IS YOUR VIDEO LANGUAGE MODEL A RELIABLE JUDGE?

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ABSTRACT

Evaluating video language models (VLMs) is crucial for improving their understanding of video content. Existing evaluation methods depend on single models, which may be unreliable or biased due to models' incapability to understand content or inherent bias, ultimately compromising reliability of the evaluation. A straightforward way is to apply the principle of collective thoughts, aggregating reviews from multiple VLMs to enhance reliability. This study investigates the efficacy of collective thought approaches in VLM evaluation, particularly when the pool of judges includes both reliable and unreliable models. Our findings reveal that incorporating collective judgments from a mix of reliable and unreliable VLMs does not necessarily enhance the accuracy of the final evaluation outcomes. The inclusion of less reliable judges could introduce noise and potentially lead to less reliable evaluations. To explore the factors of improving reliability of judges, we fine-tuned the underperformed VLM judge, Video-LLaVA, and observed that to make VLM judges serve as reliable evaluators, good understanding ability alone is not sufficient. These findings stress the limitations of collective thought approaches in VLM evaluation and highlight the need for more advanced methods that can account for the reliability of individual models. Our study promotes the development of more reliable evaluations for VLMs.

1 INTRODUCTION

With the rapid proliferation of digital video content on a wide range of platforms, including social media, the need for robust and scalable methods of evaluation has significantly increased. Traditional approaches to evaluation in these areas are generally performed by human experts, whose subjective judgments may be inconsistent and not easily scalable. This limitation has recently sparked interest in the automation of the evaluation process through advanced machine learning models.

Recent advancements have led to the development of Video Language Models (VLMs) that can generate descriptions and analyses from video inputs, potentially automating the evaluation of video. However, depending on a single VLM for evaluation presents challenges. As illustrated in Figure 1, the evaluation results from the VLM are inconsistent with those produced by multi-agent debate. Individual models can exhibit biased outcomes influenced by their training data and architectural constraints, and are susceptible to hallucinations—generating plausible but incorrect information (Tong et al., 2024; Gervi et al., 2024). These challenges compromise the reliability of employing a single VLMs as effective evaluators, particularly in complex video understanding tasks.

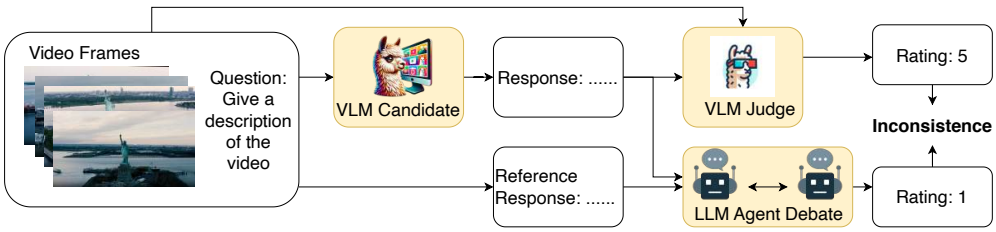

Figure 1: By contrasting reviewing results from one VLM with multiple LLM agent debate, we find that current VLMs are far from being able to provide reliable review.

An intuitive solution is to employ ensemble methods or principles from collective intelligence, aggregating judgments from multiple models to enhance reliability. The concept of *Collective Intelligence* suggests that integrating diverse thoughts could improve decision accuracy and mitigate individual biases Malone et al. (2009).

This gap in effective evaluation methodologies motivates our research, leading us to ask:

- Are current VLMs reliable for evaluation tasks, especially in complex video understanding tasks? Can we use weak VLMs to judge stronger VLMs?
- Does incorporating collective thought multiple VLMs enhance the reliability of evaluations?
- What are the limitations of collective thought approaches in the context of VLM evaluation, and how can we address them?

We address these questions by exploring the effectiveness of collective thought approaches to evaluating VLMs. Specifically, we investigate whether pooling judgments across multiple VLMs improves evaluation reliability when the pool of judges includes both reliable and unreliable models. In this work, we demonstrate that a pool of judges that comprises both reliable and unreliable judges does not necessarily improve the results of the evaluation in a collective thought approach. Adding less reliable models may inject noise into the results that can easily swamp any aggregation benefits. These observations highlight the limitations of collective thought approaches when indiscriminately aggregating evaluations from models of varying reliability. This phenomenon underscores the need for more sophisticated methods that can effectively account for the reliability of individual judges and mitigate the influence of less reliable models. The main contributions of our work are as follows:

- We assess the reliability of current VLMs in evaluation tasks, highlighting their limitations due to incapability to understand the content and inherent bias.
- We found that using weaker VLMs to judge stronger models leads to unreliable evaluations, as the weaker models lack the necessary understanding and critical reasoning abilities.
- We demonstrate that collective thought approaches, which aggregate judgments from multiple VLMs without considering individual reliability, do not necessarily enhance evaluation reliability when unreliable judges are involved.
- We analyze the limitations of collective thought in the context of VLM evaluation and discuss potential strategies to address these challenges, such as selective judge inclusion based on reliability metrics.

Our work offers insights for the design of evaluation frameworks, promoting the development of the more reliable model. By addressing the challenges identified, we could pave the way for improved methodologies that can effectively evaluate VLMs in handling real-world video content.

2 Related Work

Video Language models Video language models (Lin et al., 2023; Li et al., 2023c; Zhang et al., 2023) represent advanced model capable of handling a variety of video understanding tasks, including comprehension and captioning, question-answering. These models process video and textual inputs to generate text-based outputs. Architecturally, Video-LMMs typically integrate pre-trained vision backbones (Radford et al., 2021; Fang et al., 2023; Wang et al., 2022) with large language models (Touvron et al., 2023; Zheng et al., 2023) through connector modules such as MLP adapters, Q-former (Dai et al., 2023), and gated attention mechanisms (Alayrac et al., 2022). Early studies, such as VideoChat (Li et al., 2023b) and VideoChat-GPT (Li et al., 2023c), utilized a two-stage training approach focused on alignment and adherence to video-related instructions. Recently, the development of more advanced VLM has progressed, with some models enhancing architectural frameworks (Li et al., 2023c), expanding to new application areas (Munasinghe et al., 2023), and supporting longer video (Song et al., 2023; Ren et al., 2023).

Model Evaluation VLMs are traditionally evaluated using metrics tailored to each specific task. For example, in image captioning, common metrics include BLEU (Papineni et al., 2002), METEOR (Banerjee & Lavie, 2005), ROUGE (Lin, 2004), and CIDER (Vedantam et al., 2015), which

measure the similarity between generated captions and reference captions. Similarly, Visual Question Answering (VQA) tasks are evaluated using accuracy metrics that directly compare the model's responses to those provided by human annotators (Agrawal et al., 2023; Mañas et al., 2023). However, these traditional metrics often fail to capture the nuanced details and subtleties in the responses produced by models, particularly in complex or subjective cases. In order to achieve a more comprehensive evaluation, human assessments are employed to account for contextual and creative elements that automated metrics might overlook. Nonetheless, the high costs make human evaluations not scalable. Recent studies have developed methods that leverage models to evaluate models. For instance, numerous researches have utilized language models to assess outputs from language models Zhu et al. (2023); Li et al. (2023a); Kocmi & Federmann (2023); Chiang & Lee (2023). With the advancement of multimodal language models, recent studies have focused on using visual language models to evaluate responses from visual language models Kim et al. (2023). Our study is the first systematic work to evaluate VLMs by using VLMs.

Collective Decision-Making Drawing from interdisciplinary theories, our methodology is underpinned by principles from collective intelligence and social psychology. Collective intelligence theory suggests that groups can achieve higher levels of intelligence and problem-solving capability than isolated individuals (Malone et al., 2009). This is complemented by the "Wisdom of Crowds" principle, which argues that diverse groups can make better decisions than even the most capable individuals within them (Surowiecki, 2005). Additionally, social constructionist perspectives provide insights into how collective assessments evolve from the integration of multiple cognitive processes, reflecting broader sociocultural contexts (Burns & Engdahl, 1998). These theories inform our approach to synthesizing assessments from multiple VLM into a comprehensive evaluation.

3 METHODOLOGY

In this section, we begin by detailing the data collection process, where video question-answering pairs are gathered to serve as evaluation inputs for subsequent steps. Following this, we describe our approach for comparing individual reviews generated by VLMs with those produced through multi-LLM Agent-Debates, aiming to assess the reliability of each VLM. Subsequently, we detail our evaluation methodology for VLMs, which employs a structured three-step process. Each phase is designed to evaluate the models' ability to interpret and respond to complex video content, thereby enhancing the reliability of VLMs as evaluative judges.

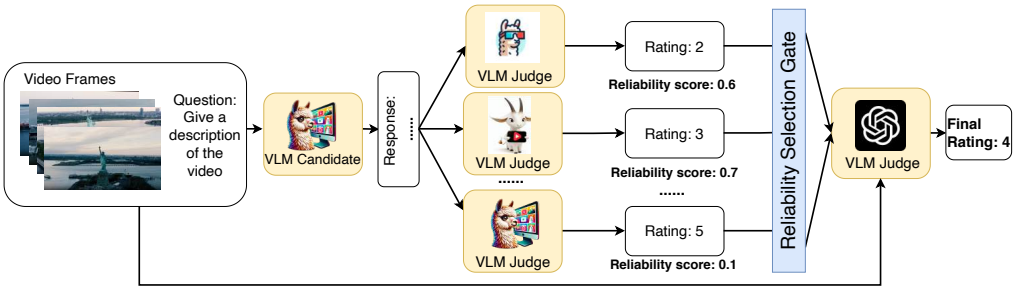

Figure 2: Diagram illustrating the multi-stage evaluation process involving multiple initial reviews and a reliability selection gate in the middle, a final comprehensive review by an advanced model.

3.1 VLM CANDIDATES GENERATE RESPONSE

A video-question pair is defined as (v, t), where v represents a video sequence and t is the corresponding textual instruction or query. There are two phases in the data collection.

Phase 1: Video-question Pair Collection The Complex Video Reasoning and Robustness Evaluation Suite (CVRR-ES) (Khattak et al., 2024) is a dataset that comprehensively assesses VLM across 11 diverse real-world visual dimensions V_d(see Table 2), such as interpretation of social context. From this dataset, we collect a set of video-question pairs $D = \{(v_1, t_1), (v_2, t_2), ..., (v_n, t_n)\}$, where each pair represents a unique video-instruction combination. (see Figure 6 for an example).

Phase 2: VLM Response Generation For each video-question pair (v_i, t_i), we generate responses using a set of VLMs $M = \{M_1, M_2, ..., M_m\}$. The response of model M_j to pair (v_i, t_i) is denoted as r_{ij}. The responses are then collected and cataloged, providing a rich source of data for subsequent analysis. We ensure that each response adheres to our predefined criteria for relevance and completeness, excluding any that do not meet the standards. (see Figure 6 for an example).

