26.20 22.03 39.10 29.48 27.94 2.74 | 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.80 37.91 47.87 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.00 0.00 0.000 0.000 10.97 |
| Watermark Blackbox-WM | Character-level Word-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | BLEORI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.27 0.48 0.23 0.21 0.35 0.15 0.13 0.10 0.15 | NOCCE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 39.10 29.48 27.94 2.74 3.83 | 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.80 37.91 47.87 50.31 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.00 0.00 0.00 0.000 0.000 0.000 |
| Watermark Blackbox-WM | Character-level Word-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | BLEORI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.15 0.13 0.10 0.15 0.13 0.13 | xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx | Bit Acc 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.80 37.91 47.87 50.31 52.73 | $\begin{array}{c} \text{56.7}\\ 58.32\\ 43.55\\ 54.34\\ 66.74\\ 31.78\\ 28.43\\ 57.70\\ 39.74\\ 14.14\\ 29.00\\ 7.55\\ 4.16\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 10.97\\ 0.00\\ 1.41\\ 1.41\\ \end{array}$ |
| Watermark Blackbox-WM | Character-level Word-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper | BLEORI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.27 0.48 0.23 0.21 0.35 0.15 0.15 0.13 0.10 0.15 0.13 0.17 | ROCCE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 39.10 29.48 27.94 2.74 3.83 3.94 4.34 | Bit Acc 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.80 37.91 47.87 50.31 52.73 55.79 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.00 0.000 0.000 0.000 0.000 10.97 0.000 1.41 8.36 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation | 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.23 0.21 0.35 0.15 0.13 0.15 0.13 0.17 BLEURT | ROUGE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 39.10 29.48 27.94 2.74 3.83 3.94 4.34 ROUGE | Bit Acc 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.91 47.87 50.31 52.73 55.79 Bit Acc | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.00 0.00 0.00 10.97 0.00 0.00 1.41 8.36 Dect Acc |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCC | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.13 0.10 0.15 0.13 0.17 BLEURT 0.38 0.32 | ROUCE 95.92 72.82 92.24 73.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 39.10 22.04 27.94 27.94 27.94 27.94 3.94 4.34 ROUGE 65.69 65.69 | bit Acc 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.91 47.87 50.31 52.73 55.79 Bit Acc 65.10 | Jeet Act 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 0.00 0.00 0.00 0.00 10.97 0.00 1.41 8.36 Dect Acc 3.61 2.61 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.33 0.38 0.38 0.38 0.38 0.38 | ROUCE 95.92 72.82 92.24 73.71 75.86 73.71 75.32 34.22 60.40 22.03 39.10 29.48 27.94 3.94 4.34 ROUGE 65.69 48.79 62.63 | bit Acc 85.39 77.19 83.34 90.40 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.80 37.91 47.87 50.31 55.79 Bit Acc 65.10 55.35 64.39 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.13 0.10 0.15 0.13 0.17 BLEURT 0.38 0.38 0.38 0.45 | ROUCE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 33.10 22.03 33.10 22.48 27.94 2.744 3.83 3.94 4.34 ROUGE 65.69 48.79 62.63 78.40 | bit Acc 85.39 97.19 83.34 90.40 70.85 69.07 85.60 75.61 69.76 57.81 56.00 61.32 69.76 57.81 56.02 57.93 Bit Acc 65.10 55.35 64.39 74.61 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.13 0.15 0.13 0.17 BLEURT 0.38 0.33 0.45 0.30 | ROUCE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 39.10 29.48 27.94 2.74 3.83 3.94 4.34 ROUGEE 65.69 48.79 62.63 78.40 37.23 | bit Acc 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.32 61.32 7.81 56.79 Bit Acc 65.10 55.35 64.39 74.61 74.61 | 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0 |
| Watermark Blackbox-WM Watermark | Character-level Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.13 0.10 0.15 0.13 0.17 BLEURT 0.38 0.33 0.30 | ROUCE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 39.10 29.48 27.94 2.74 3.83 3.94 4.34 ROUGEE 65.69 48.79 62.63 78.40 37.23 34.06 | bit Acc 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.32 63.7.80 37.80 37.80 37.81 50.31 52.73 55.79 Bit Acc 65.10 55.35 64.39 74.61 50.04 48.69 | $\begin{array}{c} \textbf{56.12}\\ 58.32\\ 43.55\\ 54.34\\ 66.74\\ 31.78\\ 28.43\\ 57.70\\ 39.74\\ 14.14\\ 29.00\\ 7.55\\ 4.16\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 1.41\\ 8.36\\ \textbf{50.00}\\ 1.41\\ 1.41\\ 8.36\\ \textbf{50.00}\\ 1.41\\$ |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.48 0.23 0.21 0.35 0.15 0.13 0.17 BLEURT 0.38 0.33 0.38 0.30 0.30 | ROUGE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 22.03 33.10 29.48 27.94 2.74 3.83 3.94 4.34 ROUGEE 65.69 48.79 62.63 78.40 37.23 34.06 70.12 70.12 | Bit Acc 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.32 61.32 61.36 37.80 37.81 52.73 50.31 52.73 50.53 64.39 74.61 50.04 48.69 71.30 | Dect Acc 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.000 0.00 0.001 10.97 0.001 1.41 8.36 3.61 2.08 4.00 6.13 1.87 1.88 6.30 6.30 6.30 |
