Can LLMs Generate Tabular Summaries of Science Papers? Rethinking the Evaluation Protocol

Anonymous ACL submission

Abstract

Literature review tables are essential for summarizing and comparing collections of scientific papers. We explore the task of generating tables that best fulfill a user's informational needs given a collection of scientific papers. Building on recent work (Newman et al., 2024), we extend prior approaches to address real-world complexities through a combination of LLM-based methods and human annotations. Our contributions focus on three key challenges encountered in real-world use: (i) User prompts are often under-specified; (ii) Retrieved candidate papers frequently contain irrelevant content; and (iii) Task evaluation should move beyond shallow text similarity techniques and instead assess the utility of inferred tables for information-seeking tasks (e.g., comparing papers). To support reproducible evaluation, we introduce ARXIV2TABLE, a more realistic and challenging benchmark for this task, along with a novel approach to improve literature review table generation in real-world scenarios. Our extensive experiments on this benchmark show that both open-weight and proprietary LLMs struggle with the task, highlighting its difficulty and the need for further advancements.

1 Introduction

Literature review tables play a crucial role in scientific research by organizing and summarizing large amounts of information from selected papers into a concise and comparable format (Russell et al., 1993). At the core of these tables are the *schema* and *values* that define their structure, where *schema* refers to the categories or aspects used to summarize different papers and *values* correspond to the specific information extracted from each paper. A well-defined *schema* allows each work to be represented as a row of *values*, enabling structured and transparent comparisons across different studies.

With recent advancements in large language models (LLMs; OpenAI, 2025b; DeepSeek-AI et al., 2025), several studies (Newman et al., 2024; Dagdelen et al., 2024; Sun et al., 2024) have explored generating literature review tables by prompting LLMs with a set of pre-selected papers and the table's caption. While these efforts represent meaningful progress, we argue that the existing task definition and evaluation protocols are somewhat unrealistic, thus hindering the practical applicability of generation methods.

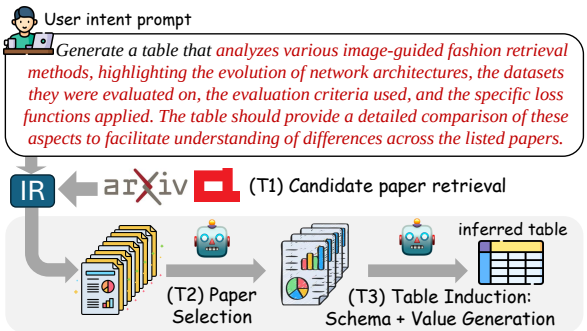

Figure 1: Overview of our proposed task: Given a user's demand, a simulated information retrieval (IR) engine first retrieves semantically relevant papers. Then, a language model further filters them and induces the table's corresponding schema and values to satisfy the user's demand. The grayed region indicates the scope covered by our method and benchmark (ARXIV2TABLE).

First, existing pipelines assume that all provided papers are relevant and should be included in the table. However, in real-world scenarios, distractor papers—those that are irrelevant or contain limited useful information—are common (OpenAI, 2025a). Models should be able to identify and filter out such papers before table construction. Additionally, current pipelines use the ground-truth table's descriptive caption as the objective for generation. These captions often lack sufficient context, making it difficult for LLMs to infer an appropriate schema, or they may inadvertently reveal the schema and values, leading to biased evaluations.

In this paper, we introduce our task, as illustrated in Figure 1, which improves upon previous task

definitions through two key adaptations. First, our pilot study shows that LLMs struggle to retrieve relevant papers from large corpora. To benchmark this, we introduce distractor papers by selecting them based on semantic similarity to papers in the ground-truth table. LLMs must first determine which papers should be included before generating the table. Second, we replace table captions with abstract user demands that describe the goal of curating the table, making the task more aligned with real-world scenarios. We build upon the ARXIVDIGESTABLES (Newman et al., 2024) dataset and construct a sibling benchmark through human annotation to verify the selected distractors, comprising 1,957 tables and 7,158 papers.

Meanwhile, current evaluation methods rely on static semantic embeddings to estimate schema overlap between generated and ground-truth tables and require human annotations to assess the quality of unseen schemas and values. However, semantic embeddings struggle to capture nuanced, context-specific variations due to their reliance on pre-trained representations, while human annotation is costly and time-consuming. Moreover, the most effective table generation approaches define schemas primarily based on paper abstracts. This method risks missing important aspects present in the full text, leading to loosely defined schemas with inconsistent granularity.

To address these issues, we propose an annotation-free evaluation framework that instructs an LLM to synthesize QA pairs based on the ground-truth table and assess the generated table by answering these questions. These QA pairs evaluate table content overlap across three dimensions: schema-level, single-cell, and pairwise-cell comparisons. Additionally, we introduce a novel table generation method that batches input papers, iteratively refining paper selection and schema definition by revisiting each paper multiple times. Extensive experiments using five LLMs demonstrate that they struggle with both selecting relevant papers and generating high-quality tables, while our method significantly improves performance on both fronts. Expert validation further confirms the reliability of our QA-synthetic evaluations.

In summary, our contributions are threefold: (1) We introduce an improved task definition for literature review tabular generation, benchmarking it in a more realistic scenario by incorporating distractor papers and replacing table captions with abstract user demands; (2) We propose an annotation-free evaluation framework that leverages LLM-generated QA pairs to assess schema-level, single-cell, and pairwise-cell content overlap, addressing the limitations of static semantic embeddings and human evaluation; and (3) We develop a novel iterative batch-based table generation method that processes input papers in batches, refining schema definition and paper selection iteratively.

To the best of our knowledge, we are the first to introduce a task that simulates real-world use cases of scientific tabular generation by incorporating user demands and distractor papers, providing a more robust assessment of LLMs in this domain.

2 Related Works

Scientific literature tabular generation Prior works primarily attempt to generate scientific tables through two stages: schema induction and value extraction. For schema induction, early methods like entity-based table generation (Zhang and Balog, 2018) focused on structured input, while recent work has explored schema induction from user queries (Wang et al., 2024) and comparative aspect extraction (Hashimoto et al., 2017). For value extraction, various approaches such as document-grounded question-answering (Kwiatkowski et al., 2019; Dasigi et al., 2021; Lee et al., 2023), aspect-based summarization (Ahuja et al., 2022), and document summarization (DeYoung et al., 2021; Lu et al., 2020) have been proposed to extract relevant information. Beyond these methods, several datasets have been introduced to support scientific table-related tasks, such as TableBank (Li et al., 2020), SciGen (Moosavi et al., 2021), and SciTabQA (Lu et al., 2023). Recently, Newman et al. (2024) proposed streamlining schema and value generation with LLMs sequentially and curated a large-scale benchmark for evaluation. However, all these methods assume a clean and fully relevant set of papers and rely on predefined captions or abstract-based schemas, which risk missing key details. In contrast, we argue for an evaluation approach where candidate papers include tangentially relevant or distracting papers, aligning more closely with real-world literature review workflows.