3.2 Individual VLM Judge Reviews Candidate Response

Review by individual VLM As shown in Figure 2, we employ a set of VLMs M^J to generate initial reviews $R = \{R_1, R_2, ..., R_q\}$ for each video-question-answer pair r_{ij} from previous section. Each model offers a unique perspective, influenced by its training and inherent capability. These reviews are expected to offer varied interpretations and assessments, reflecting the models' different ways to understand and analyze visual information. (see Figure 6 for an example).

Review by LLM Agents Debate(Reference-guided grading) As shown in Figure 1, we engage a set of LLM agents to conduct discussions and generate initial reviews. The LLM agents receive both the VLM-generated response and reference responses provided by CVRR-ES (Khattak et al., 2024) for consideration. Through multiple rounds of interaction and debate, the LLM agents collaboratively refine their assessments. Ultimately, another LLM agent consolidates the insights and finds a consensus on the rating (see Figure 6 for an example).

Contrasting Reviews from LLM Agent-Debate and VLM We assume that reviews generated through LLM Agent-Debates are the most reliable, as the inclusion of referenced responses enhances the validity of the judgments made during these debates. To evaluate the agreement between LLM debates and VLM-generated reviews, we employ *Weighted Cohen's Kappa* (Cohen, 1960; Artstein & Poesio, 2008), a statistical measure of inter-judge agreement for categorical data. Unlike the unweighted version, which treats all disagreements equally, the weighted variant accounts for the extent of disagreement by assigning different weights to each category. This approach is particularly effective for ordinal categories, as it allows for partial credit in cases of minor disagreements:

$$\kappa = 1 - \frac{\sum_{\alpha,\beta} w_{\alpha\beta} O_{\alpha\beta}}{\sum_{\alpha,\beta} w_{\alpha\beta} E_{\alpha\beta}}$$

where $O_{\alpha\beta}$ is the observed frequency in which judge 1 assigned rating α and judge 2 assigned rating β, $E_{\alpha\beta}$ is the expected frequency for such assignments under the assumption of independent ratings, and $w_{\alpha\beta}$ is the weight assigned to the disagreement between categories α and β, which is typically calculated based on the squared or linear difference between categories. For the weighting function, we employ a quadratic weighting scheme defined as

$$w_{\alpha\beta} = 1 - \left(\frac{\alpha - \beta}{k - 1}\right)^2,$$

where k represents the number of possible ratings, i.e., 5, and α and β are integers between 1 and 5.

3.3 Collective VLM Judge Reviews Candidate Response

The evaluation process with collective thought is designed to harness the collective insights of multiple VLMs, followed by a comprehensive review using a more sophisticated model. This approach is inspired by the "wisdom of crowds" concept in collective intelligence, aiming to harness the diverse strengths of various models to achieve a more accurate and nuanced assessment. By pooling the insights from different models, we leverage a form of crowdsourced thought to enhance decision-making precision in evaluating video content.

Collective Thought Judge We utilize an advanced model, M_a, which takes the video question-answering content and corresponding reviews from VLMs to generate a final assessment A:

$$A = M_a(r_{i,j}, R_1, R_2, \ldots, R_q)$$

Figure 2 shows the overall pipeline. After collecting the initial reviews, the advanced video language model aggregates these reviews along with the video question-answering data to produce a

consolidated final assessment. This model is designed to process and integrate multiple sources of information, enabling it to evaluate the initial reviews and determine the most accurate and coherent response. The advanced judge considers the video-question-answering pair along with the initial judge's evaluations as references. Using all the available information, the advanced judge provides a final review, potentially reducing individual biases and improving the overall quality of the judgment. Notably, the adavanced judge employed in this process is GPT-4o, which achieved the highest agreement with the LLM Agent-Debate.

Mixture of Judges To further enhance the accuracy of the evaluation process, as shown reliability selection gate in Figure 2, we implement a *Mixture of Judges* strategy that leverages *Weighted Cohen's Kappa* to select the most reliable subset of VLMs $M^{J'} \subseteq M^J$ for each visual dimension V_d. The *Weighted Cohen's Kappa* quantifies the agreement between model M_e and the LLM Agent-Debate within the visual dimension V_d. The reliability scores $\kappa_{d,e}$ reflect the consistency with which each model aligns with the LLM debate within the given visual dimension.

For each visual dimension V_d, we select the subset $M^{J'}$ of models M_e where $\kappa_{d,e}$ exceeds a predefined threshold θ:

$$M^{J'} = \{M_e \mid \kappa_{d,e} \geq \theta\}$$

Alternatively, we may select the top k models with the highest reliability scores for each visual dimension V_d:

$$M^{J'} = \{M_e \mid \kappa_{d,e} \text{ is among the top } k \text{ scores for visual dimension } V_d\}$$

By dynamically selecting models based on their reliability scores at the visual dimension level, we ensure that only the most reliable and consistent models contribute to the final assessment.

4 Experimental Setup

This section details the experimental setups used to evaluate the performance of VLMs judge. We adopt an "Analyze-then-Judge" framework tailored to the video domain, where evaluators first examine the video content and then provide their assessments.

4.1 Model

Candidates	Video-LLaVA, LLaMA-VID, GPT-4o mini, Video-ChatGPT, mPLUG-Owl-Video
Judges (VLM)	Video-LLaVA, LLaMA-VID, GPT-4o mini, InternVL2, GPT-4o
Judges (LLM)	GPT-3.5, Agents-Debate (GPT-4o text input only, GPT-3.5)
Final Judge	GPT-4o

Table 1: List of candidate and judge models

Table 1 lists the candidate models and judges employed in our study. We deploy several advanced VLMs to assess their judging capabilities. During the data collection phase, the candidate models—Video-LLaVA, LLaMA-VID, GPT-4o mini, Video-ChatGPT, and mPLUG-Owl-Video—are utilized to generate video question-answer pairs denoted as r_{ij}.

In the subsequent evaluation stage, we employ both VLMs and LLMs as judges. The LLM GPT-3.5 has no access to the video content, but was provided with reference answers. For LLM debates, we utilize GPT-3.5 and GPT-4o models without visual input. They are also provided with reference answers and engage in debates to assess the video-question-answering pair. For VLM judging, we select advanced models as listed under the Judges (VLM) category in Table 1. We then compare the review results obtained from individual VLMs with those derived from LLM or LLM debates to evaluate consistency and reliability. In the final stage, the advanced model GPT-4o review the video-question-answer pairs r_{ij} along with the reviews from the VLMs to produce a consolidated final assessment.

4.2 DATASET

The CVRR-ES (Khattak et al., 2024) dataset encompasses a variety of visual dimensions V_d that cover diverse video categories pertinent to real-world scenarios. These visual dimensions range from context-dependent areas, such as social and emotional contexts, to video types commonly encountered, including unusual activities (Khattak et al., 2024). The dataset comprises 2,400 high-quality open-ended question-answer (QA) pairs derived from 217 meticulously curated videos. The videos have an average duration of 22.3 seconds, with lengths varying from a minimum of 2 seconds to a maximum of 183 seconds (Khattak et al., 2024). Some samples of this dataset are listed in Table 3.

4.3 JUDGMENT CRITERIA AND METRICS

The judgments of VLMs is conducted through a **Scoring Evaluation** approach. Each judgment for a video-question-answering pair is assigned a score that reflects its accuracy and relevance. In our experiments, models are required to provide a rating on a scale from 1 to 5, where 1 represents the poorest performance and 5 indicates perfect accuracy. For additional metrics, such as Pair Comparison, we can simply utilize the scores from the Scoring Evaluation. For example, when performing a pairwise comparison between two models, the model with the higher rating score is deemed superior.

5 EXPERIMENTAL RESULTS

5.1 INDIVIDUAL VLM JUDGE REVIEWS CANDIDATE RESPONSE

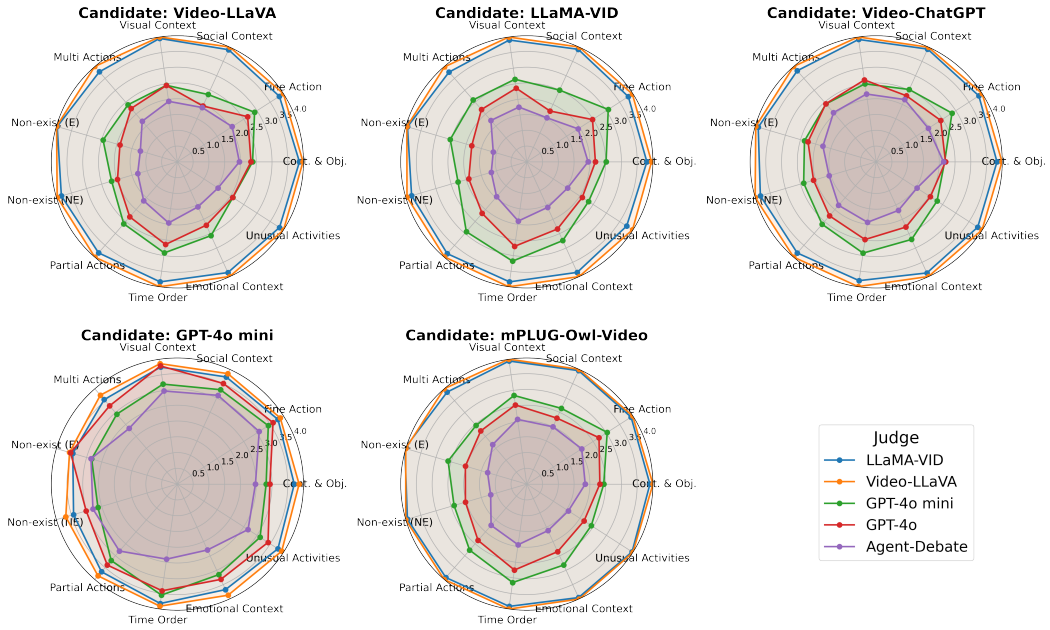

Figure 3: Score of candidates given by judges on various visual dimensions.

Figure 3 and Table 4 presents the evaluation scores assigned by different judge models to the candidate VLMs across various visual dimensions(see Table 2). Analyzing the results, we observe that some VLMs consistently assign high scores to the candidate models across all visual dimensions. For instance, when judged by Video-LLaVA, the candidate models receive scores close to 4.00 across nearly all dimensions. Similarly, LLaMA-VID as a judge also assigns high scores, typically above 3.70. This trend suggests that some VLMs tend to evaluate candidate models favorably.

In contrast, the LLM judges and the Agent-Debate method assign significantly lower scores. The Agent-Debate method, which involves multiple LLM agents engaging in discussion and reaching

a consensus, consistently gives the lowest scores among all judges. For example, in the case of LLaMA-VID as the candidate model, the Agent-Debate scores range from 1.46 to 1.94 across different dimensions. This suggests that LLM agents provide a more critical assessment than VLM judges.