| Watermark Blackbox-WM Watermark | Attack Category Word-level Sentence-level Attack Category Character-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.13 0.10 0.15 0.13 0.17 BLEURT 0.38 0.33 0.30 0.41 | ROUCE 95.92 72.82 92.24 73.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 39.10 22.03 39.10 22.44 3.94 4.34 ROUGE 65.69 48.79 62.63 78.40 37.23 34.06 70.12 49.40 19.47 | bit Acc 85.30 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.91 47.87 50.31 52.73 55.79 Bit Acc 65.10 55.35 64.39 74.61 50.04 48.69 71.30 59.22 41.52 | $\begin{array}{c} \textbf{Bett Act} \\ 58.32 \\ 43.55 \\ 54.34 \\ 66.74 \\ 31.78 \\ 28.43 \\ 57.70 \\ 39.74 \\ 14.14 \\ 29.00 \\ 7.55 \\ 4.16 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 10.97 \\ 0.00 \\ 10.97 \\ 0.00 \\ 10.97 \\ 0.00 \\ 10.97 \\ 1.88 \\ 4.00 \\ 6.13 \\ 1.87 \\ 1.88 \\ 6.30 \\ 4.33 \\ 1.34 \\ 1.4 \\ \end{array}$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Character-level Kurd-Level Word-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | BLEORI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.13 0.13 0.10 0.15 0.13 0.10 0.15 0.13 0.17 BLEURT BLEURT 0.38 0.38 0.38 0.38 0.38 0.33 0.30 0.33 0.35 0.33 0.35 0.33 0.35 0.33 0.35 0.55 | ROUCE 95.92 72.82 92.24 73.71 75.82 93.24 76.66 53.56 73.71 75.82 92.24 73.71 75.82 92.24 34.22 60.40 22.03 39.10 22.04.3 39.10 29.48 27.94 3.910 29.48 27.44 3.83 3.944 4.34 ROUGE 65.69 48.79 62.63 78.40 37.23 34.06 70.12 49.40 19.48 38.21 | Bit Acc 85.30 77.19 83.34 90.40 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 56.00 61.32 69.76 56.00 61.36 37.91 47.87 50.31 52.73 Bit Acc 65.10 55.35 64.39 74.61 50.04 48.69 71.30 59.22 41.53 | Dect Acc 58.32 43.55 54.34 66.74 31.78 28.43 57.70 39.74 14.14 29.00 7.55 4.16 0.00 0.00 10.97 0.00 10.97 0.00 14.14 8.36 Dect Acc 3.61 2.08 4.00 6.13 1.87 1.88 6.30 4.33 1.34 3.81 |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Attack Category Character-level Word-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Insert Punctuation (IP) | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.13 0.15 0.13 0.15 0.13 0.10 0.15 0.13 0.17 BLEURT BLEURT 0.38 0.38 0.38 0.38 0.33 0.38 0.33 0.30 0.30 | ROUCE 95.92 72.82 92.24 73.71 75.86 73.71 75.35 34.22 60.40 26.03 33.10 29.48 27.94 3.83 3.94 4.34 ROUGE 65.69 48.79 62.63 37.23 34.06 70.12 9.40 19.48 38.21 38.21 33.28 | Bit Acc 85.39 77.19 83.34 90.40 77.19 83.34 90.40 77.19 85.60 75.61 69.76 57.81 56.00 61.32 69.76 57.81 56.00 61.36 37.80 37.91 47.87 55.73 Bit Acc 65.10 55.35 64.39 74.61 50.04 48.69 75.22 41.53 53.55 38.91 | $\begin{array}{c} \textbf{Bett Act} \\ 58.32 \\ 43.55 \\ 54.34 \\ 66.74 \\ 31.78 \\ 28.43 \\ 57.70 \\ 39.74 \\ 14.14 \\ 29.00 \\ 7.55 \\ 4.16 \\ 0.00 \\$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Word-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Synonym Replacement (SR) Word Insertion (WD) Insert Punctuation (IP) Formal | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.13 0.15 0.13 0.15 0.13 0.15 0.13 0.15 0.13 0.15 0.13 0.13 0.10 0.15 0.13 0.38 0.33 0.38 0.33 0.38 0.33 0.38 0.33 0.30 0.30 | ROUCE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.03 30.10 29.48 27.94 2.74 3.83 3.94 4.34 ROUGE 65.69 48.79 62.63 77.23 34.06 70.12 49.40 19.48 38.21 38.21 10.07 | Bit Acc 85:39 77:19 83:34 90:40 70:85 69:07 85:60 75:61 61:32 69:76 57:81 56:00 61:36 37:80 37:53 Bit Acc 65:10 55:35 64:39 74:61 50:04 48:69 71:30 59:22 41:53 53:55 38:91 37:53 | $\begin{array}{c} \textbf{Betr Act} \\ 58.32 \\ 43.55 \\ 54.34 \\ 66.74 \\ 31.78 \\ 28.43 \\ 57.70 \\ 39.74 \\ 14.14 \\ 29.00 \\ 7.55 \\ 4.16 \\ 0.00 \\$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Character-level Word-level Word-level Word-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Neplace (CR) Synonym Replacement (SR) Word Insertion (WI) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.13 0.15 0.15 0.15 0.13 0.15 0.13 0.15 0.13 0.35 0.15 0.13 0.33 0.38 0.38 0.38 0.38 0.38 0.33 0.38 0.33 0.30 0.30 | ROUCE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 33.10 29.48 27.94 2.74 3.83 3.94 4.34 ROUGE 65.69 48.79 62.63 77.23 34.06 70.12 49.40 19.48 38.21 13.228 10.07 22.21 | Bit Acc 85:39 97:19 83:34 90:40 70:85 69:07 85:60 75:71 69:76 57:81 56:00 61:32 69:76 57:81 56:00 61:36 37:80 37:53 65:10 55:35 64:39 74:61 50:04 48:69 71:30 59:22 41:53 53:55 38:91 37:53 45:53 | $\begin{array}{c} \textbf{Bett} \ \textbf{Act}\\ 58.32\\ 43.55\\ 54.34\\ 66.74\\ 31.78\\ 28.43\\ 57.70\\ 39.74\\ 14.14\\ 29.00\\ 7.55\\ 4.16\\ 0.00\\ 0$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Character-level Word-level Word-level | Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Insertion (WD) Insert Punctuation (IP) Formal Casual Passive Active | BLEURT 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.15 0.15 0.15 0.15 0.15 0.15 0.1 | ROUCE 95.92 72.82 92.24 74.33 57.66 53.56 73.71 75.32 34.22 60.40 26.20 33.10 29.48 27.94 2.74 3.83 3.94 4.34 ROUGEE 65.69 48.79 62.63 78.40 37.23 34.06 70.12 49.48 38.21 13.28 10.07 22.21 27.57 96.65 | Bit Acc 85.39 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.32 