Table induction for general domains Other than the scientific domain, table induction is also widely studied as text-to-table generation. Prior works attempt this as a sequence-to-sequence task (Li et al., 2023; Wu et al., 2022) or as a question-answering problem (Sundar et al., 2024;

Tang et al., 2023). Similar to these works, our framework is capable of better handling both structured and distractive input for real-world literature review and knowledge synthesis.

3 Task Definition

We first define a pipeline consisting of three subtasks that extend prior definitions and better capture the real-world usage of literature review tabular generation. For all the following tasks, we are given a user demand prompt p, which specifies the intended purpose of creating the table. **(T1) Candidate Paper Retrieval:** We begin with a given *universe* of papers (e.g., the content of Google Scholar or arXiv) from which relevant papers need to be identified. Given a large collection, the goal is to use a search engine (IR) to retrieve a subset of *candidate* papers $C := \{d_i\}_{i=1}^{M}$ of size M, which may include distractor papers—i.e., papers that resemble the user demand prompt but do not fully satisfy the requirement. **(T2) Paper Selection:** Given C, the second subtask is to select the *relevant* subset of size m ($m < M$): $R := \{d_i\}_{i=1}^{m} \subseteq C$, which best aligns with the user demand p. T2 differs from T1 in scale. Due to the large scale of T1, IR engines must optimize for recall, ensuring that as many relevant papers as possible are retrieved. However, T2 operates at a smaller scale, where precision is the priority, as it focuses on filtering out distractors and selecting only the most relevant papers. **(T3) Table Induction:** Given the selected papers R, the objective is to generate a table with m rows and N columns, where $N \geq 2$ (i.e., no single-column tables). Each row $r_i \in \{r_1, r_2, \ldots, r_m\}$ corresponds to a unique input document $d_i \in R$, and each column $c_j \in \{c_1, c_2, \ldots, c_N\}$ represents a unique aspect of the documents. We refer to these N columns as the *schema* of the table and the $N \times m$ cells as the *values* of the table. The value of each cell is derived from its respective document according to the aspect defined by the corresponding column.

4 ARXIV2TABLE Construction

We then construct ARXIV2TABLE based on the ARXIVDIGESTABLES dataset which consists of literature tables (extracted from computer science papers) and their corresponding captions. We filter out tables that are structurally incomplete or lack full text for all referenced papers. As a result, we are left with 1,957 tables (with captions) which have rows referring to 7,158 papers. Our construction involves three pillars: user demand inference (§4.1), a simulated paper retrieval (§4.2) and evaluation through utilization (§4.3).

4.1 Constructing User Demand Prompts

The first step is to collect user demands p that explicitly describe the desired table (can be understood without the table content) and do not reveal the table's schema or specific values.

Table captions are not appropriate prompts While the input dataset contains one caption per table, collected from arXiv papers, these captions are meant to complement tables rather than fully describe them. As a result, they are generally concise. For example, a table caption might read: *"Performance comparison of different approaches,"* which is too vague to understand without seeing the table. Consequently, using table captions as prompts may not yield a well-defined task. A more contextually self-contained rewritten user demand might instead be: *"Draft a table that compares different knowledge editing methods, focusing on their performance on QA datasets."*

Our prompt construction To address this issue, we propose rewriting the captions of literature review tables into abstract yet descriptive user intentions using LLMs. We guide GPT-4o with a prompt (see §A) that first explains the task to the LLM, specifying that the user demand should be sufficiently contextualized to clearly state the table's purpose while avoiding the inclusion or direct description of column names or specific values. GPT-4o is then expected to infer the user demand for the given table and its caption. Here, LLM is used solely for rewriting existing table captions into user demand prompts and for generating QA pairs grounded in ground-truth tables. These reformulations are strictly tied to observed data and do not require external factual knowledge, minimizing risks of contamination or model-specific bias. For simplicity, we collect only one user demand per table. More examples are provided in Appendix C.

Table captions vs. constructed user demand prompts To verify that our collected user demands align with our objective, we visualize: (1) the distribution of the number of tokens in the original and modified user demands, and (2) the ratio of captions and user demands of different lengths that have token overlap with the schema or values.

From Figure 2, we observe that our modified user demands are generally longer than the original captions, providing a more detailed description of the table's goal. Furthermore, as shown in Table 1, user demands exhibit a significantly lower overlap ratio with the schema and table values, resulting in fewer overlapping tokens.

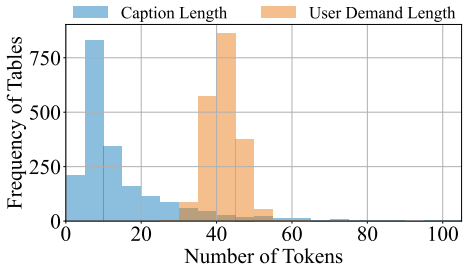

Figure 2: Distribution of the number of tokens between original captions and our modified user demands.

4.2 Paper Retrieval Simulation

The unreliability of paper retrieval Next, we approach the first subtask, candidate paper retrieval, by conducting a pilot study to assess whether LMs can reliably retrieve relevant papers from a large corpus. For each table, we employ a Sentence-BERT (Reimers and Gurevych, 2019) encoder as a retrieval engine, selecting papers from the entire corpus based on the highest similarity between the table's user demand and each paper's title and abstract. We vary the number of retrieved papers between 2 and 100 and plot the precision and recall of retrieval against the ground-truth papers in the original table (Figure 3).

We observe consistently low precision and recall across different retrieval sizes, highlighting the challenge of retrieving relevant papers from a noisy corpus. This demonstrates that the first subtask is non-trivial and may introduce noise into subtask T2. However, various information retrieval engines, such as Google Scholar and Semantic Scholar, can replace LMs in this subtask. Thus, we decide to simulate T1 by manually adding noisy distractor papers into C to construct R, ensuring a noisy input for T2. This allows us to focus on evaluating LLMs' capabilities in the T2 and T3 subtasks.

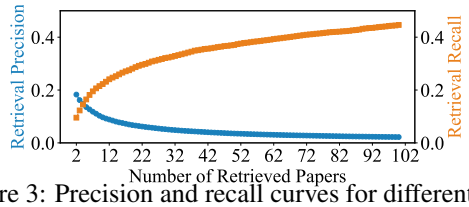

Figure 3: Precision and recall curves for different numbers of retrieved papers.