The disparity between the VLM and LLM judges highlights potential reliability issues with VLMs as judges. VLMs may be prone to overestimating the performance of candidate models due to their incapability to understand the content or inherent bias. Some output samples from various VLM judges can be found in Appendix A. This overestimation can lead to inflated scores that do not accurately reflect the true capabilities of the candidate models. On the other hand, the Agent-Debate method appears to provide a more stringent and possibly more accurate evaluation. By engaging multiple LLM agents in a debate with referenced answer provided and reaching a consensus, this method reduces individual biases. However, the reference answers are required for LLM Agent-Debate method.

Additionally, certain visual dimensions consistently receive lower scores across all judges. For example, the dimensions of Non-exist (E) and Non-exist (NE) often have lower scores, indicating that candidate models struggle with detecting non-existent entities or events in video content. This highlights specific areas where VLMs require improvement to handle complex video understanding tasks effectively.

Among the various VLMs, GPT-4o and the Agent-Debate method have the most similar evaluation patterns. They assign consistently lower scores to candidate models across most visual dimensions, reflecting a more stringent and critical assessment. For instance, when evaluating the LLaMA-VID candidate model, GPT-4o assigns scores ranging from 1.77 to 2.48, and Agent-Debate assigns scores from 1.11 to 1.94. This similarity suggests that GPT-4o and the Agent-Debate method exhibit similar levels of rigor in assessing the performance of candidate models, potentially offering more reliable and unbiased evaluations compared to other judge models.

Besides, the left chart in Figure 4 illustrates the statistics of ratings from all judges. Video-LLaVA and LLaMA-VID show a significant concentration of ratings at 4. In contrast, GPT-4o and Agent-debate have higher counts at lower ratings. InternVL2 and GPT-4o mini display a more balanced distribution across ratings.

5.2 Contrasting Reviews from VLM and LLM Agent-Debate

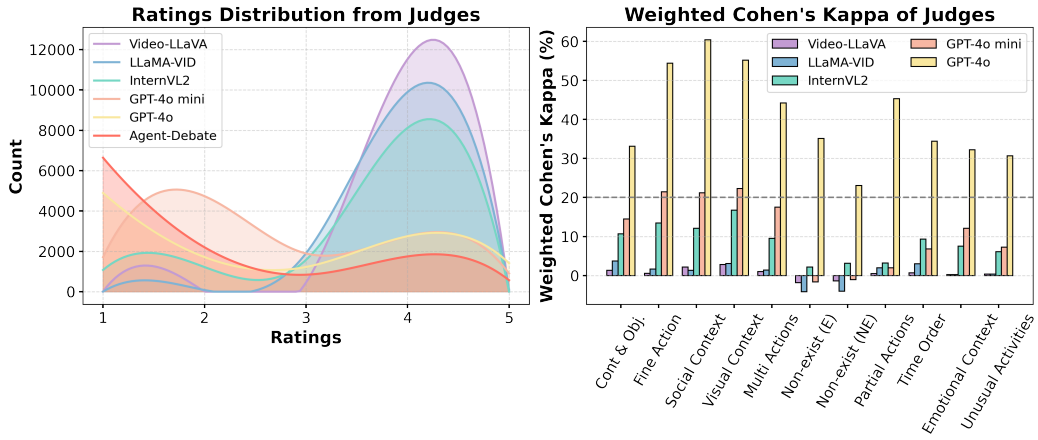

Figure 4: Left: Ratings Distributions. Right: *Weighted Cohen's Kappa* of Judges.

The right chart in Figure 4 and Table 5 display the average agreement scores in percentage between various VLMs and the Agent-Debate method across visual dimensions. The agreement is quantified using the *Weighted Cohen's Kappa* (Cohen, 1960; Artstein & Poesio, 2008), where higher values indicate greater agreement. It is generally accepted that values less than or close to 0 indicate no agreement, while values between 0 and 0.20 are considered to represent slight agreement, 0.21–0.40 as fair agreement, 0.41–0.60 as moderate agreement, 0.61–0.80 as substantial agreement, and 0.81–1.00 as indicating almost perfect agreement (Cohen, 1960; Artstein & Poesio, 2008).

From the chart, we observe that VLMs such as Video-LLaVA and LLaMA-VID have relatively low agreement scores with the Agent-Debate method, often including negative values. For instance, Video-LLaVA shows agreement scores ranging from -1.83 to 2.81, and LLaMA-VID ranges from -4.15 to 3.70. In contrast, InternVL2, GPT-4o mini and particularly GPT-4o exhibit significantly higher agreement scores, indicating substantial agreement with the Agent-Debate evaluations. GPT-4o, for example, shows agreement scores exceeding 50 in several dimensions, such as 60.38 for Social Context and 55.18 for Visual Context. More details are elaborated in Table 5.

The results suggest that **GPT-4o is more aligned with the Agent-Debate evaluations, potentially due to their multimodal capabilities allowing better understanding of video content**. On the other hand, the significant disagreement for other VLMs, such as Video-LLaMA, raises concerns about the reliability of using them as judges, possibly due to incapability to understand the content. The Agent-Debate method with referenced response provided, involving multiple LLM agents engaging in discussion and reaching a consensus, appears to provide a more reliable evaluation by mitigating individual misjudgment. The collaborative nature of the Agent-Debate reduces the impact of any single agent's misjudgment.

5.3 COLLECTIVE VLM JUDGE REVIEWS CANDIDATE RESPONSE

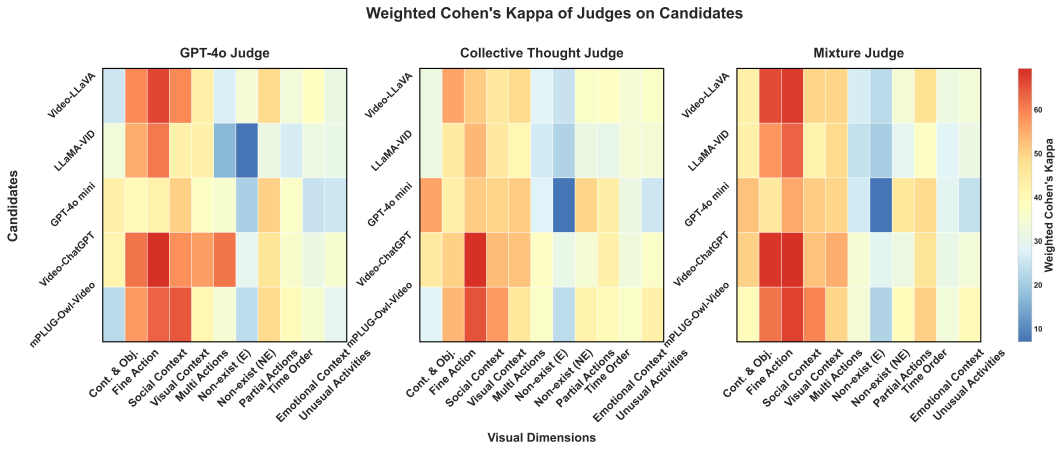

Figure 5: Left: *Weighted Cohen's Kappa* of GPT-4o judge across various candidate models; Middle: *Weighted Cohen's Kappa* of Collective thought judge across various candidate models; Right: *Weighted Cohen's Kappa* of Mixture judge across various candidate models

Collective Thought Judge The middle chart in Figure 5 and Table 6 present the agreement scores between the collective evaluations of all judges and the Agent-Debate method across various visual dimensions. The judges encompass both reliable models (high agreement score) and models with known reliability issues (low agreement score). The initial judges include LLaMA-VID, Video-ChatGPT, Video-LLaVA, GPT-4o mini. The final judge is GPT-4o.

From the data, it is evident that **including both more reliable and less reliable judges in the collective reviewing process does not enhance the reliability of the ratings**. The average agreement scores with the Agent-Debate method remain moderate to low, and in some cases, the agreement is lower than using only GPT-4o as judge. For instance, under the collective evaluation, the average agreement scores across dimensions range from 2.72 to 42.53, with the highest scores observed in dimensions like Social Context and Visual Context as shown in Table 6. These scores are lower than those scores achieved by individual GPT-4o judges. The inclusion of less reliable judges introduces noise and biases into the collective assessment. As a result, the collective ratings do not align closely with the base line established by the Agent-Debate. This phenomenon highlights the challenges of aggregating evaluations from heterogeneous judges without proper weighting or selection mechanisms.

These findings indicate that **unreliable models can adversely affect the outcomes of ensemble methods**. In the context of VLM evaluation, where hallucinations and biases are prevalentTong et al. (2024), the negative impact is pronounced.

Mixture of Judge The right chart in Figure 5 and Table 7 illustrate the agreement scores when employing a mixture of judges, selected based on their visual dimension level reliability scores (*Weighted Cohen's Kappa*). The selection of judges is dynamic, as outlined in section 3.3. For instance, for the fine action visual dimension, the selected judges include InternVL2, GPT-4o mini, with GPT-4o serving as the final judge. The goal of this strategy is to enhance evaluation reliability by including only the most reliable judges for each visual dimension.

Despite this selective approach, the results indicate that **the mixture of judges does not substantially improve the agreement with the Agent-Debate method**. The average agreement scores are comparable to those observed in the collective thought approach with all judges, and no significant enhancement is observed. For example, the average agreement scores range from 2.72% to 60.70% across different dimensions. Even though the judges were selected for higher reliability in specific categories, overall improvement in evaluation accuracy lower than the score achieved by GPT-4o.

One reason could be that **the reliability scores used for judge selection may not fully capture the judges' ability to evaluate complex video content**. As a result, the selected judges might still exhibit biases or hallucinations. These findings suggest that simply selecting judges based on past performance metrics does not guarantee improved evaluation outcomes. The intricacies of multimodal evaluation require more advanced methods that can effectively integrate judgments while mitigating individual model misjudgment.

6 DISCUSSION

Reliability of Indivisual VLMs as Judges Our results indicate that VLMs, including Video-LLaVA, are always overestimating the scores of candidate models. **The reason for such overestimation may be due to their inability to comprehend content or inherent biases in the training data. For example, if the data is representative of more positive feedback, then the model would be naturally prone to giving higher ratings.** GPT-4o is the only VLM that exhibits significant agreement with the Agent-Debate method and can be considered more reliable as a judge.

We compared the judges' *Weighted Cohen's Kappa* scores with performance scores from (Khattak et al., 2024) and observed a consistent trend: the better the judges performed on the benchmark, the higher their *Weighted Cohen's Kappa*. This finding suggests that a judge can be reliable only if it demonstrates a strong understanding of the content itself. To improve reliability, we fine-tuned the underperformed VLM model Video-LLaVA. As shown in Figure 14, despite fine-tuning, Video-LLaVA's rating distribution remained skewed towards higher ratings, and its *Weighted Cohen's Kappa*, reliability as a judge, improved only slightly. The agreement scores with the benchmark did not approach those of GPT-4o. These findings indicate that simply improving a model's comprehension ability is insufficient to enhance its reliability as a judge. Figure 15 illustrates that **a reliable judge must possess both strong comprehension skills and specific capabilities in assessment and critical analysis**.

