A Survey on Table Question Answering: Recent Advances

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1. Introduction

Given the user's question, table QA aims to provide precise answers through table understanding and reasoning. For example, Figure 1 illustrates the question answering over the tables from airline



4. Complement Part 4.1 preliminaries The Composition of Tables: We refer two additional elements called pre-annotation and post-annotation as supplement

industry.

)	uestion:	What	was	the re	ported	mainline	RPM	for	American	Airlines	in	2017?
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Table 1.	Year Ended December 31.					
	2017	2016	2015			
Mainline						
Revenue passenger miles $(millions)^{(a)}$	201,351	$199,\!014$	$199,\!467$			
Available seat miles $(millions)^{(b)}$	$243,\!806$	$241,\!734$	$239,\!375$			
Passenger load factor $(percent)^{(c)}$	82.6	82.3	83.3			

Fig. 1. An illustration example of table QA. The bold number (201,351) is the target answer.

2. Overview of Dataset

As shown in Table 1, most of the datasets are closed-domain, and their question type is factoid.

Table 1. An overview of table QA datasets. The representative methods without marks (e.g. $\dagger \bigstar \ddagger$) can be used on the datasets aligned in the same horizontal zone, and the methods with marks are currently adopted on the datasets with the same mark.

	Dataset	Closed -Domain	Question Type	Representative Methods		
	WTQ \star [24]	Yes	Factoid	Semantic-parsing-based		
	SQA * \bigstar [14]	Yes	Factoid	[5,6,7,10,13,14,19,22,24]		
Table	WikiSQL \bigstar [31]	Yes	Factoid	[25,26,27,28,29,31]		
-Only	Spider [30]	Yes	Factoid	Matching-based method ⁺		
	HiTab $[4]$	Yes	Factoid	[9]		
	AIT-QA† \star [16]	Yes	Factoid	Extractive method \Rightarrow [12]		
	FeTaQA[21]	Yes	Free form	Generative method [21]		
	FinQA [3]	Yes	Factoid	Semantic parsing-based[3]		
Non	TAT-QA [33]	Yes	Factoid	Extractive methods [2832]		
-table	HybridQA $[2]$	Yes	Factoid	Extractive methods [2,0,55]		
-only	TabMCQ $[15]$	Yes	Multiple choice	Matching-based methods		
	GeoTSQA [18]	Yes	Multiple choice	[15, 18]		
	OTTQA [1]	No	Factoid	Retriever-reader-based		
	NQ-tables $[11]$	No	Factoid	methods [1,11,17,23,32]		

3.2 Semantic-Parsing-Based Methods In table QA tasks, the semantic-parsing-based methods first transform the question into a logical form (e.g., SQL), and then execute the logical form on tables to retrieve the final answer.

		Semantic-Parsi Based Method	ng- ds	
	Weakly-Supervised		Fully-Sup	ervised
Maximum Marginal Likelihood	Reinforcement Learning	Maximum Margin Reward	Generation-Based Methods	Sketch-Based Methods

Fig. 3. The overview of semantic-parsing-based methods for table QA

parts of a table. Specifically, pre/post-annotation refers to the related sentences that appear before or after a table. Semantic Parsing: Semantic parsing refers to transforming the natural language utterance into a logical form that can be executed by machines. One of classical semantic parsing tasks is text2sql, which converts the natural language utterances into structured query language (SQL). KBQA, text-based QA and table QA: KBQA is conducted over knowledge base, which is regarded as a kind of structured knowledge, textbased QA is conducted over unstructured text, and table QA is conducted over nondatabase tables which are regarded as semi-structured knowledge, as well as over database tables which are relatively structured.

4.1 Future Directions Numerical Representation for Table QA: Dedicated num-erical representation might be a key factor for nondatabase ta-ble QA.it is an interesting chal-lenge to incorporate better numerical representations into table QA models. **Complex Reasoning in Non**database Table QA: Most existing methods for nondatabase table QA only support simple reasoning. For example, TAGOP [51] only support one-step operation, FinQANet [7] supports nested operations but limited to four basic arithmetics. Hence, future works include how to design a more general logical form that could support complex reasoning on most non-database table QA tasks.

3. Existing Methods for Table QA

We classify existing methods for table QA into five categories according to their techniques, which include semanticparsing-based, generative, extractive, matching-based, and retriever-reader-based methods.

3.1 Matching-Based Methods

Matching-based models usually process the question and each fragment of the table (e.g., row, cell) individually, and predict the matching score between them.

3.3 Generative Methods

The main difference between generative methods and Seq2Seq semantic-parsing-based methods is that the former does not generate the logical form, but instead generates the answer directly.

3.4 Extractive Methods

Rather than generating the answer through a decoder, extractive methods directly select or extract the token spans from the linearized table as candidate answers or evidences. *3.5 Retriever-Reader-Based Methods*

It is usually adopted for open-domain table QA, which provides answers by retrieval and reading. The retrieval model is in charge of retrieving the related documents containing tables from a large corpus, and the reader is used to produce the answers from the retrieved table documents.

	Retriever		Rea	der
Sparse Retriever	Dense Retriever	Iterative Retriever	Extractive Reader	Generative Reader

Fig. 4. The category of retriever and reader

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