Prompt	Content	#Table ↓	#Tokens ↓
Caption	Schema	101 (5.2%)	1.2
	Value	46 (2.4%)	1.3
User Demand	Schema	14 (0.7%)	1.0
	Value	8 (0.4%)	1.0

Table 1: Overlap statistics between prompts (the original caption or our constructed user demand) and table content (schema or values). **#Table:** Number (and %) of tables with at least one token from table content overlapping with the prompt. **#Tokens:** Average count of overlapping tokens between table content and prompt.

Similarity-based paper retrieval Moving forward, we associate distractor paper candidates with each table to simulate a potentially noisy document pool before constructing the table. Ideally, distractor candidates should be semantically related to the table but exhibit key differences that fail to meet the user demand. To select such candidates, we adopt a retrieve-then-annotate approach. First, we use a SentenceBERT encoder F to obtain embeddings for (1) the user demand $F(p)$ and (2) all papers in the corpus $\{F(d_i) \mid d_i \in C\}$. Each paper's embedding is computed by encoding the concatenation of its title and abstract. We then rank all papers $d_i \notin R$ based on the average of two cosine similarities: (1) the similarity between the candidate and the user demand, and (2) the average similarity between the candidate and each referenced paper:

$$s(d_i) = \cos(F(d_i), F(p)) + \frac{1}{m}\sum_{j=1}^{m} \cos(F(d_i), F(d_{u_j})).$$

Higher values of $s(d_i)$ indicate stronger semantic relevance, and we select the top 10 ranked papers for each table as its distractor candidates.

Candidates verification via human annotation After selecting these candidates, we conduct human annotations to verify whether they should indeed be excluded from the table. Given that annotating these tables requires expert knowledge in computer science, we recruit seven postgraduate students with research experience in the field as annotators. To ensure they are well-prepared for the task, the annotators undergo rigorous training, including pilot annotation exams. Their task is to make a binary decision on whether a given distractor paper—based on its title, abstract, user demand, the ground-truth table, and the titles and abstracts of all referenced papers—should be included in the table. Each table contains annotations for 10 papers, with each distractor paper initially assigned to two randomly selected annotators. If both an-

notators agree on the label, it is finalized. Otherwise, two additional annotators review the paper until a consensus is reached. In the first round, the inter-annotator agreement (IAA) is 94% based on pairwise agreement, and the Fleiss' Kappa (Fleiss, 1971) score is 0.73, indicating a substantial level of agreement (Landis and Koch, 1977). Finally, for each table, we randomly select a number of distractor papers between $[m, 10]$.

4.3 Evaluation via LLM-based Utilization

After constructing the benchmark, we propose evaluating the quality of generated tables from a utilization perspective to address the challenge of aligning schemas and values despite potential differences in phrasing. This is achieved by synthesizing QA pairs based on the ground-truth table and using the generated table to answer them, or vice versa. The flexibility of this QA synthesis allows us to evaluate multiple dimensions of the table while ensuring a structured and scalable assessment. An overview with running examples is shown in Figure 4.

Dimensions of evaluating a table with QAs We introduce three key aspects for evaluating a table in terms of its usability: (1) **Schema**: whether a specific column is included in the generated schema, (2) **Unary Value**: whether a particular cell from the ground-truth table appears in the generated table, (3) **Pairwise Value**: whether relationships between two cells remain consistent in the generated table.

Recall evaluation We guide GPT-4o in generating binary QA pairs based on the ground-truth table. For the first two aspects, we generate QA pairs for all columns and cells, whereas for the third, we randomly sample 10 cell pairs per table and synthesize them into QA pairs. We then prompt GPT-4o to answer these questions based on the generated table, providing yes/no responses. If the answer cannot be found, the model is instructed to respond with no," and vice versa for yes." The ratio of "yes" answers indicates how well the generated table preserves the schema, individual values, and pairwise relationships. This represents the **recall** of the ground-truth table, measuring how much original information is retained in the generated table.

Precision evaluation To additionally evaluate **precision**, we reverse the process: instead of generating QA pairs from the ground-truth table, we generate them from the generated table and ask another LLM to answer them using the ground-truth table. The precision score reflects how much of the generated table's content is actually supported by the original data. By computing the ratio of "yes" answers, we quantify the accuracy of the generated table in reflecting genuine ground-truth information, as well as any additional useful information not present in the ground-truth table.

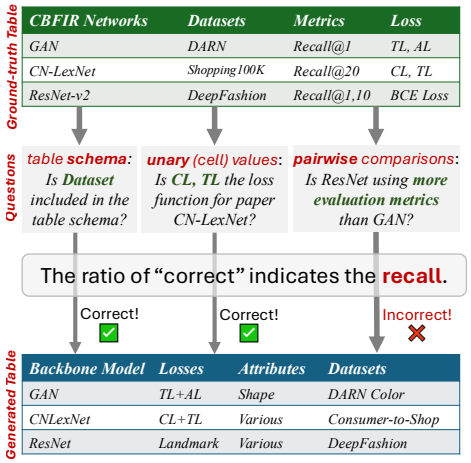

Figure 4: Overview of our proposed LLM-based QA-synthesis evaluation protocol, where LLMs synthesize QA pairs based on the ground-truth table and utilize the generated table to answer them. The ratio of successfully answered QA pairs indicate the ratio of information preserved.

5 Tabular Generation Methodologies

We explore a range of methods to evaluate on our proposed task, starting from several baselines inspired by prior work (§5.1) and then our proposed approach (§5.2).

5.1 Baseline Methods

We first introduce three methods for generating literature review tables to evaluate their performance on our task and use them as baselines for our proposed method. For easy reference, these methods are termed numerically.

First, **Baseline 1** generates the table in a one-step process. It takes all available papers R and the user demand p as input, and the model is asked to select all relevant papers and output a table with a well-defined schema and filled values in a single round of conversation. However, this method struggles with extremely long prompts that exceed the LLMs' context window when generating large tables.

To address this issue, **Baseline 2** processes papers individually. For each document, the model decides whether it should be included based on the user demand. If included, the model gener-

ates a table for that document. After processing all documents, the final table is created by merging the schemas of all individual tables using exact string matching and copying the corresponding values. While this approach reduces the input prompt length, it results in highly sparse tables due to inconsistent schema across papers and the potential omission of relevant information when individual papers lack sufficient context to define comprehensive table aspects.