69.76 57.81 56.01 61.36 55.79 Bit Acc 65.10 55.35 64.39 74.61 50.04 48.69 71.30 59.55 38.91 37.53 35.57 | $\begin{array}{c} \textbf{Betr} \textbf{Act}\\ 58.32\\ 43.55\\ 54.34\\ 66.74\\ 31.78\\ 28.43\\ 57.70\\ 39.74\\ 14.14\\ 29.00\\ 7.55\\ 4.16\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 0.00\\ 1.41\\ 8.36\\ 1.67\\ 1.88\\ 6.30\\ 4.00\\ 6.13\\ 1.87\\ 1.88\\ 6.30\\ 4.33\\ 1.34\\ 3.81\\ 1.37\\ 1.37\\ 0.00\\ 0.0$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Character-level Sentence-level Word-level Sentence-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation | BLEORI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.13 0.13 0.13 0.10 0.15 0.13 0.13 0.17 BLEURT 0.38 0.33 0.38 0.45 0.30 0.30 0.30 0.30 0.33 0.32 0.33 0.35 0.33 0.32 0.33 0.35 0.33 0.32 0.33 0.32 0.32 0.32 0.32 0.32 0.32 0.33 0.32 0.33 0.32 0.33 0.32 0.32 0.32 0.32 0.32 0.33 0.32 0.33 0.32 0.33 0.32 0.33 0.32 0.32 0.33 0.32 0.33 0.32 0.32 0.32 0.33 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.33 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.33 0.32 0.32 0.32 0.33 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.33 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.32 0.33 0.32 0.22 0. | ROUGE 95.92 72.82 92.24 73.71 75.82 92.34 76.66 53.56 73.71 75.32 34.22 60.40 22.03 39.10 22.03 39.10 22.03 39.10 22.03 39.10 22.03 39.10 22.03 39.10 22.03 39.10 22.03 39.10 22.03 39.10 22.03 39.10 22.44 3.83 3.94 38.21 13.28 10.07 22.21 27.57 26.66 4.68 | Bit Acc 85.90 77.19 83.34 90.40 77.19 83.34 90.40 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.91 74.787 50.37 56.35 74.61 50.439 74.61 50.439 74.61 50.922 41.53 35.55 38.91 37.53 45.53 30.85 | $\begin{array}{c} \textbf{Bett} \ \textbf{Att}\\ 58.32\\ 43.55\\ 54.34\\ 66.74\\ 31.78\\ 28.43\\ 57.70\\ 39.74\\ 14.14\\ 29.00\\ 7.55\\ 4.16\\ 0.00\\ 0.00\\ 0.00\\ 1.0.97\\ 0.00\\ 0.00\\ 1.0.97\\ 0.00\\ 0.00\\ 1.0.97\\ 0.00\\ 1.41\\ 8.36\\ \textbf{Bett} \ \textbf{Acc}\\ \textbf{3.61}\\ 2.08\\ 4.00\\ 6.13\\ 1.87\\ 1.88\\ 4.00\\ 6.13\\ 1.87\\ 1.88\\ 4.00\\ 6.13\\ 1.87\\ 1.88\\ 4.00\\ 6.13\\ 1.87\\ 1.88\\ 4.00\\ 6.13\\ 1.87\\ 1.88\\ 1.37$ |
| Watermark Blackbox-WM Watermark Unigram-WM | Character-level Word-level Sentence-level Word-level Character-level Sentence-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.13 0.13 0.13 0.10 0.15 0.13 0.17 BLEURT 0.38 0.33 0.38 0.45 0.30 0.30 0.30 0.33 0.33 0.45 0.30 0.33 0.33 0.45 0.30 0.33 0.25 0.21 0.27 0.27 0.48 0.21 0.27 0.27 0.27 0.27 0.27 0.48 0.23 0.13 0.13 0.13 0.13 0.15 0.13 0.15 0.13 0.15 0.13 0.15 0.13 0.27 0.27 0.27 0.27 0.48 0.23 0.13 0.13 0.13 0.15 0.13 0.15 0.13 0.15 0.13 0.27 0.27 0.27 0.27 0.27 0.27 0.48 0.23 0.15 0.13 0.15 0.13 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.27 0.13 0.13 0.13 0.13 0.27 0.38 0.33 0.33 0.33 0.32 0.30 0.30 0.30 0.30 0.30 0.30 0.30 0.21 0.32 0.22 0. | ROUCE 95.92 72.82 92.24 73.71 75.82 93.71 75.35 73.71 75.35 34.22 60.40 22.03 39.10 22.04 22.03 39.10 22.04 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 27.94 3.94 34.06 70.12 49.40 19.48 38.21 13.28 10.07 22.55 | Bit Acc 85.90 77.19 83.34 90.40 77.19 83.34 90.40 70.85 69.07 85.60 75.61 61.32 69.76 57.81 56.00 61.36 37.91 47.87 50.31 52.73 Bit Acc 65.10 55.35 64.39 74.61 50.04 48.69 71.30 59.22 41.53 37.53 45.53 15.70 16.84 30.857 | $\begin{array}{c} \textbf{Bett Act} \\ 58.32 \\ 43.55 \\ 54.34 \\ 66.74 \\ 31.78 \\ 28.43 \\ 57.70 \\ 39.74 \\ 14.14 \\ 29.00 \\ 7.55 \\ 4.16 \\ 0.00 \\ 0.00 \\ 0.00 \\ 10.97 \\ 0.00 \\ 0.00 \\ 10.97 \\ 0.00 \\ 10.97 \\ 0.00 \\ 10.97 \\ 1.88 \\ 4.00 \\ 6.13 \\ 1.87 \\ 1.88 \\ 6.30 \\ 4.33 \\ 1.34 \\ 1.37 \\ 1.37 \\ 1.37 \\ 1.37 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.00 \\ 0.118 \\ 4.74 \\ \end{array}$ |
| Watermark Blackbox-WM Unigram-WM | Character-level Word-level Sentence-level Word-level Character-level Sentence-level Sentence-level | Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | BLEURI 0.65 0.49 0.64 0.82 0.41 0.39 0.77 0.57 0.27 0.48 0.23 0.21 0.35 0.15 0.13 0.10 0.15 0.13 0.10 0.15 0.13 0.10 0.15 0.13 0.10 0.38 0.38 0.38 0.38 0.38 0.38 0.33 0.27 BLEURT BLEURT 0.38 0.33 0.27 0.5 0.12 0.13 0.12 0.32 0.21 0.12 0.22 0 | ROUCE 95.92 72.82 92.24 73.71 75.82 92.24 73.71 75.82 92.24 73.71 75.82 92.24 73.71 75.82 92.24 34.22 60.40 22.03 39.10 22.03 39.10 29.44 27.44 3.83 3.9.10 29.48 27.74 3.83 3.9.10 29.48 27.54 78.40 37.23 37.02 38.21 13.28 10.07 22.21 27.57 26.66 4.68 2.55 4.21 | Bit Acc 85.30 77.19 83.34 90.40 77.19 83.34 90.40 70.85 69.07 85.60 75.61 69.76 56.00 61.32 69.76 56.00 61.36 37.91 37.80 37.81 52.73 55.79 Bit Acc 65.10 55.35 64.39 74.61 50.04 48.69 71.30 59.22 41.53 38.91 37.53 45.53 15.70 16.84 30.85 29.67 30.51 | $\begin{array}{c} \textbf{Bett Act} \\ 58.32 \\ 43.55 \\ 54.34 \\ 66.74 \\ 31.78 \\ 28.43 \\ 57.70 \\ 39.74 \\ 14.14 \\ 29.00 \\ 7.55 \\ 4.16 \\ 0.00 \\ 0.00 \\ 0.00 \\ 10.97 \\ 0.00 \\ 10.97 \\ 0.00 \\ 10.97 \\ 0.00 \\ 10.97 \\ 0.00 \\ 10.97 \\ 1.88 \\ 3.61 \\ 2.08 \\ 3.61 \\ 2.08 \\ 3.61 \\ 1.87 \\ 1.88 \\ 1.37 \\ 1.37 \\ 1.37 \\ 1.37 \\ 1.37 \\ 0.00 \\ 0$ |

Table 18: MiniGPT-4 text watermarks under text perturbations.

| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
|--|--|--|---|---|--|---|
| | | Keyboard | 0.62 | 66.29 | 67.84 | 38.48 |
| | | OCR | 0.46 | 72.11 | 85.61 | 35.48 |
| | Character-level | Character Insert (CI) | 0.61 | 92.23 | 94.93 | 39.81 |
| | | Character Swap (CS) | 0.19 | 75.14 55.97 | 76.37 | 35.80 |
| | | Character Delete (CD) | 0.35 | 51.59 | 73.77 | 36.07 |
| | | Synonym Replacement (SR) | 0.74 | 88.75 | 98.67 | 45.71 |
| | | Word Insertion (WI) | 0.54 | 74.05 | 83.76 | 41.79 |
| KGW-WM | Word-level | Word Swap (WS) | 0.24 | 31.11 | 62.41 | 35.67 |
| | | Insert Punctuation (IP) | 0.44 | 58.28 22.53 | 75.10 57.31 | 41.18 36.25 |
| | | Formal | 0.10 | 12.00 | 51.69 | 26.51 |
| | | Casual | 0.03 | 35.76 | 62.81 | 40.44 |
| | | Passive | 0.09 | 35.82 | 27.54 | 29.58 |
| | Sentence-level | Active | 0.07 | 34.33 | 27.80 | 30.83 |
| | | Back Translation | 0.07 | 2.46 | 42.83 | 37.10 |
| | | Bart | 0.03 | 0.00 | 20.04 | 38.90 |
| | | Dipper | 0.06 | 2.14 | 20.05 | 37.52 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| | | Keyboard | 0.58 | 82.91 | 89.41 | 40.02 |
| | | OCR | 0.44 | 76.98 | 79.90 | 37.17 |
| | Character-level | Character Insert (CI) | 0.57 | 67.78 | 87.10 | 39.72 |
| | | Character Replace (CR) Character Swap (CS) | 0.71 | 61.52 58.60 | 95.34 72.64 | 42.61 35.51 |
| | | Character Delete (CD) | 0.30 | 53.64 | 72.04 | 35.07 |
| | | Synonym Replacement (SR) | 0.67 | 78.22 | 89.87 | 41.52 |
| | | Word Insertion (WI) | 0.49 | 76.48 | 78.28 | 38.01 |
| KTH-WM | Word-level | Word Swap (WS) | 0.24 | 30.76 | 61.69 | 32.88 |
| RTH-WM | | Word Deletion (WD) | 0.41 | 58.99 | 71.54 | 36.28 |
| | | Insert Functuation (IF) | 0.21 | 20.80 | 57.07 | 32.03 |
| | | Formal | 0.02 | 5.74 3.96 | 55.60 61.87 | 31.59 33.84 |
| | | Passive | 0.01 | 1.96 | 34.49 | 25.23 |
| | Sontonco lovol | Active | 0.01 | 0.81 | 34.66 | 25.51 |
| | Sentence-level | Back Translation | 0.09 | 7.63 | 46.28 | 29.49 |
| | | SCPN | 0.00 | 2.58 | 33.89 | 22.04 |
| | | Dipper | 0.01 | 3.33 | 31.05 | 27.49 28.81 |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| | | Keyboard | 0.63 | 52.81 | 87.64 | 73.97 |
| | | OCR | 0.46 | 69.28 | 79.20 | 55.15 |
| | Character-level | Character Insert (CI) Character Boplace (CB) | 0.62 | 89.23 61.02 | 85.57 | 69.76 86.47 |
| | | Character Swap (CS) | 0.00 | 01.02 | 79.72 | 41.25 |
| | | | 0.38 | 54.03 | 12.13 | 41.20 |
| | | Character Delete (CD) | $0.38 \\ 0.35$ | 54.03 49.93 | 70.91 | 37.37 |
| | | Character Delete (CD) Synonym Replacement (SR) | 0.38 0.35 0.74 | 54.03 49.93 71.33 | 70.91 88.00 | 37.37 |
| | | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | 0.38 0.35 0.74 0.54 | 54.03 49.93 71.33 72.38 | 70.91 88.00 77.71 | 41.25 37.37 76.14 53.16 |
| Blackbox-WM | Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) | 0.38 0.35 0.74 0.54 0.23 0.44 | 54.03 49.93 71.33 72.38 30.42 57.30 | 72.73 70.91 88.00 77.71 62.99 71.72 | 76.14 37.37 76.14 53.16 20.18 40.11 |
| Blackbox-WM | Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 | 72.73 70.91 88.00 77.71 62.99 71.72 59.41 | 76.14 53.16 20.18 40.11 12.56 |
| Blackbox-WM | Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.07 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 | 72.73 70.91 88.00 77.71 62.99 71.72 59.41 57.57 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 |
| Blackbox-WM | Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.07 0.01 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 | 72.73 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 |
| Blackbox-WM | Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.07 0.01 0.00 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 | 72.13 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 |
| Blackbox-WM | Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translotion | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.08 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 113 | 72.13 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 |
| Blackbox-WM | Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.07 0.01 0.00 0.00 0.08 0.06 0.00 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.31 | 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 | 41.29 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 |
| Blackbox-WM | Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 0.00 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.31 1.31 | 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 | $\begin{array}{c} 41.29\\ 37.37\\ \hline 76.14\\ 53.16\\ 20.18\\ 40.11\\ 12.56\\ \hline 8.62\\ 1.39\\ 3.19\\ 2.64\\ 9.17\\ 3.53\\ 2.55\end{array}$ |
| Blackbox-WM | Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper | $\begin{array}{c} 0.38\\ 0.35\\ 0.74\\ 0.54\\ 0.23\\ 0.44\\ 0.19\\ \hline 0.07\\ 0.01\\ 0.00\\ 0.08\\ 0.06\\ 0.00\\ 0.06\\ 0.00\\ 0.09\\ \hline \end{array}$ | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.31 1.22 1.85 | $\begin{array}{c} 12.13\\ 70.91\\ \hline \\ 88.00\\ 77.71\\ 62.99\\ 71.72\\ 59.41\\ \hline \\ 57.57\\ 63.12\\ 38.83\\ 38.97\\ 49.27\\ 30.04\\ 30.78\\ 30.95\\ \end{array}$ | $\begin{array}{c} 41.29\\ 37.37\\ \hline 76.14\\ 53.16\\ 20.18\\ 40.11\\ 12.56\\ \hline 8.62\\ 1.39\\ 3.19\\ 2.64\\ 9.17\\ 3.53\\ 2.55\\ 2.78\end{array}$ |
| Blackbox-WM | Word-level Sentence-level Attack Category | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 0.009 BLEURT | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.31 1.22 1.85 ROUGE | 72.13 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 30.95 Bit Acc | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 3.2.55 2.78 Dect Acc |
| Blackbox-WM | Word-level Sentence-level Attack Category | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCD | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.00 0.00 0.00 0.08 0.06 0.00 0.00 0.09 BLEURT 0.48 | 54.03 49.93 77.133 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.31 1.22 1.85 ROUGE 63.53 63.53 | 12.13 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.95 Bit Acc 68.48 69.57 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 |
| Blackbox-WM | Word-level Sentence-level Attack Category | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CD) | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 0.09 BLEURT 0.48 0.35 0.48 | 54.03 49.93 77.133 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.31 1.22 1.85 ROUGE 63.53 47.33 61.44 | 12.13 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 30.95 Bit Acc 68.48 60.55 66.76 | 41.29 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.89 |
| Blackbox-WM | Word-level Sentence-level Attack Category Character-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 BLEURT 0.48 0.35 0.48 0.62 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.31 1.31 1.31 1.22 1.85 ROUGE 63.53 47.33 61.44 77.46 | 70.91 88.00 77.71 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.04 30.05 Bit Acc 68.48 60.55 66.76 73.85 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 |
| Blackbox-WM | Word-level Sentence-level Attack Category Character-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.09 BLEURT 0.48 0.35 0.48 0.35 0.48 0.62 0.28 | 54.03 49.93 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.22 1.85 ROUGE 63.53 61.44 77.46 37.32 | 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 30.95 Bit Acc 68.48 60.55 66.76 75.457 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 0.60 |
| Blackbox-WM | Word-level Sentence-level Attack Category Character-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 0.06 0.00 BLEURT 0.48 0.35 0.48 0.35 0.48 0.62 0.28 0.28 | 54.03 49.93 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.22 1.85 ROUGE 63.53 47.33 61.44 77.46 37.32 34.66 | 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 30.95 Bit Acc 68.48 60.55 66.76 73.85 54.77 53.16 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 0.60 0.56 |
