Tonmoy et al (2024): A Comprehensive Survey of Hallucination Mitigation Techniques in Large Language Models

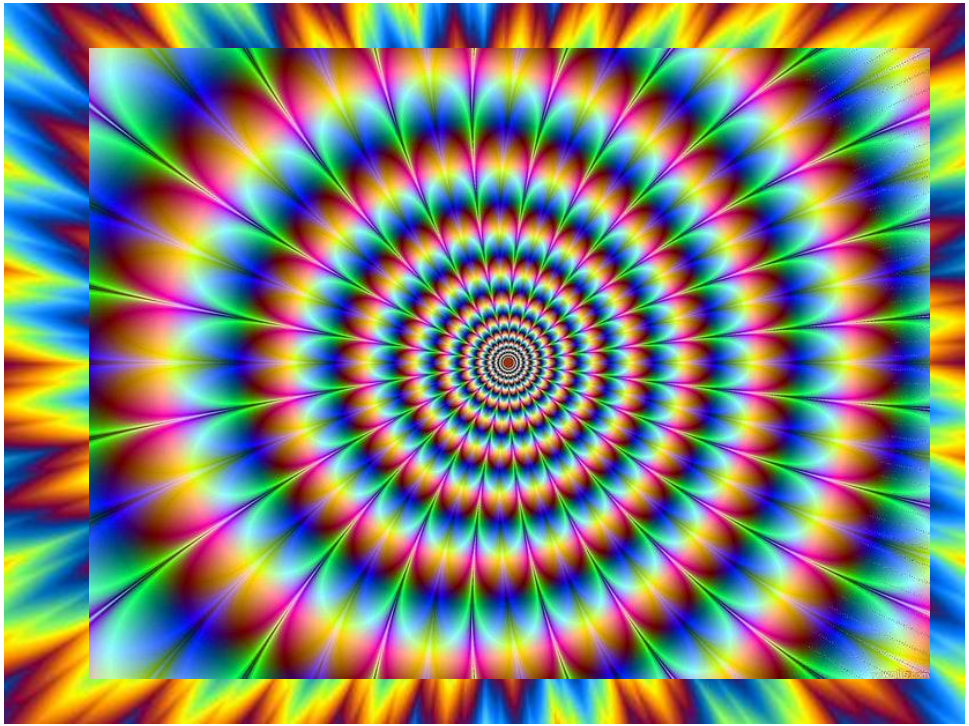
Presented by: Kristýna Klesnilová

LLMs Hallucinations

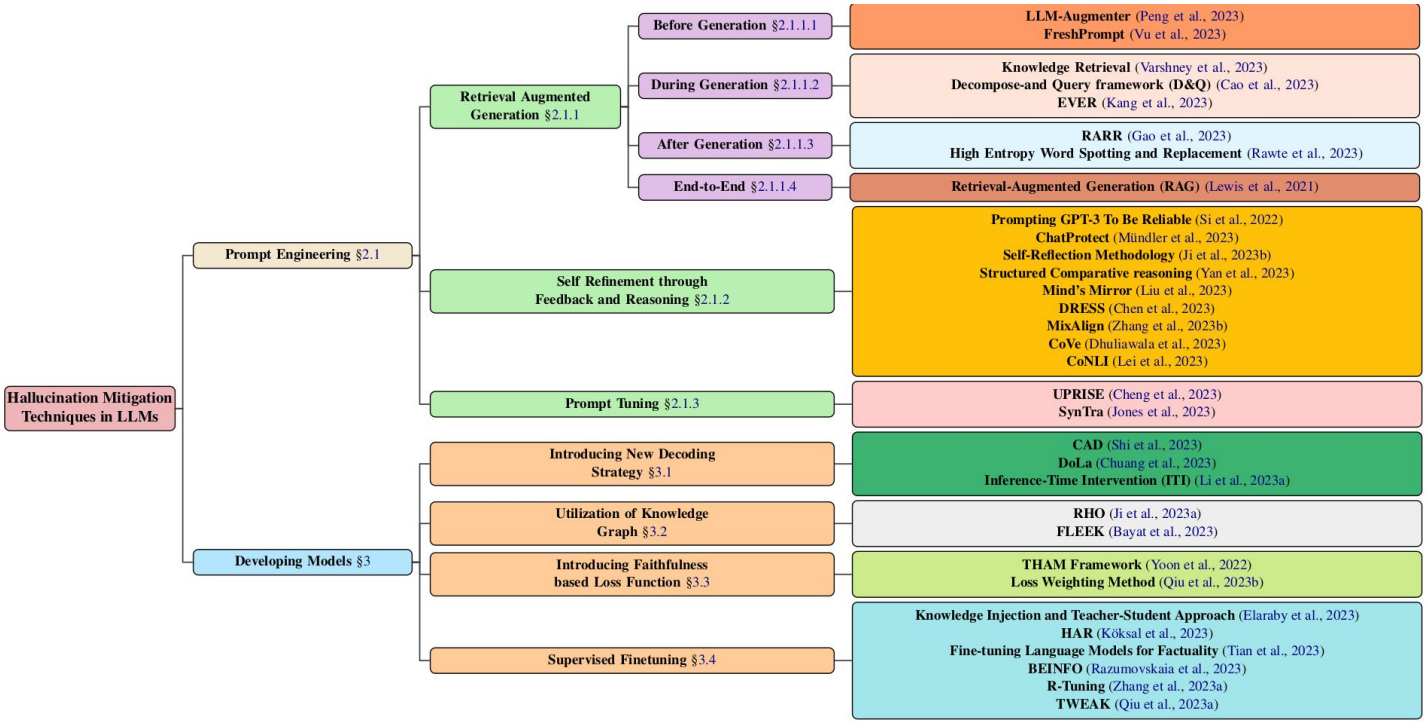
- Generating ungrounded content that appears factual

- Problematic areas:
  - Legal
  - Medical
  - Financial
  - ...