To overcome both issues, **Newman et al.** (Newman et al., 2024) introduces a two-stage process. In the first stage, the model selects papers relevant to the user demand based on their titles and abstracts, then generates a corresponding schema. In the second stage, the model loops through the selected papers and fills in the respective rows based on the full text of each document. A minor drawback of this method is that the schema is generated solely from titles and abstracts, which may overlook details present only in the full text. Note that this method is the **strongest recent baseline** for scientific tabular generation while other text-to-table methods (Deng et al., 2024b) are not directly applicable due to different assumptions.

5.2 Iterative Batch-based Tabular Generation

Then, we introduce our proposed method for generating literature review tables. Our approach consists of three steps: (A) key information extraction, (B) paper batching, and (C) paper selection and schema refinement, where the latter two steps can be iterated multiple times.

(A) Key Information Extraction Processing multiple papers simultaneously using their full text often results in excessively long prompts that exceed the LLMs' context window. To address this, we first shorten each paper by instructing the LLM to extract key information from the full text that is relevant to the user's requirements. Notably, we do not rely solely on the abstract, as important details often appear in the full text but are omitted from the abstract. For each paper, we provide the LLM with its title, abstract, and full text, along with the user's request, and ask it to generate a concise paragraph that preserves all potentially relevant details. These summary paragraphs serve as condensed representations of the papers for subsequent processing.

(B) Paper Batching Next, we divide all key information paragraphs into smaller batches. Processing too many papers at once negatively affects the model's performance (as demonstrated by the comparison of Baseline 1 in Table 2), whereas batching facilitates more efficient comparisons within each batch. For simplicity, we set a batch size of 4 and randomly partition R into $\left\lceil \frac{|R|}{4} \right\rceil$ batches.

(C) Paper Selection and Schema Refinement We initialize an empty schema and table, then sequentially process each batch with the LLM by providing it with the user's request and summaries of batched papers. The LLM is instructed to (1) decide whether each paper should be included or removed based on its key information and (2) refine the schema based on the current batch of papers. Schema refinement involves adding or removing specific columns or modifying existing values to align with different formats. For new papers that are not deemed suitable for inclusion yet are not in the current table, we also prompt the LLM to insert a new row according to the refined schema. This ensures that the table remains dynamically structured, continuously adapting to new information while maintaining consistency across batches.

Afterward, we iterate steps B and C for k iterations. Here k is a hyper-parameter and we set $k = 5$ in our experiments. The rationale is that multiple iterations allow the schema and table contents to progressively improve, ensuring better alignment with user demands. In each iteration, the batches are newly randomized so that each paper is compared with different subsets, enabling more robust decision-making and reducing bias from specific batch compositions. This iterative refinement also mitigates errors from earlier batches by revisiting and adjusting prior decisions based on newly processed information. After completing all iterations, we individually prompt the LLM to revisit the full text of the selected papers to verify the values, thereby completing the tabular generation process.

6 Experiments and Analyses

6.1 Experiment Setup

To demonstrate the generalizability of our method and evaluations, we conduct experiments using two proprietary and three open-source LLMs as backbone model representatives: GPT-4o (OpenAI, 2024b), GPT-4o-mini (OpenAI, 2024a), DeepSeek-V3 (685B; DeepSeek-AI et al., 2024), LLAMA-3.3 (70B; Dubey et al., 2024), and Mistral-Large (123B; Mistral-AI, 2024). We apply all baseline methods and our proposed method to each model

Backbone Model	Method	Paper	Schema			Unary Value			Pairwise Value			Avg
		Recall	P	R	F1	P	R	F1	P	R	F1	
LLAMA-3.3 (70B)	Baseline 1	52.8	31.3	37.7	34.2	29.6	40.4	34.2	28.4	31.8	30.0	32.8
	Baseline 2	65.4	26.7	**69.3**	38.5	17.0	56.8	26.2	11.2	22.5	15.0	26.6
	Newman et al.	61.9	36.4	40.5	38.3	32.8	44.5	37.8	29.5	30.2	29.8	35.3
	Ours	69.3	41.9	55.4	47.7	43.1	62.6	51.1	36.4	46.9	41.0	46.6
Mistral-Large (123B)	Baseline 1	54.7	33.1	34.5	33.8	31.6	30.4	31.0	15.5	24.7	19.0	27.9
	Baseline 2	66.8	27.4	65.0	38.5	22.7	47.4	30.7	17.8	30.7	22.6	30.6
	Newman et al.	67.9	39.9	41.6	40.7	34.7	46.3	39.7	29.9	35.1	32.3	37.6
	Ours	71.3	45.4	56.7	50.4	43.3	61.5	50.8	42.0	49.2	45.3	48.8
DeepSeek-V3 (685B)	Baseline 1	57.5	38.7	41.7	40.1	32.5	43.8	37.3	28.7	31.8	30.1	35.8
	Baseline 2	69.8	34.9	69.0	46.4	27.1	55.5	36.4	25.7	32.7	28.8	37.2
	Newman et al.	70.9	39.4	44.2	41.7	36.6	49.2	42.0	33.3	36.5	34.8	39.5
	Ours	74.3	39.6	56.9	46.7	47.7	65.2	55.1	40.4	49.8	44.6	48.8
GPT-4o-mini	Baseline 1	55.9	32.0	35.7	33.7	28.9	39.3	33.3	25.0	31.0	27.7	31.6
	Baseline 2	68.2	31.5	67.7	43.0	27.7	50.8	35.9	21.6	28.3	24.5	34.5
	Newman et al.	69.3	40.3	45.9	42.9	38.3	47.5	42.4	35.0	37.8	36.3	40.5
	Ours	72.6	46.5	59.7	52.3	**49.0**	**66.7**	**56.5**	43.5	51.9	47.3	52.0
GPT-4o	Baseline 1	58.5	35.8	43.2	39.2	36.9	41.8	39.2	29.0	34.7	31.6	36.7
	Baseline 2	70.2	34.2	68.0	45.5	27.9	56.0	37.2	19.4	33.6	24.6	35.8
	Newman et al.	71.3	45.0	47.9	46.4	38.7	49.8	43.6	36.9	40.0	38.4	42.8
	Ours	**74.6**	**51.5**	59.4	**55.2**	46.1	**66.7**	54.5	**45.9**	**55.7**	**50.3**	**53.3**

Table 2: Tabular evaluation results (%) of five LLMs on the ARXIV2TABLE. The best performances within each backbone are underlined and the best among all backbones are **bold-faced**. Avg refers to averaging three F1 scores.

and use our evaluation framework to assess the quality of the generated tables based on our benchmark, focusing on four aspects: paper selection (**Paper**), schema content overlap (**Schema**), single-cell value overlap (**Unary Value**), and comparisons across cells (**Pairwise Value**). For paper selection, we use **recall** as the metric to measure the number of ground-truth papers successfully selected. For the latter three tasks, we report precision (P), recall (R), and F1 scores (F1), as explained in §4.3.

