Heuristics-Driven Link-of-Analogy Prompting Document-Level Event Argument Extraction

- In-context learning (ICL) 抽取论元的问题
 - 选取哪些样例对抽取 论元有帮助?
 - 事件类型、论元类型 多,样例只能覆盖很 小的集合
 - CoT 难以用于非推理 任务(多步 **→** 单步)

StrategyQA

Q: Would a moose hypothetically be too much for a minotaur to devour whole? A: A moose is about 1,000 pounds. A minotaur is about 1,000 pounds. Thus, a moose would be too much for a minotaur to devour whole. So the answer is yes.

Math Word Problems

Q: Ali had a collection of seashells. He started with 180 seashells. He then gave away 40 seashells to his friends. He also gave 30 seashells to his brothers. If he sold half of the remaining seashells, how many seashells did he have left?

A: He started with 180 seashells. He gave away 40 to his friends and 30 to his brothers. That means he gave away 40 + 30 = 70 seashells. He has 180 - 70 = 110 seashells left. He sold half of them, so he has 110 / 2 = 55 seashells left. The answer is 55.

Document-Level EAE

D: a given document

Q: What is the giver in the document?

A: In the document, "Qataris" donated millions to the Cliton Foundation. So the giver is "Qataris".

Natural Language Inference

Q: "A woman wearing all white and eating, walks next to a man holding a briefcase."

Based on this premise, can we conclude the hypothesis "A female is next to a man." is true?

OPTIONS:

- yes
- no
- it is not possible to tell

A: A woman is another word for a female. The answer is yes.

In-context examples 背后的抽象规则

Document-Level EAE

Document:

Q: What is the giver in the document?

A: In the document, "Qataris" donated millions to the Cliton Foundation. So the [giver] is "Qataris".

Document:

Q: What is the giver in the document?

A: "Kremlin" is the subject of "funded" in "Kremlin funded environmental groups". So the [giver] is "Kremlin".

.....

StrategyQA

Q: Would a moose hypothetically be too much for a minotaur to devour whole?

A: A moose is about 1,000 pounds. A minotaur is about 1,000 pounds. Thus, a moose would be too much for a minotaur to devour whole. So the answer is yes.

Q: Yes or no: Is H's most common two letter pair partner a freebie in Wheel of Fortune bonus round?

A: The most common two letter pair partner for H is E. E is a freebie in the Wheel of Fortune bonus round. Thus, H's most common two letter pair partner is a freebie. So the answer is yes.

.

Implicit Heuristics

Semantic heuristic: "Giver" is the person, group, or organization in the document that gives the grant or gift.

Subject-verb-object heuristic: "Giver" may be the subject of a verb that indicates the act of giving, or granting.

.....

Implicit Heuristics

Comparison heuristic: comparing the weight of a moose and a minotaur to make a conclusion about the feasibility of consumption.

Knowledge-based heuristic: using known facts about a game show's rules to answer the question.

.

LLM 从样例中学习:

- 识别隐式规则
- 将规则用于推理

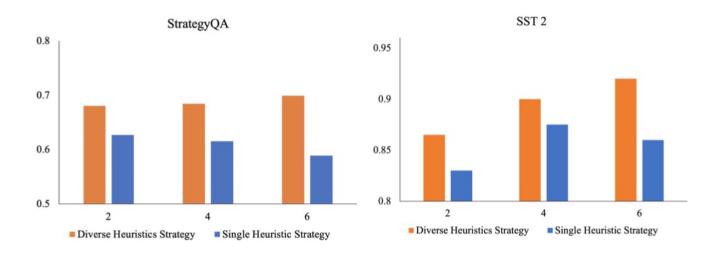


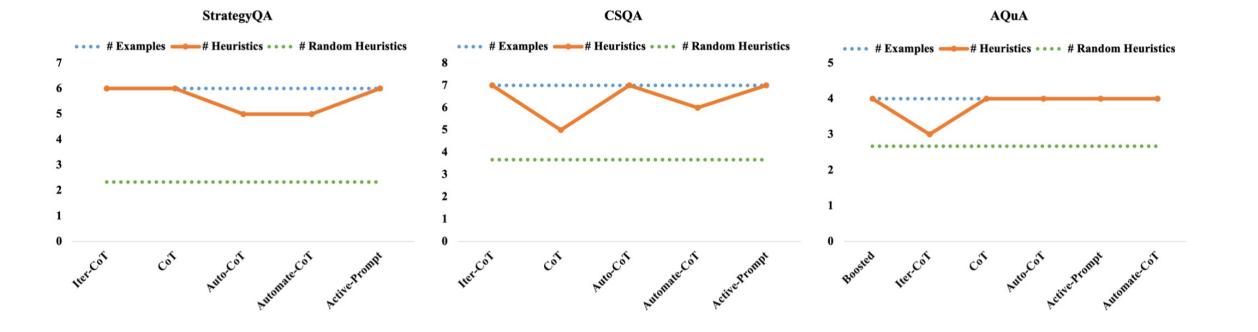
直接基于规则推理

LLM 的样例学习

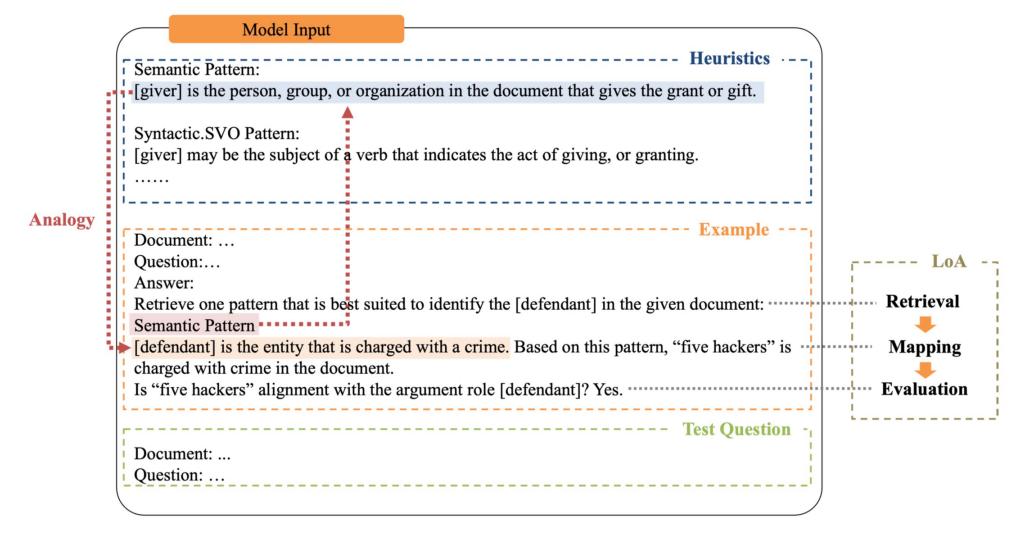
- 选取包含规则的代表性样例
 - GPT-4 识别背后的规则 (??)

• 规则的多样性





完整框架



Heuristics-Driven Link-of-Analogy Prompting: Enhancing Large Language Models for Document-Level Event Argument Extraction

What is the most critical and profound heuristic at play in each of the following examples? If any two examples share the same heuristic, please indicate this connection. Use no more than two sentences to illustrate the heuristics of each example.

example 1

Q: Did the death of Helen Palmer have a significant effect on Dr. Seuss?

A: Helen Palmer was Dr. Seuss's wife. The death of a spouse can have a significant effect on a person. Thus, the death of Helen Palmer could have a significant effect on Dr. Seuss. So the answer is yes.



Example 1: This employs the "empathetic reasoning" heuristic, assuming that because most people would be significantly affected by the death of a spouse, so too would Dr. Seuss.

Instruction: Your task is Event Argument
Extraction. In this task, you will be provided
with a document that describes an event. Your
job is to extract and quote the entities
(event arguments) from the document that
correspond to each argument role associated
with the event.

Specifically, you will use the patterns in the "Pattern List" below to identify event arguments. The answers should also satisfy the "Argument Format Principle" and "Argument Number Principle" below.

Structured Information for Explainable Multi-hop QA and Reasoning

Model Input

Documents:

Wikipedia Title: Anne

Anne loves She was the daughter of Jean ...

Wikipedia Title: Jean

Jean was great-grandson of Louis. He is also the third son and youngest child of Robert and ... Both Jean and Robert were taught by Philips.

Q: Answer the following question step-by-step. Who is the teacher of Anne's paternal grandfather?

Model Input

Documents:

Wikipedia Title: Anne

Anne loves She was the daughter of Jean .

Wikipedia Title: Jean

Jean was great-grandson of Louis ... He is also the third son and youngest child of Robert and ... Both Jean and Robert were taught by Philips.

Semantic Structure:

- <Anne, daughter, Jean>
- <Jean, youngest child, Robert>
- <Jean, great-grandson of, Louis>
- <Robert, taught by, Philips>

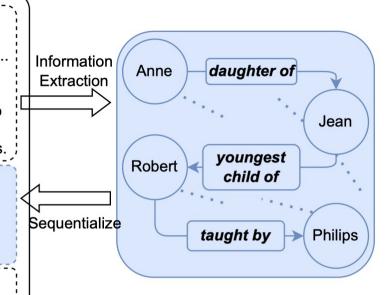
Q: Answer the following question step-by-step. Who is the teacher of Anne's paternal grandfather?