- Causes
  - Training method
  - Absence of real-time internet updates



Hallucination Mitigation Techniques



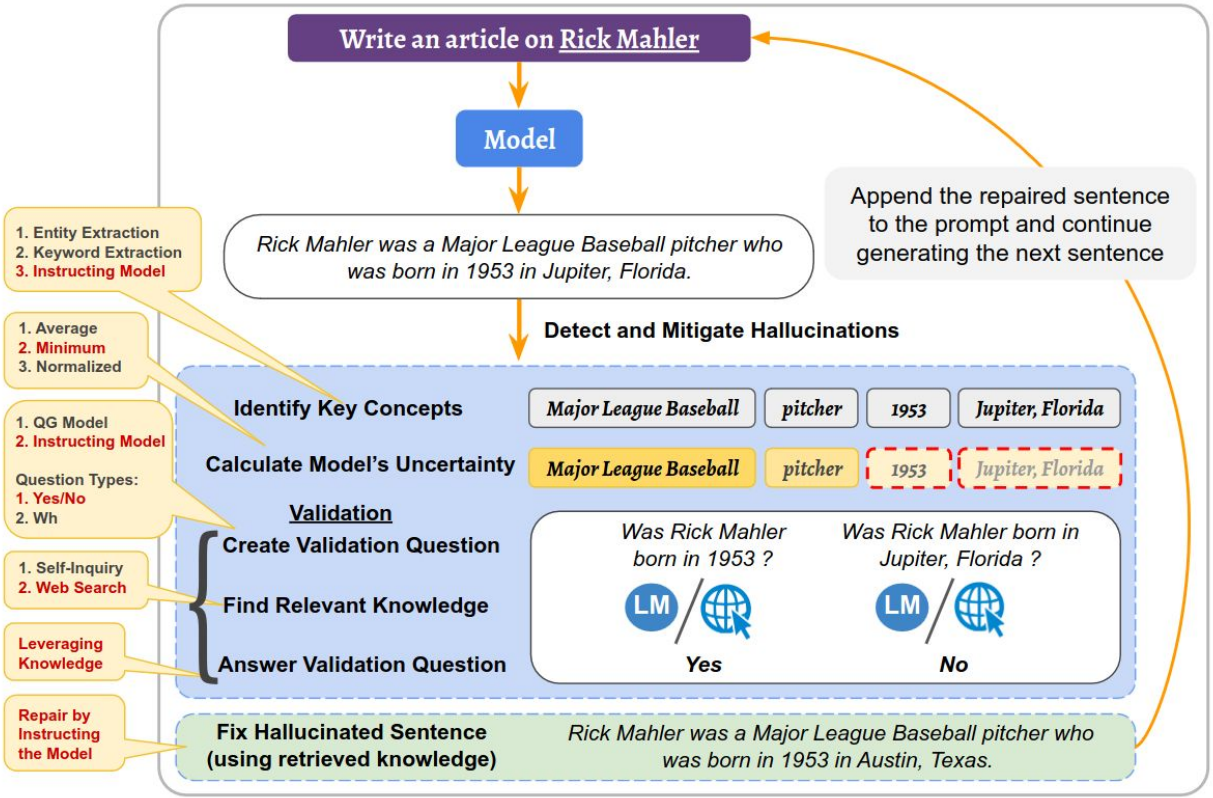
Prompt Engineering

Prompt Engineering: Retrieval Augmented Generation

- Before Generation
  - Retrieving external knowledge and adding it to LLM prompt

- During Generation
  - Retrieving external knowledge at sentence-by-sentence level

Knowledge Retrieval