6.2 Main Evaluation Results

We report the main evaluation results in Table 2 and summarize our key findings as follows. A visual comparison of model-wise performance across methods is also provided in Figure 6.

(1) All methods and models struggle to distinguish relevant papers from distractors. For example, even with their best-performing methods, LLAMA-3.3 and GPT-4o achieve only 65.4% and 71.3% recall on average, respectively. This indicates that a significant number of distractor papers are still being included in the generated tables. Additionally, we observe that processing papers individually or using only abstracts for inclusion decisions yields better performance than concatenating full texts. This suggests that excessively long prompts may weaken LLMs' ability to make accurate inclusion decisions for each paper.

(2) Aligning generated schemas with the ground-truth table remains challenging. Among the baselines, the second method consistently achieves higher recall (e.g., 69.3% with LLAMA-3.3), primarily because it generates a larger number of columns, leading to more overlaps with the ground-truth schema. However, other methods exhibit significantly lower recall, indicating that LLMs still struggle to generate meaningful columns that align well with the ground-truth structure.

(3) While unary values are well preserved, pairwise comparisons suffer substantial losses. Most methods, especially our proposed approach, extract unary values with relatively high F1 scores. However, extracting and maintaining pairwise relationships remains challenging. This trend is consistent across different models, suggesting that while individual entries are correctly identified, capturing the relationships between them remains difficult. The significant gap highlights the challenge of preserving complex relational comparisons within the generated tables.

(4) Our proposed method improves performance across all aspects and models. Across all backbone models and evaluation criteria, our method consistently outperforms the baselines. For example, it achieves the highest recall and F1 scores for both unary and pairwise metrics, regardless of model size. This demonstrates that our approach not only enhances overall performance but also provides a more robust solution for handling distractor paper selection and precise table generation.

(5) Larger models lead to better performance. For the three open-source LLMs, we observe a clear trend that increasing the model size improves performance across all aspects when using the same method. For instance, with our approach, scaling from 70B to 123B parameters leads to consistent improvements in most aspects and metrics, reinforcing the importance of stronger generative capabilities in addressing this task.

6.3 Ablation Study on Iteration Number

We further study the impact of the number of iterations, k, in our proposed method to illustrate the importance of refining the schema and table contents over multiple iterations using different batches of papers. As described in §5.2, we perform one round of paper selection and schema refinement five times to achieve optimal performance. In this section, we analyze this process by studying the model's performance across previous rounds. We select GPT-4o as the backbone model and visualize changes in the F1 scores for schema, unary value, pairwise comparison overlap, and their average, by applying the same evaluation protocol to the generated tables across iterations ranging from 1 (the first cycle) to 5.

The results are plotted in Figure 5. We observe that during the first four iterations, performance steadily improves across all aspects, demonstrating the effectiveness of iteratively refining paper selection and table schema through multiple iterations and comparisons between different subsets of papers. At the fifth iteration, however, the improvement slows down, and in some cases, performance even decreases. One possible reason is that the table starts overfitting by including additional values that do not appear in the ground-truth table, reducing precision and leading to lower F1 scores. Considering the overall performance, $k = 5$ is supported as the optimal number of iterations.

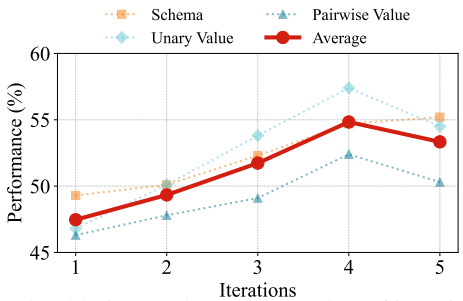

Figure 5: Ablation study on the number of iterations for our iterative batch-based table generation method.

6.4 Validation of Utilization-Based Evaluation

To verify the reliability of synthesizing QA pairs using LLMs for evaluating tabular data, we conduct two complementary expert assessments. First, we invited the authors (as domain experts) to manually inspect a random sample of 200 QA pairs—spanning schema-level, unary value, and pairwise value comparisons. Annotators were asked to assess (1) whether each QA pair is firmly grounded in the source table, and (2) whether the LLM's answer is correct based on the generated target table. As shown in Table 3, the expert acceptance rates exceed 98% in all categories, confirming the quality of the synthesized QA pairs.

Table	Schema	Unary Value	Pairwise Value
Source	99.5%	100%	98.5%
Target	98.5%	99.5%	97.0%

Table 3: Expert acceptance rate for the synthesized QA pairs sampled from our evaluations.

Second, we conducted an additional human study to assess whether our LLM-based evaluation aligns with human judgment across different generation methods. For each method, we sampled 300 QA pairs, answered them using both LLMs and human annotators, and measured the agreement rate. As shown in Table 4, LLM and human "yes" response rates are highly consistent, with over 97% agreement across all methods. These results reinforce the robustness of our evaluation framework, demonstrating that LLM-synthesized QA pairs provide a scalable and trustworthy proxy for human judgment in assessing semantically diverse tabular outputs. Specifically, these results indicate that the high agreement is not driven by an inherent bias of LLMs toward their own generated QA pairs.

Method	LLM Rate	Human Rate	Agreement
Baseline 1	39.1%	39.6%	97.3%
Baseline 2	57.1%	57.3%	98.2%
Newman et al.	42.9%	43.0%	98.6%
Ours	57.3%	57.5%	98.0%

Table 4: Comparison between GPT-4o and human annotators on 300 QA pairs. We report the proportion of "yes" answers by each and their overall agreement.

7 Conclusion

In this work, we introduce an improved literature review table generation task that incorporates distractor papers and replaces table captions with abstract user demands to better align with real-world scenarios, and curated an associated benchmark. Additionally, we propose an annotation-free evaluation framework using LLM-synthesized QA pairs and a novel method to enhance table generation. Our experiments show that current LLMs and existing methods struggle with our task, while our approach significantly improves performance. We envision that our work paves the way for more automated and scalable literature review table generation, ultimately facilitating the efficient synthesis of scientific knowledge in large-scale applications.

Limitations

A minor limitation is that our work uses ARXIVDIGESTABLES as the source of literature review tables for subsequent data reconstruction. However, Newman et al. (2024) have included their pipeline for scalably extracting literature review tables from scientific papers, thus resolving the data reliance gap. Beyond the computer science domain, our formulation and methodology are readily applicable to other scientific fields such as medicine, physics, and social sciences, where structured comparisons across publications are equally valuable. Moreover, the core task—generating structured tables from noisy, unstructured input with under-specified intent—extends naturally to real-world applications like news fact aggregation, personalized knowledge card generation, and structured database population from web or legal documents.