Weak to Strong Evaluation The results in Table 4 and Table 5 indicate that the weaker VLMs, such as Video-LLaVA,judging stronger models, such as GPT-4o mini, result in unreliable evaluations since these weaker models lack the requisite understanding and critical reasoning abilities. This accords with recent research into weak-to-strong generalization in language models, which proves that if one naively fine-tunes strong models with labels from weaker supervisors, not all of the capabilities of the stronger models are being tapped into (Burns et al., 2023). Equally important is our finding that **much stronger models cannot be reliably evaluated by weak VLMs alone**. This calls for the development of more sophisticated method for evaluation that to ensure the reliable alignment and performance in such advanced VLMs.

Limitations of Collective Thought Approaches Our experiments with collective thought approaches did not yield significant improvements in evaluation reliability. The inclusion of both reliable and unreliable judges introduced noise. Even when selecting judges based on reliability scores, the mixture of judges did not substantially enhance agreement with the Agent-Debate method. Notably, we found that GPT-4o, when used as a sole judge, outperformed its performance when paired with a group of less reliable judges. This indicates that GPT-4o is affected by the presence of incorrect or unreliable opinions within the collective, highlighting its vulnerability to noise introduced by less reliable judges.

Implications and Future Work The results underscore the importance of employing reliable and robust evaluation frameworks for VLMs. Relying solely on individual VLMs for evaluation is inadequate due to their incapability in content understanding or critical analysis. The Agent-Debate method, leveraging collaborative reasoning among multiple agents, provides a more accurate assessment of VLM performance. In future work, we will study the effectiveness of an iterative collective thought approach, exploring how multi-round discussions among VLM agents can further enhance evaluation reliability and mitigate the limitations observed with current aggregation method.

7 Conclusion and Limitations

In this paper, we conducted a comprehensive evaluation of Video Language Models using a multi-stage methodology that included individual assessments by VLMs and a collaborative Agent-Debate approach. Our study aimed to determine the most reliable model for evaluating VLMs on complex video understanding tasks.

Our findings highlight several key insights:

- **Reliability of VLMs as Judges:** Some VLM judges tend to overestimate the performance of candidate VLMs, likely due to their inherent bias or incapability in understanding content. GPT-4o is the only model that exhibits significant reliability as judge.
- **Towards Improving VLM Reliability as Judge:** A reliable judge must possess not only strong comprehension skills but also advanced capabilities in assessment and critical analysis. To improve reliability, we can incorporate specialized training to improve both understanding and evaluation skills and to reduce biases and hallucinations.
- **Limitations of Collective Thought Approaches:** Collective evaluation methods that aggregate judgments from both reliable and unreliable models do not necessarily enhance evaluation accuracy. The inclusion of less reliable judges introduces noise and biases, diminishing the overall reliability of the assessment. Even when employing a mixture of judges selected based on reliability scores, significant improvements were not observed.

While our study provides valuable insights, several limitations should be acknowledged:

- **Dependence on Specific Datasets and Models:** Due to limited resources, our experiments are based on the CVRR-ES (Khattak et al., 2024) dataset and a selected set of VLMs and LLMs. The generalizability of our findings to other datasets and models may be limited.
- **Scope of Evaluation Methods:** We focused on the Agent-Debate method and collective thought approaches involving VLMs and LLMs. Other evaluation strategies, such as human expert assessments or alternative ensemble methods, were not explored in this study.
- **Quantitative Metrics:** The reliance on agreement scores *Weighted Cohen's Kappa* provides a quantitative measure of the agreement but may not entirely capture the qualitative aspects of model evaluations. Subtle nuances in judgments might not be reflected in these metrics.
- **Computational Resources and Costs:** The use of advanced models such as GPT-4o incurs significant computational costs. This may limit the practicality of deploying such evaluation methods at scale or in resource-constrained environments.

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APPENDIX

- Qualitative Samples
- Dataset Details
- Details on Ratings
- Details on Agreement
- Compare GPT-4o, collective thought, mixture judge
- Ablation Study on finetuning Video-LLaVA

A SAMPLES

Reference: "A man in a suit appears to fall backward, but not moving. Spectators watch, and a woman drops money in his hat. When he stands up, revealing the box that helped him stay in that position, he smiles, picks it up, and walks away. The video showcases a clever street performance using optical illusion."

Question: What is happening in the video?

Candidate \ Judge	video_llava	llama_vid	internvl2	gpt4o-mini	gpt4o	GPT3.5	LLM Agent Debate
mplug_owl_Video: *The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.*	4	4	4	4	2	2	1
llama_vid: *In the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.*	4	4	4	3	3	1	1
video_chatgpt: *In the video, a man is seen performing a trick on a skateboard, possibly in a public area. He is seen jumping over a person and a dog, and he is also seen jumping over a person and a car. The video ends with the man jumping over a person and a dog on a skateboard.*	4	3	1	1	1	1	1
video_llava: *In the video, a man is seen walking down the street while holding an umbrella.*	4	3	3	2	2	1	1
gpt4o-mini: *In the video, a man dressed in a suit is humorously attempting to balance while holding a red umbrella and a folder. He appears to be slipping or losing his balance, creating a comedic effect. As he struggles, a woman runs in to help him, and the scene continues with various people walking by, adding to the lively atmosphere. Eventually, he regains .....*	4	4	4	4	4	2	2

Figure 6: An example from the CVRR dataset, with candidate responses and corresponding ratings from the judges. Due to space constraints, only the rating numbers are displayed. In our setup, each judge provides both reasoning and a rating number. We have limited the selection of judges to the models listed, as other models demonstrate poor instruction-following abilities and tend to only provide a rating number.

Reference: "A man in a suit appears to fall backward, but not moving. Spectators watch, and a woman drops money in his hat. When he stands up, revealing the box that helped him stay in that position, he smiles, picks it up, and walks away. The video showcases a clever street performance using optical illusion."

"Please serve as an unbiased judge in assessing the quality of the responses from AI assistants regarding the user's instruction and a video. \nEvaluation Method:\n\nYou will receive a single response from the AI assistant to user's instruction. Use scores to show the quality of the response. Here is the detailed scoring rubric for evaluating the quality of responses from AI assistants:\nPoor (1): The response significantly deviates from the user's instruction and fails to address the query effectively. It shows a lack of relevance, accuracy, and comprehensiveness. Creativity and granularity are absent or poorly executed.\nFair (2): The response addresses the user's instruction partially, with evident shortcomings in relevance, accuracy, or comprehensiveness. It lacks depth in creativity and granularity, indicating a superficial understanding of the user's inquiry.\nAverage (3): The response adequately addresses the user's instruction, showing a fair level of relevance, accuracy, and comprehensiveness. It reflects a basic level of creativity and granularity but may lack sophistication or depth in fully capturing the user's inquiry.\nGood (4): The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.\nExcellent (5): The response perfectly adheres to the user's instruction, excelling in relevance, accuracy, comprehensiveness, creativity, and granularity. It provides an insightful, detailed, and thorough answer, indicating a deep and nuanced understanding of the user's inquiry.\n\nUse \"[[1]]\", \"[[2]]\", \"[[3]]\", \"[[4]]\", \"[[5]]\" to indicate your evaluate score in the key 'Judgement'.\n\nHere is the input:\n\n[The Start of User Instruction]\nWhat is happening in the video?\n[The End of User Instruction]\n

[The Start of Assistant's Answer]\n
The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.\n
[The End of Assistant's Answer]

\nRatings from other judges may be used as additional information:\n
[The Start of Judge A's rating]\n```json\n{\n \"rating\": \"[[4]]\",\n \"reason\": \"The response effectively describes the main action in the video, highlighting the man's unique dance routine and his balance on the umbrella. It is relevant and accurate, providing a good level of detail. However, it could benefit from additional context or description of the environment or audience reactions to enhance comprehensiveness.\"\n}\n```\n
[The End of Judge A's rating]\n

[The Start of Judge B's rating]\n{{'rating': '4', 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}\n
[The End of Judge B's rating]\n

[The Start of Judge C's rating]\n{{'rating': 4, 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}\n
[The End of Judge C's rating]\n\n

Your reply should be in JSON format: {{'rating': 'your rating number', 'reason': 'your reasoning'}}'"

Candidate \ Judge	collective
mplug_owl_Video: *The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.*	**"```json\n{\n \"rating\": \"4\",\n \"reason\": \"The response effectively describes the main action in the video, highlighting the man's unique dance routine and his balance on the umbrella. It is relevant and accurate, providing a good level of detail. However, it could benefit from additional context or description of the environment or audience reactions to enhance comprehensiveness.\"\n}\n```"**
llama_vid: *In the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.*	**"{{'rating': '3', 'reason': 'The response adequately describes the main action in the video, mentioning the man dancing and interacting with people while spinning an umbrella. However, it lacks detail about the context, emotions, or any specific interactions that could enhance the understanding of the scene. The description could benefit from more granularity and creativity to fully capture the essence of the video.'}}"**
video_chatgpt: *In the video, a man is seen performing a trick on a skateboard, possibly in a public area. He is seen jumping over a person and a dog, and he is also seen jumping over a person and a car. The video ends with the man jumping over a person and a dog on a skateboard.*	**"```json\n{\n \"rating\": \"1\",\n \"reason\": \"The response does not accurately describe the content of the video. It mentions a man performing tricks on a skateboard, which is not relevant to the video shown. The video features a man in a suit with an umbrella, not a skateboard, and the actions described do not match what is happening in the video. Overall, the response lacks relevance, accuracy, and comprehensiveness.\"\n}\n```"**
video_llava: *In the video, a man is seen walking down the street while holding an umbrella.*	**"{{'rating': '2', 'reason': 'The response partially addresses the user\\'s instruction by mentioning a man with an umbrella, but it lacks detail and context about the situation in the video. It does not capture the dynamic action or the humorous elements present, which are crucial for a comprehensive understanding of what is happening.'}}"**
gpt4o-mini: *In the video, a man dressed in a suit is humorously attempting to balance while holding a red umbrella and a folder. He appears to be slipping or losing his balance, creating a comedic effect. As he struggles, a woman runs in to help him, and the scene continues with various people walking by, adding to the lively atmosphere. Eventually, he regains .....*	**"{{'rating': '4', 'reason': 'The response effectively captures the main actions and the humorous nature of the video. It accurately describes the man struggling to balance with the red umbrella and folder, and the involvement of a woman who helps him. The description of the lively atmosphere and the man regaining his composure adds to the context. However, the response could be improved with more details about the setting and the reactions of the bystanders to provide a more comprehensive and nuanced understanding of the scene.'}}"**

Figure 7: An example from the CVRR dataset, with candidate responses and corresponding ratings from the collective judges.

Reference: "A man in a suit appears to fall backward, but not moving. Spectators watch, and a woman drops money in his hat. When he stands up, revealing the box that helped him stay in that position, he smiles, picks it up, and walks away. The video showcases a clever street performance using optical illusion."