| Blackbox-WM | Word-level Sentence-level Attack Category Character-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 0.09 BLEURT 0.48 0.35 0.48 0.35 0.48 0.28 0.27 | 54.03 49.93 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.22 1.85 ROUGE 63.53 47.33 61.44 77.46 37.32 34.66 70.69 | 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 30.95 Bit Acc 68.48 60.55 66.76 73.85 54.77 53.16 | $\begin{array}{c} 37.37\\ 76.14\\ 53.16\\ 20.18\\ 40.11\\ 12.56\\ 8.62\\ 1.39\\ 3.19\\ 2.64\\ 9.17\\ 3.53\\ 2.55\\ 2.78\\ \hline \textbf{Dect Acc}\\ 1.71\\ 0.85\\ 1.82\\ 2.90\\ 0.60\\ 0.56\\ \hline 2.84\\ \end{array}$ |
| Blackbox-WM Watermark | Word-level Sentence-level Attack Category Character-level Word lavel | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 0.09 BLEURT 0.48 0.35 0.48 0.35 0.48 0.27 0.28 0.27 | 54.03 49.93 77.133 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.12 1.22 1.85 ROUGE 63.53 47.33 61.44 77.46 37.32 34.66 70.69 50.71 9.07 | 72.13 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 30.95 Bit Acc 68.48 60.55 54.76 73.85 54.76 53.16 69.58 59.90 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 0.60 0.56 2.84 1.75 |
| Blackbox-WM Watermark | Word-level Sentence-level Attack Category Character-level Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Deltion (WD) | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.00 0.00 0.08 0.06 0.00 0.09 BLEURT 0.48 0.35 0.48 0.27 0.58 0.42 0.34 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.31 1.22 1.85 ROUGE 63.53 47.33 61.44 77.46 37.32 34.66 70.69 50.71 21.67 40.60 | 72.13 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.04 30.95 Bit Acc 68.48 60.55 66.75 66.75 53.16 (73.85) 54.44 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 0.60 0.566 2.84 1.75 0.13 1.38 |
| Blackbox-WM Watermark Unigram-WM | Word-level Sentence-level Attack Category Character-level Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.09 BLEURT 0.48 0.35 0.48 0.48 0.48 0.27 0.28 0.27 0.58 0.42 0.58 0.34 0.35 | 54.03 49.93 71.33 72.38 30.42 5.79 0.28 0.62 1.13 1.31 1.22 1.85 ROUGE 63.53 47.33 61.44 77.46 37.32 34.669 50.71 21.67 40.60 | 12.13 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.95 Bit Acc 68.48 60.55 66.76 73.85 54.77 53.16 69.58 69.59 69.59 69.59 69.544 42.83 | $\begin{array}{c} 41.29\\ 37.37\\ 76.14\\ 53.16\\ 20.18\\ 40.11\\ 12.56\\ 8.62\\ 1.39\\ 3.19\\ 2.64\\ 9.17\\ 3.53\\ 2.55\\ 2.78\\ \hline \textbf{Dect Acc}\\ 1.71\\ 0.85\\ 1.82\\ 2.90\\ 0.60\\ 0.56\\ 2.84\\ 1.75\\ 0.13\\ 1.38\\ 0.05\\ \end{array}$ |
| Blackbox-WM Watermark Unigram-WM | Word-level Sentence-level Attack Category Character-level Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Melacement (SR) Word Insertion (WT) Word Deletion (WD) Insert Punctuation (IP) Formal | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.00 0.00 0.00 0.00 0.00 0.00 0.00 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.31 1.22 1.85 ROUGE 63.53 47.33 61.44 77.46 37.32 34.66 70.69 50.71 21.67 40.60 16.48 3.378 | 70.91 88.00 77.71 62.19 70.91 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.95 Bit Acc 68.48 60.55 66.76 73.85 54.77 53.16 69.58 59.90 45.99 54.44 42.83 41.20 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 0.60 0.56 2.84 1.75 0.13 1.38 0.05 |
| Blackbox-WM Watermark Unigram-WM | Word-level Sentence-level Attack Category Character-level Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Deletion (WD) Insert Punctuation (IP) Formal Casual | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 0.06 0.00 BLEURT 0.48 0.35 0.48 0.62 0.28 0.27 0.58 0.42 0.28 0.27 0.58 0.42 0.33 0.48 0.42 0.28 0.27 | 54.03 49.93 71.33 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.22 1.85 ROUGE 63.53 61.44 77.46 37.32 34.66 70.69 50.69 50.69 50.69 121.67 40.60 16.48 70.69 50. | 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.95 Bit Acc 68.48 60.55 66.76 73.85 54.77 53.16 69.58 59.90 54.44 42.83 41.83 42.83 42.83 44.85 44.84 44.85 45.85 45 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 0.60 0.56 2.84 1.75 2.84 1.75 1.38 0.05 0.00 0.000 0.000 0.87 |
| Blackbox-WM Watermark Unigram-WM | Word-level Sentence-level Attack Category Character-level Word-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 0.09 BLEURT 0.48 0.35 0.48 0.35 0.48 0.22 0.28 0.27 0.58 0.22 0.28 0.27 0.58 0.22 0.28 0.27 | 54.03 49.93 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.22 1.85 ROUGE 63.53 47.33 61.44 77.46 37.32 34.66 70.69 50.71 21.67 40.60 16.48 3.78 6.22 2.02 40.20 2.02 40.20 2.02 40.20 40. | 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 30.95 Bit Acc 68.48 60.55 66.76 73.85 54.77 53.16 69.58 59.90 54.44 42.83 41.20 46.62 23.59 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 0.60 0.56 2.84 1.75 0.13 1.38 0.05 0.33 1.38 0.05 |
| Blackbox-WM Watermark Unigram-WM | Word-level Sentence-level Character-level Word-level Sentence-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.09 BLEURT 0.48 0.35 0.48 0.35 0.48 0.62 0.28 0.27 0.58 0.42 0.28 0.27 0.58 0.42 0.5 0.03 0.04 0.05 | 54.03 49.93 77.133 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 1.22 1.85 ROUGE 63.53 47.33 61.44 77.46 33.4.66 70.69 50.71 21.67 40.60 16.48 3.78 6.22 40.60 16.48 | 12.13 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 30.95 Bit Acc 68.48 60.55 66.76 73.85 54.77 53.16 69.58 59.90 45.99 54.44 42.83 41.20 46.62 53.59 23.85 33.80 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 0.60 0.56 2.84 1.75 0.13 1.38 0.05 0.00 0.00 0.00 0.00 0.00 0.00 0.0 |
| Blackbox-WM Watermark | Word-level Sentence-level Word-level Sentence-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | 0.38 0.35 0.74 0.23 0.44 0.19 0.07 0.01 0.00 0.08 0.06 0.00 0.09 BLEURT 0.48 0.35 0.48 0.35 0.48 0.27 0.58 0.42 0.28 0.42 0.58 0.42 0.55 0.34 0.05 0.05 0.05 0.05 0.05 0.05 | 54.03 49.93 77.133 72.38 30.42 57.30 22.40 18.23 5.79 0.28 0.62 1.13 11.22 1.85 ROUGE 63.53 47.33 46.144 77.46 37.32 34.66 70.69 50.71 21.67 40.60 16.48 3.378 6.22 0.42 0.062 | 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.78 30.95 Bit Acc 68.48 60.55 66.76 73.85 54.76 73.85 54.76 73.85 54.76 69.58 59.90 45.99 54.44 42.83 41.20 46.62 23.59 23.85 33.80 29.41 | 37.37 76.14 53.16 20.18 40.11 12.56 8.62 1.39 3.19 2.64 9.17 3.53 2.55 2.78 Dect Acc 1.71 0.85 1.82 2.90 0.60 0.56 2.84 1.75 0.13 8.05 0.00 0.87 1.38 0.05 |
| Blackbox-WM Watermark Unigram-WM | Word-level Sentence-level Character-level Word-level Sentence-level | Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | 0.38 0.35 0.74 0.54 0.23 0.44 0.19 0.00 0.00 0.08 0.00 0.08 0.00 0.09 BLEURT 0.48 0.35 0.48 0.35 0.48 0.27 0.48 0.27 0.48 0.27 0.48 0.27 0.48 0.27 0.48 0.27 0.48 0.27 0.48 0.48 0.27 0.48 0.48 0.27 0.48 0.48 0.27 0.48 0.48 0.48 0.48 0.48 0.48 0.48 0.48 | $\begin{array}{r} 54.03\\ 49.93\\ 77.133\\ 72.38\\ 30.42\\ 57.30\\ 22.40\\ 18.23\\ 5.79\\ 0.28\\ 0.62\\ 1.13\\ 1.21\\ 1.22\\ 1.85\\ \hline \textbf{ROUGE}\\ 63.53\\ 47.33\\ 61.44\\ 77.46\\ 37.32\\ 34.66\\ 70.69\\ 50.71\\ 21.67\\ 40.60\\ 1.64\\ 8\\ 3.78\\ 6.22\\ 0.42\\ 0.06\\ 1.09\\ 0.03\\ \end{array}$ | 70.91 88.00 77.71 62.99 71.72 59.41 57.57 63.12 38.83 38.97 49.27 30.04 30.95 Bit Acc 68.48 60.55 66.76 73.85 54.77 53.16 69.58 69.59 65.8 69.59 54.44 42.83 41.20 46.62 23.59 53.80 29.41 | $\begin{array}{c} 37.37\\ 37.37\\ 76.14\\ 53.16\\ 20.18\\ 40.11\\ 12.56\\ 3.39\\ 3.19\\ 2.64\\ 9.17\\ 3.53\\ 2.55\\ 2.78\\ \hline \textbf{Dect} \ \textbf{Acc}\\ 1.71\\ 0.85\\ 1.82\\ 2.90\\ 0.60\\ 0.56\\ 2.84\\ 1.75\\ 0.13\\ 1.38\\ 0.05\\ 0.00\\ 0.87\\ 1.94\\ 1.74\\ 0.29\\ 1.53\\ 1.23\\ 0.5\\ \end{array}$ |

Table 19: mPLUG-Owl2 text watermarks under text perturbations.

| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
|--|---|--|---|---|---|--|
| | | Keyboard | 0.64 | 65.57 | 90.76 | 30.89 |
| | | OCR | 0.49 | 51.60 | 80.30 | 15.60 |
| | Character-level | Character Insert (CI) | 0.62 | 69.54 | 88.15 | 35.16 |
| | Character-level | Character Replace (CR) | 0.76 | 10.11 | 97.14 | 56.91 |
| | | Character Swap (CS) | 0.40 | 53.03 | 72.23 | 14.10 |
| | | Character Delete (CD) | 0.37 | 41.19 | 09.90 | 14.39 |
| | | Synonym Replacement (SR) | 0.70 | 96.03 | 91.03 | 59.14 |
| | Word-level | Word Swap (WS) | 0.52 | 00.84 25.11 | 60.09 | 0.52 9.47 |
| KGW-WM | word-level | Word Deletion (WD) | 0.20 | 49.72 | 70.85 | 34.57 |
| | | Insert Punctuation (IP) | 0.21 | 14.80 | 55.61 | 10.19 |
| | | Formal | 0.02 | 0.49 | 53 31 | 10.42 |
| | | Casual | 0.03 | 0.12 | 60.15 | 28.05 |
| | | Passive | 0.01 | 0.70 | 30.11 | 24.51 |
| | Sentence-level | Active | 0.01 | 0.39 | 30.26 | 19.61 |
| | beneence level | Back Translation | 0.07 | 0.34 | 42.95 | 9.19 |
| | | SCPN Bast | 0.00 | 0.54 | 40.03 | 9.99 |
| | | Dipper | 0.02 | 0.59 | 44.05 | 9.12 |
| 337-41- | Atta -la Cata anna | Damper Denter Denter | DIFUDT | DOLICE | D:4 A | Dent Are |
| watermark | Attack Category | Ferturbation | BLEURI | RUUGE | DIL ACC | Dect Acc |
| | | Keyboard | 0.57 | 70.00 | 92.83 | 45.41 |
| | | Character Insert (CI) | 0.43 | 74.03 04.32 | 01.23 | 40.10 |
| | Character-level | Character Replace (CR) | 0.55 | 66.84 | 91.23 66.68 | 49.99 |
| | | Character Swap (CS) | 0.33 | 55.89 | 68.65 | 36.83 |
| | Character-level | Character Delete (CD) | 0.30 | 50.66 | 66.32 | 35.96 |
| | | Synonym Replacement (SR) | 0.60 | 72.93 | 80.83 | 47.78 |
| | | Word Insertion (WI) | 0.43 | 71.95 | 82.00 | 41.23 |
| KTH-WM | Word-level | Word Swap (WS) | 0.18 | 27.49 | 54.54 | 31.71 |
| ICTIT-WINI | | Word Deletion (WD) | 0.33 | 54.35 | 72.77 | 37.93 |
| | | Insert Punctuation (IP) | 0.12 | 17.22 | 50.00 | 30.02 |
| | | Formal | 0.09 | 1.91 | 47.62 | 29.14 |
| | | Casual | 0.02 | 9.12 | 59.67 | 33.22 |
| | | Active | 0.02 | 4.40 | 15.00 | 17.27 |
| | Sentence-level | Back Translation | 0.00 | 0.08 | 36.33 | 24.99 |
| | | SCPN | 0.00 | 0.01 | 18.68 | 18.46 |
| | | Bart | 0.03 | 0.04 | 19.68 | 19.00 |
| | | Dipper | 0.06 | 2.31 | 16.38 | 17.62 |
| | | | | | | |
| Watermark | Attack Category | Perturbation | BLEURT | ROUGE | Bit Acc | Dect Acc |
| Watermark | Attack Category | Perturbation Keyboard | BLEURT 0.61 | ROUGE 78.45 | Bit Acc 69.26 | Dect Acc 26.62 |
| Watermark | Attack Category | Perturbation Keyboard OCR | BLEURT 0.61 0.45 | ROUGE 78.45 58.54 | Bit Acc 69.26 62.59 | Dect Acc 26.62 24.32 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Banlage (CB) | BLEURT 0.61 0.45 0.59 0.75 | ROUGE 78.45 58.54 75.43 94.64 | Bit Acc 69.26 62.59 67.62 73.30 | Dect Acc 26.62 24.32 27.60 31.23 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) | BLEURT 0.61 0.45 0.59 0.75 0.36 | ROUGE 78.45 58.54 75.43 94.64 45.66 | Bit Acc 69.26 62.59 67.62 73.39 57.47 | Dect Acc 26.62 24.32 27.60 31.23 24.52 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 |
| Watermark | Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 | Dect Acc 26.62 27.60 31.23 24.52 24.71 32.02 29.03 |
| Watermark Blackboy.WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) here the metatorise (ID) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 656.66 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.50 0.21 0.40 0.17 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 | $\begin{array}{c} \textbf{Bit Acc} \\ 69.26 \\ 62.59 \\ 67.62 \\ 73.39 \\ 57.47 \\ 56.03 \\ 69.53 \\ 61.40 \\ 49.76 \\ 56.66 \\ 46.93 \end{array}$ | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Insert Punctuation (IP) Formal | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 61.40 49.76 56.66 46.93 45.46 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Paceiro | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.04 0.07 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.01 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 46.93 45.46 49.86 30.65 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 24.95 24.95 27.92 19.65 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active | BLEURT 0.61 0.45 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.04 0.07 0.02 0.09 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 0.03 0.01 0.06 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 46.93 45.46 49.86 30.65 30.76 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 19.65 20.58 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation | BLEURT 0.61 0.45 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.04 0.07 0.02 0.09 0.09 0.03 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.01 0.06 0.10 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 61.40 49.76 56.66 46.93 45.46 30.65 30.76 38.90 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 19.65 27.92 19.65 20.58 25.34 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN | BLEURT 0.61 0.45 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.04 0.07 0.02 0.09 0.03 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.01 0.01 0.06 0.10 0.000 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 46.93 45.46 49.86 30.65 30.76 38.90 39.68 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 19.65 20.58 25.34 18.80 |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart D: | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.04 0.07 0.02 0.09 0.03 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.01 0.06 0.10 0.003 0.03 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 46.93 45.46 49.86 30.76 30.76 33.29 33.29 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 24.95 27.92 24.95 27.92 20.58 20.59 20.58 20.59 20.58 20.59 20. |