Another limitation of our work is its reliance on GPT-4o, a proprietary LLM, for benchmark curation and subsequent evaluation, which may introduce several issues. First, it raises concerns about data contamination (Deng et al., 2024a; Dong et al., 2024), as the model may generate user demands (during benchmark curation) and synthesis evaluation questions (when evaluating a generated table against the ground truth) that are similar to its training data, potentially leading to inflated performance in table generation. A data provenance check (Longpre et al., 2024) can be further implemented to address this issue. Second, the benchmark and evaluation process may inherit the internal knowledge or semantic distribution biases of GPT-4o, which could skew the evaluation of other LLMs and reduce the generalizability of our findings. Lastly, a minor issue is scalability, as curating larger datasets using a proprietary model can be resource-intensive and may limit accessibility when extending our framework to other literature or domains. Future work can explore the use of open-source LLMs to replicate the entire process for convenient adaptation to other tabular datasets.

Ethics Statement

The ARXIVDIGESTABLES (Newman et al., 2024) dataset used in our work is shared under the Open Data Commons License, which grants us access to it and allows us to improve and redistribute it for research purposes. Regarding language models, we access all open-source LMs via the Hugging Face Hub (Wolf et al., 2020) and proprietary GPT models through their official API[1]. The number of these models, if available, is marked in Table 2. All associated licenses for these models permit user access for research purposes, and we commit to following all terms of use.

When prompting GPT-4o to generate user demands and synthetic QA questions, we explicitly state in the prompt that the LLM should not generate any content that contains personal privacy violations, promotes violence, racial discrimination, hate speech, sexual, or self-harm contents. We also manually inspect a random sample of 100 data entries generated by GPT-4o for offensive content, and none are detected. Therefore, we believe that our dataset is safe and will not yield any negative or harmful impact.

Our human annotations are conducted by recruiting five graduate-level students who have sufficient experience in data collection for training large language models. They are proficient in English, primarily from Asia, and are paid above the minimum wage in their local jurisdictions. They receive thorough training on the task and are reminded to have a clear understanding of the task instructions before proceeding to annotation. The high level of inter-agreement also confirms the quality of our annotation. The expert annotators have agreed to participate as their contribution to the paper without receiving any compensation.

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Appendices

A Implementation Details

In this section, we provide additional implementation details about our benchmark curation and evaluation pipeline, including the prompt we used and the models we accessed.

A.1 Prompts Used

We first introduce the prompt used to construct the ARXIV2TABLE benchmark, as explained in Section 4. The main step involves prompting LLM is to collect user demands that describe the purpose of creating the table while remaining contextually self-contained and not revealing the actual schema or values of the table. We use the following prompt to instruct GPT-4o in generating these user demands.

```
Given a literature review table, along with its caption, you are tasked with writing a user demand or intention for the creator of this table. The user demand should be written as though you are instructing an AI system to generate the table. Avoid directly mentioning column names in the table itself, but instead, focus on explaining why the table is needed and what information it should contain. You may include a description of the table's structure, whether it requires detailed or summarized columns. Additionally, infer the user's intentions from the titles of the papers the table will include. Limit each user demand to 1-2 sentences. Examples of good user demands are: I need a table that outlines how each study conceptualizes the problem, categorizes the task, describes the data analyzed, and summarizes the main findings. The table should have detailed columns for each of these aspects. Generate a detailed table comparing the theoretical background, research methodology, and key results of these papers. You can use several columns to capture these aspects for each paper. I want to create a table that summarizes the datasets used to evaluate different GNN models, focusing on the common features and characteristics found across the papers listed below. The table should have concise columns to highlight these dataset attributes. Now, write a user demand for the table below. The caption of the table is "<CAPTION>". The table looks like this:
<TABLE>
The following papers are included in the table:
<PAPER-1> . . . <PAPER-N>
Write the user demand for this table. Do not include the column names in the user demand. Write a concise and clear user demand covering the function, topic, and structure of the table with one or two sentences. The user demand is:
```

Then, for synthesizing QA pairs from a table, we use the following prompt to guide GPT-4o in generating some QA pairs with answers:

```
You will evaluate the quality of a generated table by comparing it against a ground-truth table. The goal is to assess whether the generated table correctly retains the schema, individual values, and pairwise relationships. This is achieved by generating targeted QA pairs based on the ground-truth table and answering them using the generated table. Step 1: QA Pair Generation Based on the Ground-Truth Table Generate binary (Yes/No) QA pairs focusing on three aspects: Schema QA Pairs: Check whether a specific column from the ground-truth table appears in the generated table schema. Example: Is Dataset included in the table schema? Unary Value QA Pairs: Check whether a specific cell value from the ground-truth table is present in the generated table. Example: Is CL, TL the loss function for paper CN-LexNet? Pairwise Value QA Pairs: Check whether a relationship between two values remains consistent in the generated table. Example: Is ResNet-v2 using more evaluation metrics than GAN? For Schema and Unary Value, generate a QA pair for every column and every cell, respectively. For Pairwise Value, randomly sample 10 pairs per table and construct the corresponding QA pairs.
```

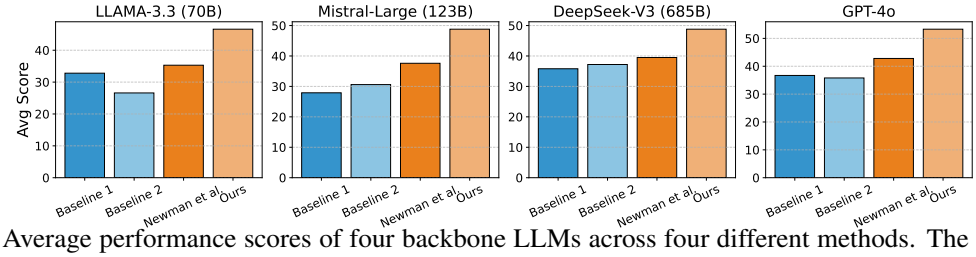

Figure 6: Average performance scores of four backbone LLMs across four different methods. The comparison highlights the consistent improvement of our proposed method over existing baselines and prior work.

Statistic	Paper Count	Column Count	Distractor Count
Min	1	2	4
Max	35	13	10
Mean	3.65	3.56	5.21
Total	7158	6967	10196

Table 5: Summary statistics of the ARXIV2TABLE benchmark. We report aggregate values for the number of papers, columns, and distractor papers per table.