"Please serve as an unbiased judge in assessing the quality of the responses from AI assistants regarding the user's instruction and a video. \nEvaluation Method:\n\nYou will receive a single response from the AI assistant to user's instruction. Use scores to show the quality of the response. Here is the detailed scoring rubric for evaluating the quality of responses from AI assistants:\nPoor (1): The response significantly deviates from the user's instruction and fails to address the query effectively. It shows a lack of relevance, accuracy, and comprehensiveness. Creativity and granularity are absent or poorly executed.\nFair (2): The response addresses the user's instruction partially, with evident shortcomings in relevance, accuracy, or comprehensiveness. It lacks depth in creativity and granularity, indicating a superficial understanding of the user's inquiry.\nAverage (3): The response adequately addresses the user's instruction, showing a fair level of relevance, accuracy, and comprehensiveness. It reflects a basic level of creativity and granularity but may lack sophistication or depth in fully capturing the user's inquiry.\nGood (4): The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.\nExcellent (5): The response perfectly adheres to the user's instruction, excelling in relevance, accuracy, comprehensiveness, creativity, and granularity. It provides an insightful, detailed, and thorough answer, indicating a deep and nuanced understanding of the user's inquiry.\n\nUse \"[[1]]\", \"[[2]]\", \"[[3]]\", \"[[4]]\", \"[[5]]\" to indicate your evaluate score in the key 'Judgement'.\n\nHere is the input:\n\n[The Start of User Instruction]\nWhat is happening in the video?\n[The End of User Instruction]\n

[The Start of Assistant's Answer]\n
The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.\n
[The End of Assistant's Answer]

\nRatings from other judges may be used as additional information:\n
[The Start of Judge A's rating]\n{{'rating': '3', 'reason': 'The response adequately addresses the user\\'s instruction by describing the main action in the video, which is a man dancing and spinning an umbrella. However, it lacks depth and detail, such as the man\\'s unique pose and the interaction with the environment, which would have provided a more comprehensive and nuanced understanding of the video.'}}\n
[The End of Judge A's rating]

Your reply should be in JSON format: {{'rating': 'your rating number', 'reason': 'your reasoning'}}'"

Candidate \ Judge	collective
mplug_owl_Video: *The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.*	**"{{'rating': '2', 'reason': 'The response partially addresses the user\\'s instruction by mentioning a man performing a unique dance routine. However, it inaccurately describes the man as dancing on a spinning, upside-down, red umbrella, which is not evident in the video. The response lacks depth and granularity, failing to capture the full context and details of the scene.'}}"**
llama_vid: *In the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.*	**"```json\n{\n \"rating\": \"3\",\n \"reason\": \"The response adequately addresses the user's instruction by describing the main action in the video, which is a man dancing and spinning an umbrella. However, it lacks depth and detail, such as the man's unique pose and the interaction with the environment, which would have provided a more comprehensive and nuanced understanding of the video.\"\n}\n```"**
video_chatgpt: *In the video, a man is seen performing a trick on a skateboard, possibly in a public area. He is seen jumping over a person and a dog, and he is also seen jumping over a person and a car. The video ends with the man jumping over a person and a dog on a skateboard.*	**"{{'rating': '1', 'reason': 'The response significantly deviates from the user\\'s instruction. The video does not show a man performing a trick on a skateboard or jumping over a person, dog, or car. Instead, it shows a man seemingly floating in mid-air while holding an umbrella and a book, which is not mentioned at all in the response. The response lacks relevance, accuracy, and comprehensiveness.'}}"**
video_llava: *In the video, a man is seen walking down the street while holding an umbrella.*	**"```json\n{\n \"rating\": \"2\",\n \"reason\": \"The response partially addresses the user's instruction by mentioning a man holding an umbrella. However, it lacks accuracy and comprehensiveness as it fails to describe the unusual and notable aspect of the video, which is the man appearing to float or levitate in the air. The response lacks depth and does not capture the unique and creative element of the video.\"\n}\n```"**
gpt4o-mini: *In the video, a man dressed in a suit is humorously attempting to balance while holding a red umbrella and a folder. He appears to be slipping or losing his balance, creating a comedic effect. As he struggles, a woman runs in to help him, and the scene continues with various people walking by, adding to the lively atmosphere. Eventually, he regains .....*	**"```json\n{\n \"rating\": \"4\",\n \"reason\": \"The response is well-aligned with the user's instruction, providing a detailed and accurate description of the video. It captures the main events and the comedic nature of the scene. However, it could have included more specific details about the actions and interactions to achieve a perfect score.\"\n}\n```"**

Figure 8: An example from the CVRR dataset, with candidate responses and corresponding ratings from the mixed judges.

Reference: "A man in a suit appears to fall backward, but not moving. Spectators watch, and a woman drops money in his hat. When he stands up, revealing the box that helped him stay in that position, he smiles, picks it up, and walks away. The video showcases a clever street performance using optical illusion."

"Please serve as an unbiased judge in assessing the quality of the responses from AI assistants regarding the user's instruction and a video. \nEvaluation Method:\n\nYou will receive a single response from the AI assistant to user's instruction. Use scores to show the quality of the response. Here is the detailed scoring rubric for evaluating the quality of responses from AI assistants:\nPoor (1): The response significantly deviates from the user's instruction and fails to address the query effectively. It shows a lack of relevance, accuracy, and comprehensiveness. Creativity and granularity are absent or poorly executed.\nFair (2): The response addresses the user's instruction partially, with evident shortcomings in relevance, accuracy, or comprehensiveness. It lacks depth in creativity and granularity, indicating a superficial understanding of the user's inquiry.\nAverage (3): The response adequately addresses the user's instruction, showing a fair level of relevance, accuracy, and comprehensiveness. It reflects a basic level of creativity and granularity but may lack sophistication or depth in fully capturing the user's inquiry.\nGood (4): The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.\nExcellent (5): The response perfectly adheres to the user's instruction, excelling in relevance, accuracy, comprehensiveness, creativity, and granularity. It provides an insightful, detailed, and thorough answer, indicating a deep and nuanced understanding of the user's inquiry.\n\nUse \"[[1]]\", \"[[2]]\", \"[[3]]\", \"[[4]]\", \"[[5]]\" to indicate your evaluate score in the key 'Judgement'.\n\nHere is the input:\n\n[The Start of User Instruction]\nWhat is happening in the video?\n[The End of User Instruction]\n[The Start of Assistant's Answer]\nIn the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.\n[The End of Assistant's Answer]\nYour reply should be in JSON format: {{'rating': 'your rating number', 'reason': 'your reasoning'}}"

Candidate \ Judge	gpt4o
mplug_owl_Video: *The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.*	**"{{'rating': '2', 'reason': 'The response partially addresses the user\\'s instruction by mentioning a man performing a unique dance routine. However, it inaccurately describes the man as dancing on a spinning, upside-down, red umbrella, which is not evident in the video. The response lacks depth and granularity, failing to capture the full context and details of the scene.'}}",**
llama_vid: *In the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.*	**"{{'rating': '3', 'reason': 'The response adequately addresses the user\\'s instruction by describing the main action in the video, which is a man dancing and spinning an umbrella. However, it lacks depth and detail, such as the man\\'s unique pose and the interaction with the environment, which would have provided a more comprehensive and nuanced understanding of the video.'}}",**
video_chatgpt: *In the video, a man is seen performing a trick on a skateboard, possibly in a public area. He is seen jumping over a person and a dog, and he is also seen jumping over a person and a car. The video ends with the man jumping over a person and a dog on a skateboard.*	**"{{'rating': '1', 'reason': 'The response significantly deviates from the user\\'s instruction. The video does not show a man performing a trick on a skateboard or jumping over a person, dog, or car. Instead, it shows a man seemingly floating in mid-air while holding an umbrella and a book, which is not mentioned at all in the response. The response lacks relevance, accuracy, and comprehensiveness.'}}",**
video_llava: *In the video, a man is seen walking down the street while holding an umbrella.*	**"{\n \"rating\": \"2\",\n \"reason\": \"The response partially addresses the user's instruction by mentioning a man holding an umbrella. However, it lacks accuracy and comprehensiveness as it fails to describe the unusual and notable aspect of the video, which is the man appearing to float or levitate in the air. The response lacks depth and does not capture the unique and creative element of the video.\"\n}",**
gpt4o-mini: *In the video, a man dressed in a suit is humorously attempting to balance while holding a red umbrella and a folder. He appears to be slipping or losing his balance, creating a comedic effect. As he struggles, a woman runs in to help him, and the scene continues with various people walking by, adding to the lively atmosphere. Eventually, he regains .....*	**"{{'rating': '4', 'reason': 'The response is well-aligned with the user\\'s instruction, providing a detailed and accurate description of the video. It captures the main events and the comedic nature of the scene. However, it could have included more specific details about the actions and interactions to achieve a perfect score.'}}"**

Figure 9: An example from the CVRR dataset, with candidate responses and corresponding ratings from the GPT-4o judges.

Reference: "A man in a suit appears to fall backward, but not moving. Spectators watch, and a woman drops money in his hat. When he stands up, revealing the box that helped him stay in that position, he smiles, picks it up, and walks away. The video showcases a clever street performance using optical illusion."

"Please serve as an unbiased judge in assessing the quality of the responses from AI assistants regarding the user's instruction and a video. \nEvaluation Method:\n\nYou will receive a single response from the AI assistant to user's instruction. Use scores to show the quality of the response. Here is the detailed scoring rubric for evaluating the quality of responses from AI assistants:\nPoor (1): The response significantly deviates from the user's instruction and fails to address the query effectively. It shows a lack of relevance, accuracy, and comprehensiveness. Creativity and granularity are absent or poorly executed.\nFair (2): The response addresses the user's instruction partially, with evident shortcomings in relevance, accuracy, or comprehensiveness. It lacks depth in creativity and granularity, indicating a superficial understanding of the user's inquiry.\nAverage (3): The response adequately addresses the user's instruction, showing a fair level of relevance, accuracy, and comprehensiveness. It reflects a basic level of creativity and granularity but may lack sophistication or depth in fully capturing the user's inquiry.\nGood (4): The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.\nExcellent (5): The response perfectly adheres to the user's instruction, excelling in relevance, accuracy, comprehensiveness, creativity, and granularity. It provides an insightful, detailed, and thorough answer, indicating a deep and nuanced understanding of the user's inquiry.\n\nUse \"[[1]]\", \"[[2]]\", \"[[3]]\", \"[[4]]\", \"[[5]]\" to indicate your evaluate score in the key 'Judgement'.\n\nHere is the input:\n\n[The Start of User Instruction]\nWhat is happening in the video?\n[The End of User Instruction]\n[The Start of Assistant's Answer]\nIn the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.\n[The End of Assistant's Answer]\nYour reply should be in JSON format: {{'rating': 'your rating number', 'reason': 'your reasoning'}}"