Model Output

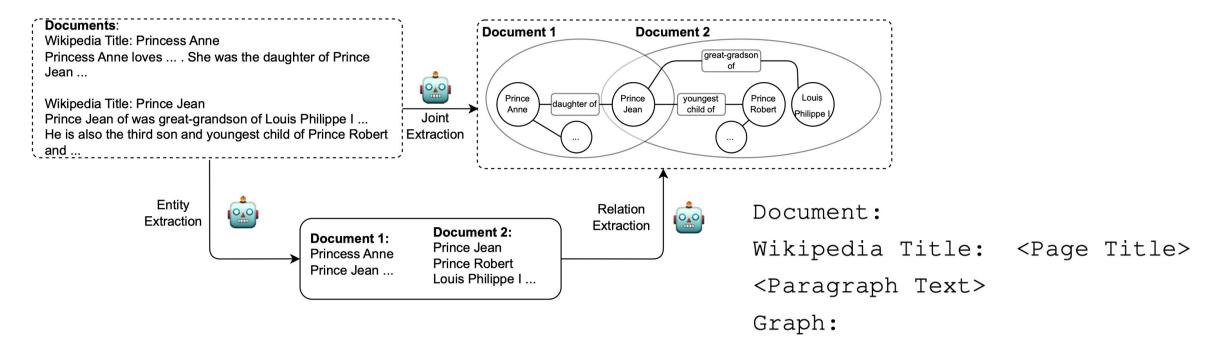
A: Anne was the daughter of Jean. Jean was the youngest child of Robert. Therefore, Robert is the paternal grandfather of Anne. Robert was taught by Philips. So the answer is: Philips.

Model Output

A: Anne was the daughter of Jean. Jean was the youngest child of Robert. Robert was the great-grandson of Louis. The document does not say who taught Louis. So the answer is: unknown.



Entity and Relation Extraction



```
Document:
```

Wikipedia Title: <Page Title>

<Paragraph Text>

Entities:

Document:

Wikipedia Title: <Page Title>

<Paragraph Text>

<Entity 1>\n ... \n<Entity k>

Graph:

实验结果

	EM	F1	Precision	Recall	EM	F1	Precision	Recall
Methods	HotpotQA				2WikiMultiHopQA			
Base	0.59	0.733	0.745	0.779	0.43	0.532	0.501	0.724
G-Full prompt	0.62	0.763	0.777	0.813	0.46	0.565	0.534	0.757
SG-Multi prompt	0.64	0.785	0.791	0.849	0.49	0.601	0.573	0.772
SG-One prompt	0.61	0.749	0.741	0.823	0.47	0.579	0.563	0.748

	F1	Precision	Recall	F1	Precision	Recall	
Methods		CoT Setting	5	Few-shot Setting			
Base	0.716	0.729	0.830	0.6280	0.5970	0.7821	
G-Full prompt	0.714	0.732	0.805	0.6065	0.5910	0.7802	
SG-Multi prompt	0.728	0.731	0.872	0.5925	0.5596	0.8205	

优点

- 忠于原文
- 推理更准确

Wikipedia Title: Marcel (song)

"Marcel" was the German entry in the Eurovision Song Contest 1963, performed in German by Heidi Brühl ...

Wikipedia Title: Heidi Brühl Heidi Rosemarie Brühl (30 January 1942 in Gräfelfing, Upper Bavaria – 8 June 1991 in Starnberg) was a German singer and actress [...]

Graph:

("Marcel", performed by, Heidi Brühl) (Heidi Rosemarie Brühl, was born in, Gräfelfing) (Gräfelfing, located in, Upper Bavaria) ...

Question:

What is the place of birth of the performer of song Marcel (Song)?

Reasoning chian (base prompt):

The performer of the song "Marcel" is Heidi Brühl. According to the Wikipedia page about Heidi Brühl, she was born in Gräfelfing, Upper Sing in Germany. So the answer is: Germany Sing.

Reasoning Chain (SG-One prompt):

The performer of the song Marcel is Heidi Brühl. Heidi Rosemarie Brühl was born on January 30, 1942, in Gräfelfing, which is located in Upper Bavaria. So the answer is: Gräfelfing, Upper Bavaria.

Documents:

Wikipedia Title: Princess Anne of Orléans
Princess Anne of Orléans ... She was the daughter of
Prince Jean, Duke of Guise and Princess Isabelle of
Orléans.

Wikipedia Title: Prince Jean, Duke of Guise
Prince Jean of Orléans, Duke of Guise [...], was the
third son and youngest child of Prince Robert, Duke of
Chartres (1840 – 1910), grandson of Prince Ferdinand
Philippe and great-grandson of Louis Philippe I, King of
the French. ...

Graph:

(Princess Anne of Orléans, daughter of, Prince Jean) (Prince Jean, was, grandson of Prince Ferdinand Philippe)

(Prince Jean, was, great-grandson of Louis Philippe I)

Question:

Who is the paternal grandfather of Princess Anne Of Orléans?

Documents:

Wikipedia Title: Princess Anne of Orléans

Princess Anne of Orléans ... She was the daughter of
Prince Jean, Duke of Guise and Princess Isabelle of
Orléans.

Wikipedia Title: Prince Jean, Duke of Guise Prince [...] youngest child of Prince Robert, Duke of Chartres[...] Philippe and great- grandson of Louis Philippe I, [...]

Question:

Who is the paternal grandfather of Princess Anne Of Orléans?