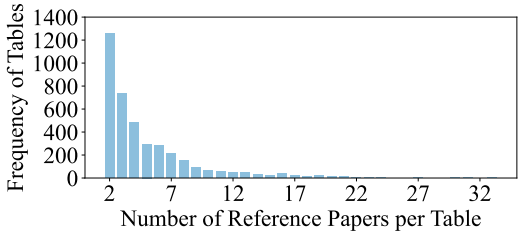

Figure 7: Distribution of number of papers in each table.

```
Step 2: Answering QA Pairs Using the
Generated Table After generating the QA
pairs, answer them using the generated
table. Provide only "yes" or "no"
responses: If the information is present
in the generated table, respond with
"yes." If the information is missing or
different, respond with "no." Your task
is to generate the QA pairs based on the
ground-truth table and then answer them
based on the generated table. Now, begin
by generating the QA pairs.
```

The distribution of number of papers per table in ARXIV2TABLE is shown in Figure 7.

A.2 Evaluation Implementations

We access all open-source LLMs via the Hugging Face library (Wolf et al., 2020). The models used are `meta-llama/Llama-3.3-70B-Instruct`, `mistralai/Mistral-Large-Instruct-2411`, and `deepseek-ai/DeepSeek-V3`.

For GPT models, we access them via the official OpenAI Batch API[2]. The models used are `gpt-4o-mini-2024-07-18` and `gpt-4o-2024-08-06`.

Note that the DeepSeek model family has a context window limit of 64K tokens, whereas the others have a limit of 128K tokens. The generation temperature is set to 0.5 for all experiments. All experiments are repeated twice and the average performance is reported.

[2]https://platform.openai.com/docs/guides/batch

A.3 Computational Cost Comparisons

To assess the efficiency and scalability of our iterative batch-based method, we report computational statistics in Table 6. Each method was run using the same LLaMA-3.3 model backend. We measure three aspects: (1) generation success rate, defined as the proportion of prompts yielding complete tables within the context window, (2) average token usage per table, and (3) average runtime per table. Our method achieves a 100% success rate, outperforming the baselines that occasionally fail due to context limitations or prompt instability. While our runtime is moderately longer than Baseline 1 and Baseline 2, it remains comparable to Newman et al. and stays well within acceptable latency for practical usage. Furthermore, token usage remains controlled, confirming that our iterative approach does not incur excessive computational cost despite its multi-step structure. These results demonstrate that our method offers a favorable trade-off between performance and efficiency.

Method	Success Rate	#Tokens	Avg. Runtime
Baseline 1	48.2%	128K	37
Baseline 2	98.2%	167K	118
Newman et al.	99.7%	110K	208
Ours	100.0%	118K	194

Table 6: Computational cost and efficiency metrics across different generation methods using LLaMA-3.3. We report the generation success rate, average token usage, and average runtime (s) per table.

B Annotation Details

To ensure the high quality of our human annotations, we implement strict quality control measures. First, we select only postgraduate students with research experience in computer science to ensure they are familiar with relevant topics. All selected annotators undergo qualification rounds, and we invite only those who demonstrate satisfactory performance to serve as our main annotators.

For each task, we provide workers with comprehensive task explanations in layman's terms to enhance their understanding. Additionally, we offer detailed definitions and multiple examples for each choice to help annotators make informed decisions. Each entry requires the worker to provide a binary vote on whether the paper should be excluded or not. Our annotation interface is shown in Figure 8.

To ensure comprehension, we require annotators to confirm that they have thoroughly read the instructions by ticking a checkbox before starting the annotation task. We also manually monitor the performance of annotators throughout the annotation process and provide feedback based on common errors. Spammers or underperforming workers are disqualified. As described in Section 4.2, the inter-annotator agreement supports the quality of our collected annotations.

C Case Studies

Table 7 presents randomly sampled examples of original table captions alongside their improved user demands, demonstrating how refining vague captions enhances specificity and ensures more structured table generation. The findings highlight that well-defined user demands help capture key aspects of table construction, leading to more informative and targeted tabular representations.

Table 8 illustrates schema, unary value, and pairwise value questions designed to assess the quality of generated tables, ensuring alignment with ground-truth information. The results reveal that this QA-based evaluation effectively quantifies schema retention, individual value accuracy, and consistency in relationships, providing a structured approach for benchmarking table generation models.

In addition, we present two pairs of ground-truth and generated tables as examples for a case study on table generation, as shown in Table 9. From these tables, we observe that the generation process is capable of incorporating many useful columns, thereby enriching the available information. For instance, in the first example, the generated table introduces new columns such as *Number of Images*, *Number of Subjects*, and *Avg. Images per Subject*, which add valuable quantitative insights beyond the original ground truth table. However, it is also evident that some columns present in the ground truth, like the *Evaluation Metric*, are not fully covered in the generated version. In the second example, the user demand for detailed descriptions has led to a generated table with numerous specific columns, including *ID*, *Method Used*, *Performance Metric*, and *Results Achieved*. Although these additional details enhance the descriptive quality of the table, they also suggest a potential issue: the need for further polishing and refinement of the user demand to balance detail with clarity.

Original Table Caption	User Demand
Comparison of Trajectory and Path Planing Approach	Generate a table that compares different trajectory and path planning approaches, focusing on their collision avoidance techniques, benefits, limitations, and applicable scenarios. The table should include detailed columns to capture these aspects for each method mentioned in the relevant papers.
Publications with deep-learning focused sampling methods. We cluster the papers based on the space the sample through and how the samples are evaluated. Some approaches further consider an optional refinement stage.	Create a table that categorizes publications focused on deep-learning-based sampling methods for grasp detection, organizing them by the space in which samples are generated, the evaluation criteria used, and whether a refinement stage is included. The table should provide a comprehensive yet concise overview of the methodological variations and enhancements across different papers.
Categorization of textual explanation methods.	Create a table that categorizes the methods used for providing textual explanations in visual question answering systems, focusing on the types of texts generated and the reasoning processes employed. The table should use succinct columns to differentiate between these methodological aspects for each paper.
Metadata of the three benchmarks that we focus on. XSumSota is a combined benchmark of cite:1400aac and cite:d420ef8 for summaries generated by the state-of-the-art summarization models.	Create a table that details the metadata for three summarization benchmarks, focusing on the composition of annotators, the dataset sizes for validation and testing, and the distribution of positive and negative evaluations. The table should provide a comprehensive comparison across these aspects for each benchmark.
Review of open access ground-based forest datasets	Create a table that reviews various open-access forest datasets, focusing on the publication and data recording years, types of data collected, and their applicability to specific forestry-related tasks. The table should offer a concise summary of each dataset's attributes, including the number of classification categories and geographical location.
Comparison of existing consistency-type models.	Create a table that compares different models focusing on their purpose, the trajectory they follow, the main objects they equate, and their methodological approach. The table should provide detailed insights into how each model addresses consistency issues, drawing from specified papers.