Candidate \ Judge	gpt4o-mini
mplug_owl_Video: *The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.*	**"```json\n{\n \"rating\": \"[[4]]\",\n \"reason\": \"The response effectively describes the main action in the video, highlighting the man's unique dance routine and his balance on the umbrella. It is relevant and accurate, providing a good level of detail. However, it could benefit from additional context or description of the environment or audience reactions to enhance comprehensiveness.\"\n}\n```",**
llama_vid: *In the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.*	**"```json\n{\n \"rating\": \"[[3]]\",\n \"reason\": \"The response adequately describes the main action in the video, mentioning the man dancing and interacting with people while spinning an umbrella. However, it lacks detail about the context, emotions, or any specific interactions that could enhance the understanding of the scene. The description could benefit from more granularity and creativity to fully capture the essence of the video.\"\n}\n```",**
video_chatgpt: *In the video, a man is seen performing a trick on a skateboard, possibly in a public area. He is seen jumping over a person and a dog, and he is also seen jumping over a person and a car. The video ends with the man jumping over a person and a dog on a skateboard.*	**"```json\n{\n \"rating\": \"[[1]]\",\n \"reason\": \"The response does not accurately describe the content of the video. It mentions a man performing tricks on a skateboard, which is not relevant to the video shown. The video features a man in a suit with an umbrella, not a skateboard, and the actions described do not match what is happening in the video. Overall, the response lacks relevance, accuracy, and comprehensiveness.\"\n}\n```",**
video_llava: *In the video, a man is seen walking down the street while holding an umbrella.*	**"```json\n{\n \"rating\": \"2\",\n \"reason\": \"The response partially addresses the user's instruction by mentioning a man with an umbrella, but it lacks detail and context about the situation in the video. It does not capture the dynamic action or the humorous elements present, which are crucial for a comprehensive understanding of what is happening.\"\n}\n```",**
gpt4o-mini: *In the video, a man dressed in a suit is humorously attempting to balance while holding a red umbrella and a folder. He appears to be slipping or losing his balance, creating a comedic effect. As he struggles, a woman runs in to help him, and the scene continues with various people walking by, adding to the lively atmosphere. Eventually, he regains .....*	**"```json\n{\n \"rating\": \"[[4]]\",\n \"reason\": \"The response effectively describes the humorous scenario in the video, capturing the main actions and the lighthearted atmosphere. It provides a good level of detail about the man's struggle and the involvement of the woman, which adds to the overall context. However, it could benefit from a bit more depth or nuance regarding the setting or the reactions of the bystanders to achieve an excellent rating.\"\n}\n```"**

Figure 10: An example from the CVRR dataset, with candidate responses and corresponding ratings from the GPT-4o mini judges.

Reference: "A man in a suit appears to fall backward, but not moving. Spectators watch, and a woman drops money in his hat. When he stands up, revealing the box that helped him stay in that position, he smiles, picks it up, and walks away. The video showcases a clever street performance using optical illusion."

"Please serve as an unbiased judge in assessing the quality of the responses from AI assistants regarding the user's instruction and a video. \nEvaluation Method:\n\nYou will receive a single response from the AI assistant to user's instruction. Use scores to show the quality of the response. Here is the detailed scoring rubric for evaluating the quality of responses from AI assistants:\nPoor (1): The response significantly deviates from the user's instruction and fails to address the query effectively. It shows a lack of relevance, accuracy, and comprehensiveness. Creativity and granularity are absent or poorly executed.\nFair (2): The response addresses the user's instruction partially, with evident shortcomings in relevance, accuracy, or comprehensiveness. It lacks depth in creativity and granularity, indicating a superficial understanding of the user's inquiry.\nAverage (3): The response adequately addresses the user's instruction, showing a fair level of relevance, accuracy, and comprehensiveness. It reflects a basic level of creativity and granularity but may lack sophistication or depth in fully capturing the user's inquiry.\nGood (4): The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.\nExcellent (5): The response perfectly adheres to the user's instruction, excelling in relevance, accuracy, comprehensiveness, creativity, and granularity. It provides an insightful, detailed, and thorough answer, indicating a deep and nuanced understanding of the user's inquiry.\n\nUse \"[[1]]\", \"[[2]]\", \"[[3]]\", \"[[4]]\", \"[[5]]\" to indicate your evaluate score in the key 'Judgement'.\n\nHere is the input:\n\n[The Start of User Instruction]\nWhat is happening in the video?\n[The End of User Instruction]\n[The Start of Assistant's Answer]\nIn the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.\n[The End of Assistant's Answer]\nYour reply should be in JSON format: {{'rating': 'your rating number', 'reason': 'your reasoning'}}"

Candidate \ Judge	Internvl-2
mplug_owl_Video: *The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.*	**"```json\n{\n 'rating': '4',\n 'reason': 'The assistant's response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the video content, providing a detailed description of the man's actions and the setting. However, the response could be improved by mentioning the presence of other people in the background, which adds context to the scene.'\n}\n```",**
llama_vid: *In the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.*	**"```json\n{\n 'rating': '4',\n 'reason': 'The assistant's response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the video content, with detailed granularity that enhances the response quality. However, the response could be improved by providing more specific details about the man's actions and interactions with people in the video.'\n}\n```",**
video_chatgpt: *In the video, a man is seen performing a trick on a skateboard, possibly in a public area. He is seen jumping over a person and a dog, and he is also seen jumping over a person and a car. The video ends with the man jumping over a person and a dog on a skateboard.*	**"```json\n{\n 'rating': '1',\n 'reason': 'The assistant's response is incorrect and does not accurately describe the video. The video shows a man performing a trick on a skateboard, not jumping over people and a dog or a car. The assistant's response is misleading and does not address the user's instruction effectively.'\n}\n```",**
video_llava: *In the video, a man is seen walking down the street while holding an umbrella.*	**"```json\n{\n 'rating': '3',\n 'reason': 'The response is somewhat relevant and accurate, but it lacks depth and detail. The assistant mentions the man walking down the street and holding an umbrella, but it does not describe the man's attire, the presence of other people, or the overall scene. The response could be improved by providing a more comprehensive description of the video content.'\n}\n```",**
gpt4o-mini: *In the video, a man dressed in a suit is humorously attempting to balance while holding a red umbrella and a folder. He appears to be slipping or losing his balance, creating a comedic effect. As he struggles, a woman runs in to help him, and the scene continues with various people walking by, adding to the lively atmosphere. Eventually, he regains .....*	**"```json\n{\n 'rating': '4',\n 'reason': 'The assistant's response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the video content, with detailed granularity that enhances the response quality. However, the assistant could have provided more specific details about the man's actions and the reactions of the people around him to further enrich the description.'\n}\n```"**

Figure 11: An example from the CVRR dataset, with candidate responses and corresponding ratings from the InternVL2 judge.

Reference: "A man in a suit appears to fall backward, but not moving. Spectators watch, and a woman drops money in his hat. When he stands up, revealing the box that helped him stay in that position, he smiles, picks it up, and walks away. The video showcases a clever street performance using optical illusion."

"Please serve as an unbiased judge in assessing the quality of the responses from AI assistants regarding the user's instruction and a video. \nEvaluation Method:\n\nYou will receive a single response from the AI assistant to user's instruction. Use scores to show the quality of the response. Here is the detailed scoring rubric for evaluating the quality of responses from AI assistants:\nPoor (1): The response significantly deviates from the user's instruction and fails to address the query effectively. It shows a lack of relevance, accuracy, and comprehensiveness. Creativity and granularity are absent or poorly executed.\nFair (2): The response addresses the user's instruction partially, with evident shortcomings in relevance, accuracy, or comprehensiveness. It lacks depth in creativity and granularity, indicating a superficial understanding of the user's inquiry.\nAverage (3): The response adequately addresses the user's instruction, showing a fair level of relevance, accuracy, and comprehensiveness. It reflects a basic level of creativity and granularity but may lack sophistication or depth in fully capturing the user's inquiry.\nGood (4): The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.\nExcellent (5): The response perfectly adheres to the user's instruction, excelling in relevance, accuracy, comprehensiveness, creativity, and granularity. It provides an insightful, detailed, and thorough answer, indicating a deep and nuanced understanding of the user's inquiry.\n\nUse \"[[1]]\", \"[[2]]\", \"[[3]]\", \"[[4]]\", \"[[5]]\" to indicate your evaluate score in the key 'Judgement'.\n\nHere is the input:\n\n[The Start of User Instruction]\nWhat is happening in the video?\n[The End of User Instruction]\n[The Start of Assistant's Answer]\nIn the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.\n[The End of Assistant's Answer]\nYour reply should be in JSON format: {{'rating': 'your rating number', 'reason': 'your reasoning'}}"

Candidate \ Judge	video_llava
mplug_owl_Video: *The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.*	**"{{'rating': '4', 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}",**
llama_vid: *In the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.*	**"{{'rating': '4', 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}",**
video_chatgpt: *In the video, a man is seen performing a trick on a skateboard, possibly in a public area. He is seen jumping over a person and a dog, and he is also seen jumping over a person and a car. The video ends with the man jumping over a person and a dog on a skateboard.*	**"{{'rating': '4', 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}",**
video_llava: *In the video, a man is seen walking down the street while holding an umbrella.*	**"{{'rating': '4', 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}",**
gpt4o-mini: *In the video, a man dressed in a suit is humorously attempting to balance while holding a red umbrella and a folder. He appears to be slipping or losing his balance, creating a comedic effect. As he struggles, a woman runs in to help him, and the scene continues with various people walking by, adding to the lively atmosphere. Eventually, he regains .....*	**"{{'rating': '4', 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}"**

Figure 12: An example from the CVRR dataset, with candidate responses and corresponding ratings from the Video-LLaVA judges.

Reference: "A man in a suit appears to fall backward, but not moving. Spectators watch, and a woman drops money in his hat. When he stands up, revealing the box that helped him stay in that position, he smiles, picks it up, and walks away. The video showcases a clever street performance using optical illusion."