| Watermark Blackbox-WM | Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.04 0.07 0.02 0.09 0.03 0.00 0.03 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.01 0.06 0.00 0.00 0.00 0.03 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 30.76 46.93 45.46 49.86 30.76 38.90 38.68 33.29 38.48 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 19.65 20.58 25.34 18.80 17.36 16.56 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.02 0.09 0.03 0.00 0.00 0.00 BLEURT | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.06 0.10 0.03 0.06 ROUGE | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.63 46.93 45.46 49.86 30.67 38.90 38.48 Bit Acc | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.37 27.92 19.65 20.58 25.34 18.80 017.36 16.56 Dect Acc |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation | BLEURT 0.61 0.45 0.59 0.75 0.36 0.50 0.21 0.40 0.17 0.02 0.04 0.07 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 4.41 0.03 0.06 0.01 0.03 0.06 ROUGE 60.061 60.062 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.63 49.76 56.63 49.86 30.76 38.90 38.48 33.29 38.48 Bit Acc 80.47 56.04 56.64 56.65 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.36 28.53 24.47 27.92 19.65 20.58 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Locat (CI) | BLEURT 0.61 0.45 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.47 0.04 0.07 0.02 0.09 0.09 0.03 0.00 0.00 BLEURT | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.01 0.03 0.03 0.03 0.03 0.04 ROUGE 60.66 45.61 57.02 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 61.40 49.76 56.66 49.86 30.76 30.76 38.90 39.68 30.76 38.90 38.48 Bit Acc 80.47 67.28 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 19.65 27.92 19.65 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.92 0.43 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.04 0.07 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.71 25.71 48.45 8.94 5.41 0.03 0.06 0.10 0.00 0.03 0.06 ROUGEE 60.61 57.90 71.90 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 56.66 46.93 45.46 49.86 30.76 33.29 33.29 33.48 Bit Acc 80.47 67.28 76.97 88.00 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 27.92 27.92 27.92 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.09 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.01 0.06 0.00 0.03 0.06 ROUGE 60.66 45.61 57.90 71.90 35.26 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.63 69.53 61.40 49.76 56.66 46.93 61.40 49.76 56.84 49.86 30.67 38.90 33.29 38.48 Bit Acc 80.47 67.28 76.97 80.09 56.84 90.76 56.84 90.76 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.29 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Delete (CD) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.44 5.41 0.03 0.01 0.06 0.010 0.03 0.06 ROUGE 60.66 45.61 57.90 71.90 32.43 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.63 49.76 56.63 46.93 30.76 38.90 33.29 38.48 33.29 38.48 Bit Acc 80.47 67.28 76.97 88.09 56.84 53.88 93.68 45.38 90.47 97.28 97.69 97.28 97.69 97.28 97.69 97.28 97.69 97.28 97.69 97.28 97.69 97.68 97.69 97.66 98.09 95.68 98.09 95.68 93.28 93.28 93.28 93.29 93.28 93.29 93.28 93.29 93.28 93.29 93.28 93.29 93.28 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.37 27.92 19.65 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CD) Synonym Replacement (SR) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.50 0.21 0.40 0.17 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 4.64 0.03 0.01 0.06 0.010 0.03 0.06 ROUGE 60.66 45.61 57.90 71.90 32.43 64.48 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 49.86 30.76 38.90 39.68 33.29 38.48 Bit Acc 80.47 67.28 76.97 88.09 56.84 53.88 80.10 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.36 28.53 24.77 24.95 27.92 19.65 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.29 0.00 1.58 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Sentence-level Attack Category Character-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) | BLEURT 0.61 0.45 0.59 0.75 0.33 0.69 0.50 0.50 0.21 0.40 0.47 0.04 0.07 0.02 0.09 0.09 0.03 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.06 0.010 0.003 0.006 45.61 57.90 77.90 35.26 32.43 64.48 46.03 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 49.86 30.65 30.76 33.890 33.49 88.90 38.48 Bit Acc 80.47 67.28 76.28 76.83 90.56 56.84 53.88 80.09 56.84 53.88 80.01 64.07 80.01 64.07 80.01 64.07 80.01 64.07 80.01 64.07 80.01 80.01 64.07 80.01 80.01 64.07 80.01 80.01 80.01 80.41 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.36 28.53 24.77 24.95 27.92 19.65 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.29 0.00 1.58 0.96 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synouym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Swap (WS) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.01 0.02 0.02 0.02 0.03 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.71 48.45 5.61 25.71 48.45 8.94 5.41 0.03 0.06 0.10 0.00 0.03 0.06 60.66 45.790 71.90 35.266 32.43 64.48 46.03 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 46.93 45.46 49.86 30.76 33.29 33.29 38.48 Bit Acc 80.77 80.97 56.84 53.88 80.10 64.19 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 24.95 27.92 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.29 0.00 1.58 0.96 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Obletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.44 5.41 0.03 0.01 0.06 0.00 0.03 0.06 ROUGE 60.66 45.61 57.90 71.90 32.43 64.48 46.03 9.39 36.03 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 61.40 49.76 56.63 61.40 49.76 56.64 40.86 30.67 38.90 33.29 38.48 Bit Acc 80.47 67.28 76.97 88.09 56.84 53.88 80.10 64.07 41.19 54.52 100 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 20.58 25.34 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.29 0.00 1.58 0.90 0.00 0.000 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.06 0.010 0.03 0.06 8.94 5.41 0.03 0.06 0.010 0.03 0.06 8.94 5.41 0.03 0.06 0.03 0.06 8.94 60.66 45.61 57.90 71.90 32.43 64.48 46.03 19.39 36.03 3.84 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.63 64.693 64.693 64.693 63.63 63.64 63.63 63.890 33.29 38.48 80.47 67.28 80.47 67.28 80.97 53.84 80.09 55.84 53.88 80.10 64.07 41.19 54.52 53.66 80.10 64.07 41.19 54.52 35.36 80.10 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.36 28.53 24.37 27.92 19.65 20.58 25.34 18.80 017.36 16.56 Dect Acc 0.92 0.43 0.43 0.98 0.00 0.29 0.00 1.58 0.00 0.00 0.00 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM Watermark | Attack Category Character-level Word-level Attack Category Character-level Word-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal | BLEURT 0.61 0.45 0.59 0.75 0.33 0.69 0.21 0.40 0.17 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.44 5.41 0.03 0.06 0.010 