Table 7: Randomly sampled examples of the original captions and their corresponding improved user demands. Most captions are relatively short and may be vague without the full table's content.

Schema	Unary Value	Pairwise Value
Is Dataset included in the table schema?	Is CL, TL the loss function for paper CNLexNet?	Is ResNet-v2 using more evaluation metrics than GAN?
Is Model Architecture included in the table schema?	Is GPT-4o the model used for multimodal understanding?	Does GPT-4o have a larger parameter size than LLaMA-2?
Is Training Dataset included in the table schema?	Is ImageNet the dataset used for training ResNet?	Is ResNet trained on more samples than EfficientNet?
Is Performance Metric included in the table schema?	Is BLEU-4 the evaluation metric for MT-BERT?	Does BERT outperform LSTM on BLEU-4 score?
Is Activation Function included in the table schema?	Is ReLU the activation function used in Transformer?	Is GELU smoother than ReLU in function continuity?
Is Optimization Algorithm included in the table schema?	Is Adam the optimizer used for training BERT?	Does Adam converge faster than SGD for BERT training?
Is Pretraining Task included in the table schema?	Is Masked Language Modeling the pretraining task for BERT?	Does BERT use a more complex pretraining strategy than GPT?
Is Hyperparameter included in the table schema?	Is the learning rate set to 0.001 for training ViT?	Does ViT use a higher learning rate than ResNet?
Is Hardware Accelerator included in the table schema?	Is TPU used for training T5?	Do TPUs provide faster training than GPUs for T5?

Table 8: Randomly sampled examples of schema, unary value, and pairwise value questions used to evaluate the quality of generated tables. Each row contains three related questions derived from the same table.

Annotation Task

User Demand

"I need a table that summarizes the key characteristics of various benchmark datasets used in temporal knowledge graph reasoning, including the number of entities, relations, timestamps, and triplets for training, validation, and testing. The table should present this information in a concise manner to facilitate comparison across the studies represented."

Papers in the Current Table

# Entities	# Relations	# Timestamps	# Train Triplets	# Val. Triplets	# Test Triplets
500	20	366	2,735,685	341,961	341,961
15,403	34	198	110,441	13,815	13,800
125,726	203	1,700	323,635	5,000	5,000

Current Literature Review Table

Paper Arxiv Link	Title	Corpus ID
https://arxiv.org/pdf/2104.08419	TIE: A Framework for Embedding-based Incremental Temporal Knowledge Graph Completion	233295959
https://arxiv.org/pdf/1809.03202	Learning Sequence Encoders for Temporal Knowledge Graph Completion	52183483
https://arxiv.org/pdf/2112.05785	TempoQR: Temporal Question Reasoning over Knowledge Graphs	245124416

Paper to Be Decided

Title: Wiki-CS: A Wikipedia-Based Benchmark for Graph Neural Networks

Abstract: We present Wiki-CS, a novel dataset derived from Wikipedia for benchmarking Graph Neural Networks. The dataset consists of nodes corresponding to Computer Science articles, with edges based on hyperlinks and 10 classes representing different branches of the field. We use the dataset to evaluate semi-supervised node classification and single-relation link prediction models. Our experiments show that these methods perform well on a new domain, with structural properties different from earlier benchmarks. The dataset is publicly available, along with the implementation of the data pipeline and the benchmark experiments, at this https URL .

Link: https://arxiv.org/pdf/2007.02901

Decision

Based on the user demand and the existing literature review table, should this paper be included?

○ **Include** ○ **Exclude**

Submit

Figure 8: The annotation interface we used for collecting the gold labels for distractor papers.

Tasks	#Categories	Evaluation Metric
fine-grained	100	mean accuracy
face	9131	-

(a) Ground-truth table of the first pair of example.

Number of Images	Number of Subjects	Avg. Images per Subject	Number of Classes	Dataset Purpose
10,000	100	100	100	Fine-grained visual classification
3,310,000	9,131	362.6	9,131	Face recognition across variations

(b) Generated table of the first pair of example.

Problem	Description
Visual Reference Resolution	Capturing related visual region through an associative attention memory.
Visual Reference Resolution	Selectively referring dialogue history to refine the visual attention until referencing the answer.
Visual Reference Resolution	Establishing mapping of visual object and textual entities to exclude undesired visual content.
Visual-based Dialogue Strategies Optimization	Enhancing response generator with discriminator by RL reward.
Visual-based Dialogue Strategies Optimization	Maximizing the information gain while asking questions with a RL paradigm for explicit dialogue goals.
Pre-trained Vision Language Model-based VAD	Training unified Transformer encoder initialized by BERT with two visual training objectives.
Pre-trained Vision Language Model-based VAD	Utilizing GPT-2 to capture cross-modal semantic dependencies.
Unique Training Schemes-based VAD	Simulating Dual-coding theory of human cognition to adaptively find query-related information from the image.
Unique Training Schemes-based VAD	Asking questions to confirm the conjecture of models about the referent guided by human cognitive literature.

(c) Ground-truth table of the second pair of example.

ID	Method Used	Dataset	Problem Addressed	Performance Metric	Results Achieved	Model Type
5677543	Attention memory model	VisDial	Visual dialog with reference resolution	Answer prediction accuracy	16% improvement over state-of-the-art	Generative
54446647	Recursive Visual Attention mechanism	VisDial v0.9	Visual co-reference resolution	Mean Rank	State-of-the-art performance	Generative
236478107	Multimodal transformer with visual grounding	VisDial v0.9 and v1.0	Visual dialogue generation	BLEU	Achieves new state-of-the-art results	Generative
24537813	Adversarial learning with co-attention	VisDial	Visual dialog generation	Recall@5	+2.14% improvement over the previous best	Generative
196180698	Goal-oriented question generation model	GuessWhat?!	Goal-oriented visual dialogue	Accuracy	67.19% on GuessWhat?!	Generative
216562638	Vision-dialog transformer architecture	VisDial v0.9 and v1.0	Visual dialog	NDCG	New state-of-the-art performance	Generative and Discriminative
220045105	GPT-2 based architecture	AVSD	Video-grounded dialogue	BLEU	Outperforms existing approaches	Generative
208138178	Adaptive dual encoding framework	VisDial	Visual dialogue	State-of-the-art results	Generative	2023
237491596	Beam search re-ranking algorithm	GuessWhat?!	Referential guessing games	Task accuracy	+4.35% improvement with re-ranking	Generative

(d) Generated table of the second pair of example.

Table 9: Case studies on the generation of literature review tables in ARXIV2TABLE.