"Please serve as an unbiased judge in assessing the quality of the responses from AI assistants regarding the user's instruction and a video. \nEvaluation Method:\n\nYou will receive a single response from the AI assistant to user's instruction. Use scores to show the quality of the response. Here is the detailed scoring rubric for evaluating the quality of responses from AI assistants:\nPoor (1): The response significantly deviates from the user's instruction and fails to address the query effectively. It shows a lack of relevance, accuracy, and comprehensiveness. Creativity and granularity are absent or poorly executed.\nFair (2): The response addresses the user's instruction partially, with evident shortcomings in relevance, accuracy, or comprehensiveness. It lacks depth in creativity and granularity, indicating a superficial understanding of the user's inquiry.\nAverage (3): The response adequately addresses the user's instruction, showing a fair level of relevance, accuracy, and comprehensiveness. It reflects a basic level of creativity and granularity but may lack sophistication or depth in fully capturing the user's inquiry.\nGood (4): The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.\nExcellent (5): The response perfectly adheres to the user's instruction, excelling in relevance, accuracy, comprehensiveness, creativity, and granularity. It provides an insightful, detailed, and thorough answer, indicating a deep and nuanced understanding of the user's inquiry.\n\nUse \"[[1]]\", \"[[2]]\", \"[[3]]\", \"[[4]]\", \"[[5]]\" to indicate your evaluate score in the key 'Judgement'.\n\nHere is the input:\n\n[The Start of User Instruction]\nWhat is happening in the video?\n[The End of User Instruction]\n[The Start of Assistant's Answer]\nIn the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.\n[The End of Assistant's Answer]\nYour reply should be in JSON format: {{'rating': 'your rating number', 'reason': 'your reasoning'}}",

Candidate \ Judge	llama-vid
mplug_owl_Video: *The video features a man dressed in a suit and tie, performing a unique dance routine on a spinning, upside-down, red umbrella. He is spinning around and maintaining his balance while performing the dance.*	**"{{'rating': 4, 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}",**
llama_vid: *In the video, a man is seen dancing and spinning an umbrella around while walking down the street. He continues to dance and spin the umbrella around while walking around and interacting with people.*	**"{\n\"rating\": 4,\n\"reason\": \"The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.\"\n}",**
video_chatgpt: *In the video, a man is seen performing a trick on a skateboard, possibly in a public area. He is seen jumping over a person and a dog, and he is also seen jumping over a person and a car. The video ends with the man jumping over a person and a dog on a skateboard.*	**"{{'rating': 4, 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}",**
video_llava: *In the video, a man is seen walking down the street while holding an umbrella.*	**"{{'rating': 3, 'reason': 'The response adequately addresses the user's instruction, showing a fair level of relevance, accuracy, and comprehensiveness. It reflects a basic level of creativity and granularity but may lack sophistication or depth in fully capturing the user's inquiry.'}}",**
gpt4o-mini: *In the video, a man dressed in a suit is humorously attempting to balance while holding a red umbrella and a folder. He appears to be slipping or losing his balance, creating a comedic effect. As he struggles, a woman runs in to help him, and the scene continues with various people walking by, adding to the lively atmosphere. Eventually, he regains .....*	**"{{'rating': 4, 'reason': 'The response is well-aligned with the user's instruction, demonstrating a high degree of relevance, accuracy, and comprehensiveness. It shows creativity and a nuanced understanding of the topic, with detailed granularity that enhances the response quality.'}}"**

Figure 13: An example from the CVRR dataset, with candidate responses and corresponding ratings from the LLaMA-VID judges.

B DATASET DETAILS

Visual Dimension	Definition
1) Multiple actions in a single video **(Multi Actions)**	This category includes videos with 2-4 activities, mostly featuring humans performing multiple actions. It tests the model's ability to reason about and understand interrelations between different actions.
2) Fine-grained action understanding **(Fine Action)**	Focuses on subtle human activities like pushing, opening, closing, etc. Challenges the model's comprehension of fine-grained actions through carefully crafted questions.
3) Partial actions **(Partial Actions)**	Features videos with actions likely to be followed by subsequent actions, but not executed. Tests the model's ability to avoid generating contextually relevant but non-existent content.
4) Time order understanding **(Time Order)**	Assesses the model's ability to recognize temporal sequences of activities, crucial for distinguishing between atomic actions like pushing and pulling.
5) Non-existent actions with existent scene depictions **(Non-exist (E))**	Examines the model's robustness in scenarios with introduced non-existent activities without altering the physical and spatial scenes.
6) Non-existent actions with non-existent scene depictions **(Non-exist (NE))**	Evaluates the model's reliability in handling questions with both non-existent activities and scene comprehension, testing its ability to avoid generating imaginary content.
7) Continuity and object instance count **(Cont. & Obj.)**	Tests the model's ability to accurately recognize and count object instances, and distinguish between existing and newly introduced objects in a scene.
8) Unusual and physically anomalous activities **(Unusual Activities)**	Assesses the model's ability to understand unconventional activities that seem to defy physics, testing generalization to out-of-distribution scenarios.
9) Interpretation of social context **(Social Context)**	Evaluates the model's ability to infer the rationale behind actions based on social context, using diverse videos with challenging questions.
10) Understanding of emotional context **(Emotional Context)**	Tests the model's capacity to interpret actions considering emotional context, using videos and questions focused on recognizing action nature based solely on emotional cues.
11) Interpretation of visual context **(Visual Context)**	Focuses on the model's ability to recognize actions using overall visual contextual cues, requiring reasoning based on visual elements like shadows.

Table 2: Definitions of Visual Dimensions for Video Understanding (Khattak et al., 2024).

Table 3: Examples of question-answer pairs in the CVRR-ES benchmark for various complex video evaluation dimensions. The content is collected from previous work (Khattak et al., 2024).

Visual Dimension	Sample Question-Answer Pairs
1. Multiple actions in a single video	**Q:** Does the person stand up to welcome the cat or remain seated? **A:** The person remains seated throughout their interaction with the cat. **Q:** What is the next action after using the laptop? **A:** Placing a bag in the refrigerator.
2. Fine-grained action understanding	**Q:** Does the man use the thread to sew fabric? **A:** No, he uses it to create loops and demonstrate tying a knot. **Q:** What action is performed by the person's hands? **A:** Plugging a black USB charging cable into the charging port.
3. Partial actions	**Q:** What is happening in the video? **A:** The video shows a red car door and a hand reaching for the handle. **Q:** Is the snack replaced to its original position? **A:** No, the video only shows moving the snack from right to left.
4. Time order understanding	**Q:** Is liquid being taken out of the soda can? **A:** No, the video doesn't show this activity. **Q:** In which direction is the person running on the track? **A:** The person is running anticlockwise.
5. Non-existent actions with existent scene depictions	**Q:** Does the person clean around the sink after going through the bag? **A:** No, the person does not clean the area around the sink. **Q:** How does the audience react to the keynote speaker? **A:** The scene does not include a keynote speaker delivering a speech.
6. Non-existent actions with non-existent scene depictions	**Q:** How do children interact with the flowers? **A:** There are no children or flowers depicted in the video. **Q:** How does the child react when the dog runs past? **A:** There is no child or dog in the video.
7. Continuity and Object Instance Count	**Q:** How many unique sunglasses appear in the video? **A:** There are 4 unique sunglasses, one for each person in the car. **Q:** Did the men's attire change when they re-entered the frame? **A:** Yes, their attire changed upon re-entering the frame.
8. Unusual and Physically Anomalous activities	**Q:** How does the person reach an elevated position? **A:** They ascended and floated in the air, not by walking or running. **Q:** How is the person able to fly over the water? **A:** They are using a flyboard system attached to their shoes.
9. Interpretation of social context	**Q:** How did the crowd respond to the girl landing the water bottle? **A:** The crowd applauded to show appreciation for her success. **Q:** Why does the boy touch ashes before touching the goat? **A:** He uses the ashes to warm the goat, showing care.
10. Understanding of emotional context	**Q:** Is the emotional context of the video negative? **A:** No, it is overwhelmingly positive. **Q:** What is the nature of the interaction between the two individuals? **A:** The interaction is friendly, evidenced by a warm hug and handshake.
11. Interpretation of visual context	**Q:** Does the person undergo a real physical transformation? **A:** No, they remove a rubber mask, revealing they are a woman. **Q:** What unusual behavior is shown between a predator and prey? **A:** A cat plays and sleeps with chicks instead of hunting them.

C DETAILS ON RATINGS

Candidate & Judge	Visual Dimensions										
	Cont. & Obj.	*Fine Action*	*Social Context*	*Visual Context*	*Multi Actions*	*Non-exist (E)*	*Non-exist (NE)*	*Partial Actions*	*Time Order*	*Emotional Context*	*Unusual Activities*
LLaMA-VID											
Video-LLaVA	3.95	3.98	4.00	4.00	3.98	3.96	3.96	3.99	4.00	4.00	3.98
LLaMA-VID	3.81	3.83	3.92	3.90	3.76	3.94	3.81	3.85	3.84	3.85	3.76
GPT-4o mini	2.51	3.07	2.50	2.64	2.60	2.53	2.27	2.93	3.18	2.74	2.33
InternVL2	3.12	3.63	3.31	3.36	3.55	3.46	3.12	3.63	3.56	3.34	3.09
GPT-4o	2.18	2.48	1.77	2.36	2.20	1.82	1.92	2.16	2.70	2.34	2.09
GPT-3.5	2.31	2.30	1.85	2.05	2.01	1.06	1.17	1.73	2.24	1.90	1.95
Agent-Debate	1.94	1.93	1.53	1.75	1.73	1.11	1.17	1.46	1.89	1.58	1.54
GPT-4o mini											
Video-LLaVA	3.86	3.88	3.85	3.86	3.73	3.57	3.69	3.84	3.91	3.87	3.93
LLaMA-VID	3.71	3.79	3.73	3.75	3.54	3.46	3.43	3.67	3.82	3.67	3.79
GPT-4o mini	2.81	3.43	3.29	3.20	2.93	2.83	2.63	3.20	3.55	3.15	3.12
InternVL2	3.14	3.59	3.57	3.57	3.39	3.33	3.20	3.43	3.60	3.47	3.64
GPT-4o	2.93	3.60	3.51	3.78	3.28	3.53	3.01	3.39	3.41	3.32	3.42
GPT-3.5	3.41	3.90	3.95	3.73	3.21	3.80	3.74	3.73	3.93	3.20	3.49
Agent-Debate	2.47	3.08	3.09	2.98	2.34	2.86	2.79	2.81	2.40	2.29	2.66
Video-ChatGPT											
Video-LLaVA	3.99	4.00	3.99	4.00	4.00	3.98	4.00	3.99	3.99	3.99	3.99
LLaMA-VID	3.83	3.87	3.93	3.92	3.82	3.90	3.83	3.82	3.80	3.87	3.83
GPT-4o mini	2.17	2.86	2.52	2.50	2.43	2.37	2.40	2.62	2.92	2.70	2.29
InternVL2	3.02	3.42	3.25	3.21	3.37	3.33	3.03	3.41	3.53	3.21	3.07
GPT-4o	2.20	2.43	2.30	2.62	2.44	2.25	2.07	2.26	2.49	2.27	2.04
GPT-3.5	2.66	2.34	2.60	2.53	2.48	1.75	1.62	2.17	2.34	2.05	1.96
Agent-Debate	2.14	1.97	2.17	2.17	2.07	1.76	1.56	1.82	1.93	1.69	1.54
mPLUG-Owl-Video											
Video-LLaVA	4.00	3.99	4.00	2.07	4.00	4.00	4.00	4.00	4.00	4.00	4.00
LLaMA-VID	3.90	3.93	3.95	3.94	3.86	4.03	3.94	3.92	3.91	3.95	3.97
GPT-4o mini	2.44	3.03	2.64	2.84	2.46	2.60	2.40	2.77	3.15	2.82	2.43
InternVL2	3.22	3.64	3.44	3.49	3.49	3.53	3.16	3.54	3.70	3.44	3.46
GPT-4o	2.32	2.72	2.53	2.54	2.23	2.03	2.03	2.36	2.75	2.35	2.16
GPT-3.5	2.27	2.46	2.35	2.34	2.02	1.11	1.19	1.73	2.27	1.95	1.57
Agent-Debate	1.85	2.07	2.00	2.07	1.65	1.30	1.19	1.73	1.94	1.62	1.57
Video-LLaVA											
Video-LLaVA	3.98	3.99	4.00	4.00	4.00	3.99	3.97	4.00	4.00	3.99	4.00
LLaMA-VID	3.87	3.84	3.91	3.95	3.78	3.97	3.83	3.82	3.84	3.86	3.85
GPT-4o mini	2.38	2.91	2.35	2.45	2.39	2.46	2.17	2.60	2.91	2.57	2.09
InternVL2	3.28	3.65	3.39	3.36	3.43	3.38	3.17	3.67	3.59	3.29	3.10
GPT-4o	2.33	2.65	1.95	2.45	2.24	2.21	2.08	2.26	2.64	2.21	2.08
GPT-3.5	2.31	2.30	1.85	2.05	2.01	1.06	1.17	1.73	2.24	1.90	1.95
Agent-Debate	1.97	2.07	1.89	1.94	1.70	1.22	1.31	1.63	1.95	1.57	1.53

Table 4: Scores of candidate models given by judge models across various visual dimensions.