0.03 0.06 8.94 6.4.4 8.94 6.4.4 6.4.4 4.6.03 19.39 36.03 3.84 0.05 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.63 49.76 56.63 45.46 49.86 30.76 33.99 38.48 80.45 33.29 38.48 Bit Acc 80.47 67.28 76.97 88.09 56.84 53.88 80.10 64.07 41.19 54.52 35.36 32.36 32.36 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.36 28.53 24.37 27.92 19.65 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.29 0.00 1.58 0.00 0.00 0.00 0.00 0.00 |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Word-level Sentence-level Character-level Word-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Usord Swap (WS) Word Deletion (WD) Insert Punctuation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Synonym Replacement (SR) Word Deletion (WI) Insert Punctuation (IP) Formal Casual Ca | BLEURT 0.61 0.45 0.59 0.75 0.33 0.69 0.50 0.50 0.50 0.50 0.50 0.50 0.41 0.40 0.07 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 36.44 45.66 42.20 85.70 61.21 25.71 48.45 30.03 0.06 0.010 0.003 0.006 45.61 57.90 32.43 64.48 46.03 19.39 36.03 3.84 0.096 0.07 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.66 49.86 30.76 30.76 33.29 38.48 Bit Acc 80.47 67.28 76.28 76.29 38.48 Bit Acc 80.47 67.28 76.84 53.88 80.09 56.84 53.88 80.09 56.84 53.88 80.01 64.07 41.19 54.52 35.36 32.36 40.78 32.36 40.78 32.36 40.78 32.36 40.78 32.36 40.78 32.36 40.78 32.36 40.78 32.36 40.78 32.36 40.78 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 19.65 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.0 |
| Watermark Blackbox-WM Unigram-WM | Attack Category Character-level Word-level Sentence-level Character-level Word-level Word-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Swap (CS) Character Swap (S) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.17 0.02 0.02 0.02 0.02 0.03 0.00 BLEURT 0.45 0.33 0.44 0.56 0.26 0.26 0.24 0.52 0.26 0.24 0.52 0.36 0.14 0.52 0.36 0.14 0.52 0.36 0.14 0.52 0.36 0.14 0.52 0.36 0.52 0.36 0.52 0.36 0.52 0.36 0.52 0.36 0.52 0.36 0.52 0.36 0.52 0.36 0.52 0.36 0.52 0.36 0.55 0.55 0.55 0.55 0.55 0.55 0.55 0.5 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.71 48.45 48.45 5.71 48.45 5.71 48.45 0.01 0.03 0.06 0.00 0.03 0.06 60.66 45.61 57.90 71.90 35.26 32.43 64.48 46.03 9.36.03 3.84 0.07 0.06 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.03 61.40 49.76 56.03 61.40 49.76 56.30 61.40 49.86 30.76 38.48 Bit Acc 80.47 67.28 76.97 88.09 56.84 53.88 80.10 64.078 32.36 40.78 31.3 310 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.29 0.00 1.58 0.96 0.00 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Word-level Sentence-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Oeletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Insert (CI) Character Swap (CS) Character Insert (CI) Synonym Replacement (SR) Word Insertion (WI) Word Insertion (WI) Synonym Replacement (SR) Word Insertion (WI) Formal Casual Passive Active Back Translation | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.50 0.21 0.40 0.50 0.21 0.40 0.50 0.21 0.40 0.00 0.00 0.00 0.00 0.00 0.00 0.0 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.01 0.06 0.00 0.03 0.06 60.66 45.61 57.90 71.90 32.43 64.48 46.03 9.39 36.03 3.84 0.07 0.06 0.07 0.06 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 61.40 49.76 56.63 61.40 49.76 56.64 49.86 30.67 38.90 33.29 38.48 Bit Acc 80.47 67.28 80.97 56.84 53.88 80.10 64.07 45.38 80.10 64.07 41.19 54.52 35.36 32.36 40.78 3.13 3.19 31.91 31.91 31.91 31.89 < | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.77 24.95 27.92 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.29 0.00 1.58 0.98 0.00 0.00 0.00 0.00 0.00 0.00 0.0 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Word-level Sentence-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Replace (CR) Character Replace (CR) Character Swap (CS) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Insertion (WI) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Synonym Replacement (SR) Word Insertion (WI) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN SCPN SCPN SCPN SCPN SCPN SCPN SCPN | BLEURT 0.61 0.45 0.59 0.75 0.36 0.33 0.69 0.50 0.21 0.40 0.77 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 BLEURT 0.45 0.33 0.44 0.56 0.24 0.52 0.36 0.14 0.29 0.10 0.08 0.02 0.02 0.02 0.02 0.02 0.02 0.0 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.45 8.94 5.41 0.03 0.06 0.010 0.03 0.06 8.94 5.41 0.03 0.06 0.03 0.06 8.94 5.41 0.03 0.06 0.03 0.06 71.90 32.43 64.48 46.03 19.39 36.03 3.84 0.06 0.08 0.02 0.04 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.63 64.693 64.693 64.693 63.63 63.64 63.63 63.64 63.64 63.64 63.64 53.88 80.01 64.07 80.01 64.07 80.11 64.07 81.15 53.88 80.10 64.07 41.19 54.52 35.36 31.33 3.19 13.34 3.19 18.34 3.68 3.68 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.36 28.53 24.37 27.92 19.65 20.58 25.34 18.80 017.36 16.56 Dect Acc 0.92 0.43 0.43 0.98 0.00 0.29 0.00 1.58 0.98 0.00 0.00 0.00 0.00 0.00 0.00 0.0 |
| Watermark Blackbox-WM Watermark Unigram-WM | Attack Category Character-level Word-level Sentence-level Attack Category Character-level Word-level Sentence-level | Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Swap (CS) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart Dipper Perturbation Keyboard OCR Character Insert (CI) Character Replace (CR) Character Replace (CR) Character Replace (CR) Character Delete (CD) Synonym Replacement (SR) Word Insertion (WI) Word Swap (WS) Word Deletion (WD) Insert Punctuation (IP) Formal Casual Passive Active Back Translation SCPN Bart | BLEURT 0.61 0.45 0.59 0.75 0.36 0.50 0.21 0.40 0.17 0.02 0.09 0.03 0.00 0.00 0.00 0.00 0.00 0.00 | ROUGE 78.45 58.54 75.43 94.64 45.66 42.20 85.70 61.21 25.71 48.44 5.41 0.03 0.06 0.10 0.06 0.010 0.03 0.06 8.94 6.41 6.0.66 45.61 57.90 71.90 32.43 32.43 96.03 3.84 0.096 0.02 0.04 | Bit Acc 69.26 62.59 67.62 73.39 57.47 56.03 69.53 61.40 49.76 56.63 64.93 61.40 49.76 56.63 30.76 33.89 33.29 38.48 80.45 33.29 38.48 80.47 67.28 76.97 88.09 56.84 53.88 80.10 64.07 41.19 54.52 35.36 32.36 40.78 3.13 3.19 18.94 3.52 | Dect Acc 26.62 24.32 27.60 31.23 24.52 24.71 32.02 29.03 24.36 28.53 24.36 28.53 24.77 24.95 20.58 25.34 18.80 17.36 16.56 Dect Acc 0.92 0.43 0.98 0.00 0.0 |

Table 20: Qwen-VL text watermarks under text perturbations.