D DETAILS ON AGREEMENT

Judge & Candidate	visual dimensions										
	Cont. & Obj.	*Fine Action*	*Social Context*	*Visual Context*	*Multi Actions*	*Non-exist (E)*	*Non-exist (NE)*	*Partial Actions*	*Time Order*	*Emotional Context*	*Unusual Activities*
Video-LLaVA											
Video-LLaVA	-0.02	0.64	0.00	0.00	0.00	0.04	-0.13	0.09	0.00	0.01	0.00
LLaMA-VID	0.93	-0.35	0.00	-0.03	0.07	0.09	-1.02	-0.61	0.00	-0.14	0.09
GPT-4o mini	5.34	2.01	10.69	14.09	4.91	-8.05	-5.77	3.20	3.41	1.53	2.18
Video-ChatGPT	0.48	0.14	0.05	0.00	0.00	-1.24	0.00	-0.32	-0.01	-0.17	-0.44
mPLUG-Owl-Video	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.06	0.00
Average	1.35	0.52	2.15	2.81	1.00	-1.83	-1.38	0.47	0.68	0.23	0.37
LLaMA-VID											
Video-LLaVA	0.66	1.42	-1.42	0.27	0.11	-0.55	-0.67	0.59	2.64	-0.12	0.39
LLaMA-VID	2.26	-0.27	-0.03	-1.16	-1.11	-0.02	-2.63	-0.81	2.31	-0.03	0.21
GPT-4o mini	10.62	9.06	7.46	16.13	5.64	-17.09	-14.94	9.04	5.99	3.88	-0.53
Video-ChatGPT	3.72	-0.01	0.62	0.40	3.58	-3.42	-1.91	0.38	1.68	-0.65	-1.21
mPLUG-Owl-Video	1.24	-0.15	-1.41	-0.25	-1.28	0.32	-0.08	0.81	2.31	-0.76	-0.09
Average	3.70	2.01	1.04	3.08	1.39	-4.15	-4.04	2.00	2.99	0.23	0.37
GPT-4o mini											
Video-LLaVA	11.72	23.37	19.88	25.00	18.66	4.39	-1.96	-4.02	5.75	17.65	15.14
LLaMA-VID	11.72	23.37	19.88	25.00	18.66	4.39	-1.96	-4.02	5.75	17.65	15.14
GPT-4o mini	28.59	19.43	23.18	20.10	26.19	-5.55	-28.86	16.54	6.85	3.08	-8.32
Video-ChatGPT	10.58	18.04	21.01	17.99	9.20	-15.19	-18.65	-7.23	0.68	5.91	6.75
mPLUG-Owl-Video	9.87	22.94	21.96	23.31	14.94	3.84	-3.31	-1.56	14.86	16.27	7.66
Average	14.50	21.43	21.18	22.28	17.53	-1.62	-1.09	1.94	6.78	12.11	7.27
InternVL2											
Video-LLaVA	6.57	8.48	6.74	10.23	4.30	1.09	0.52	2.99	2.60	6.94	5.90
LLaMA-VID	22.68	22.34	22.44	32.12	20.03	5.65	10.46	15.93	19.29	11.86	8.40
GPT-4o mini	8.75	14.78	9.82	16.79	11.80	-1.98	-0.63	-1.78	6.57	3.06	6.43
Video-ChatGPT	8.75	14.78	9.82	16.79	11.80	-1.98	-0.63	-1.78	6.57	3.06	6.43
mPLUG-Owl-Video	6.15	9.43	11.24	13.73	6.36	2.89	0.63	-1.26	8.29	7.24	2.97
Video-LLaVA	9.31	12.30	10.15	10.70	5.11	3.24	4.52	0.20	9.89	8.40	6.78
Average	10.69	13.47	12.08	16.71	9.52	2.18	3.10	3.21	9.33	7.50	6.10
GPT-4o											
Video-LLaVA	25.16	58.85	66.35	59.28	43.14	27.01	34.00	48.85	33.57	37.80	31.75
LLaMA-VID	33.66	54.43	60.79	43.13	43.08	16.74	6.99	31.50	26.41	32.23	30.87
GPT-4o mini	42.58	39.71	42.07	50.45	37.04	35.67	21.15	50.29	36.87	24.59	25.22
Video-ChatGPT	41.44	61.71	69.39	58.41	56.87	61.53	29.74	46.53	36.29	31.45	35.47
mPLUG-Owl-Video	22.73	57.36	63.28	64.64	41.08	34.49	23.56	49.32	38.89	35.09	29.93
Average	33.11	54.41	60.38	55.18	44.24	35.09	23.09	45.30	34.40	32.23	30.65

Table 5: Agreement scores across various visual dimensions between VLMs and LLM Agent-Debate

E COMPARE GPT-4O, COLLECTIVE THOUGHT, MIXTURE JUDGE

Judge & Candidate	**visual dimensions**										
	Cont. & Obj.	*Fine Action*	*Social Context*	*Visual Context*	*Multi Actions*	*Non-exist (E)*	*Non-exist (NE)*	*Partial Actions*	*Time Order*	*Emotional Context*	*Unusual Activities*
Collective thought											
LLaMA-VID	14.76	28.37	37.42	28.59	23.23	7.62	2.72	14.11	12.75	16.20	16.52
GPT-4o	**40.17**	26.42	34.67	33.35	35.19	9.66	-13.23	**33.61**	**26.46**	13.81	7.29
Video-ChatGPT	28.34	34.51	**55.19**	37.17	**36.14**	**20.21**	**13.35**	17.03	26.19	15.43	18.97
mPLUG-Owl-Video	10.58	37.69	50.54	**42.02**	29.43	19.55	4.78	25.48	22.51	**18.98**	**25.86**
Video-LLaVA	14.18	**40.36**	34.82	28.71	32.62	10.23	5.99	19.27	20.28	17.14	18.98
Average	21.61	33.47	42.53	33.97	31.32	13.46	2.72	21.90	21.64	16.31	17.52

Table 6: Agreement scores across various visual dimensions between Agent-Debate and collective thought.

Judge & Candidate	**visual dimensions**										
	Cont. & Obj.	*Fine Action*	*Social Context*	*Visual Context*	*Multi Actions*	*Non-exist (E)*	*Non-exist (NE)*	*Partial Actions*	*Time Order*	*Emotional Context*	*Unusual Activities*
Mixture Judge											
LLaMA-VID	29.91	48.34	54.59	29.17	37.50	7.62	2.72	14.11	23.36	12.75	16.52
GPT-4o mini	41.42	33.08	45.14	40.03	37.99	9.66	-13.23	33.61	37.17	13.81	7.29
Video-ChatGPT	38.89	60.70	61.94	41.18	44.01	20.21	13.35	17.03	35.14	15.43	18.97
mPLUG-Owl-Video	25.16	52.21	59.43	50.16	37.94	19.55	4.78	25.48	39.16	18.98	25.86
Video-LLaVA	30.29	57.66	60.05	38.08	37.92	10.23	5.99	19.27	35.64	17.14	18.98
Average	33.13	50.40	56.23	39.72	39.07	13.46	2.72	21.90	34.09	16.31	17.52

Table 7: Agreement scores across various visual dimensions between Agent-Debate and mixture judges.

F ABLATION STUDY ON FINETUNING VIDEO-LLAVA

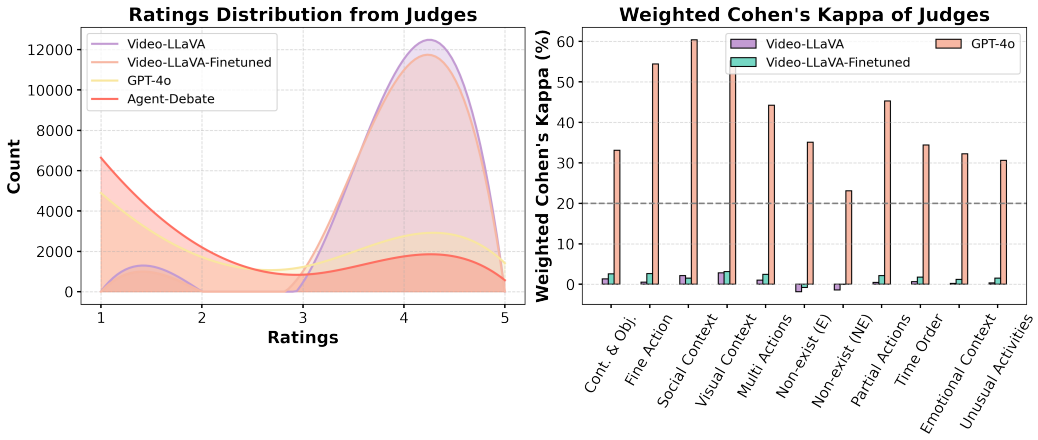

Figure 14: Left: Ratings Distributions. Right: *Weighted Cohen's Kappa* of Judges.

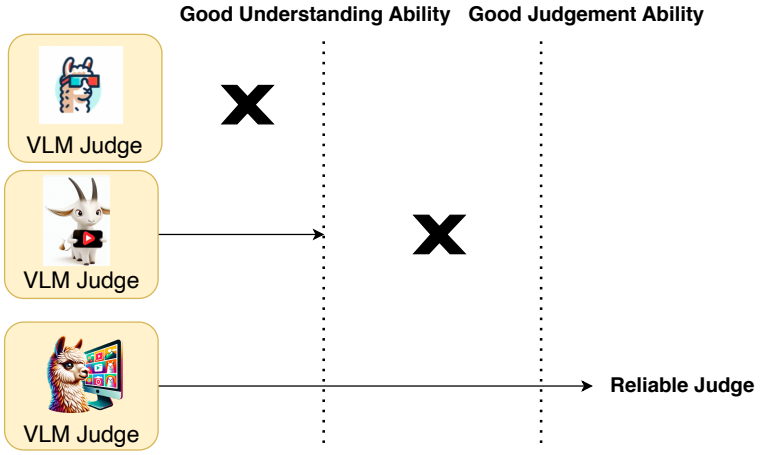

Figure 15: To serve as a reliable judge, both strong comprehension and critical analysis abilities are essential.