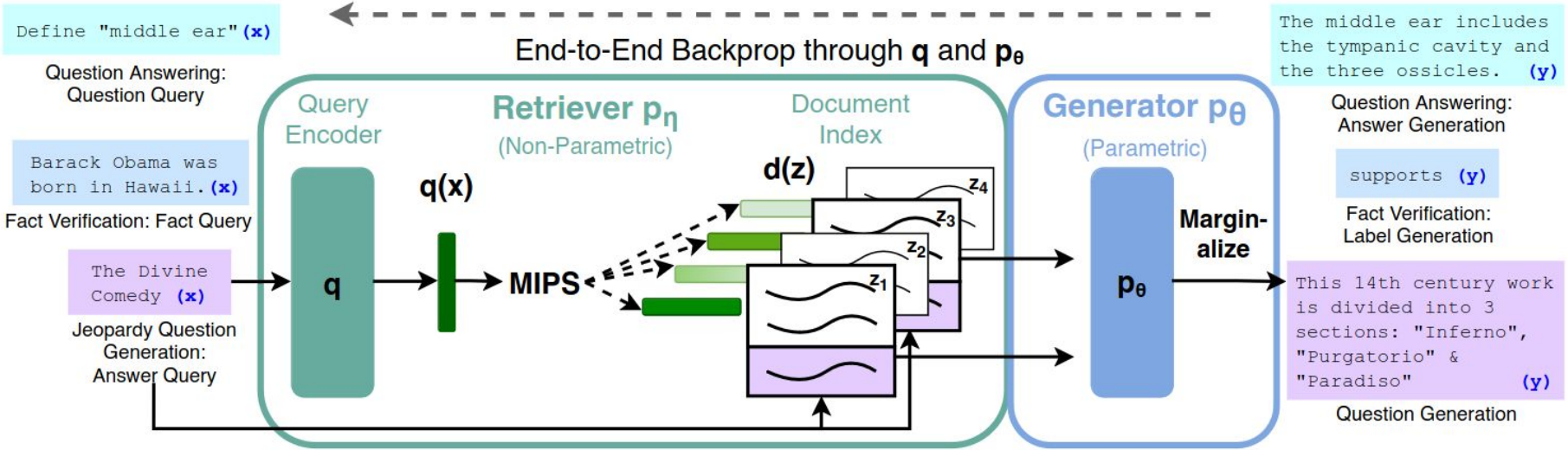


Prompt Engineering: Retrieval Augmented Generation

- After Generation
  - Post-editing LLM output with retrieved external knowledge
  - Replacing high-entropy words or phrases (open-source LLMs)

- End-to-End
  - RAG
    - Generator (seq2seq transformer) and document retriever trained jointly end-to-end

End-to-End RAG



Prompt Engineering: Self-refinement through feedback + reasoning

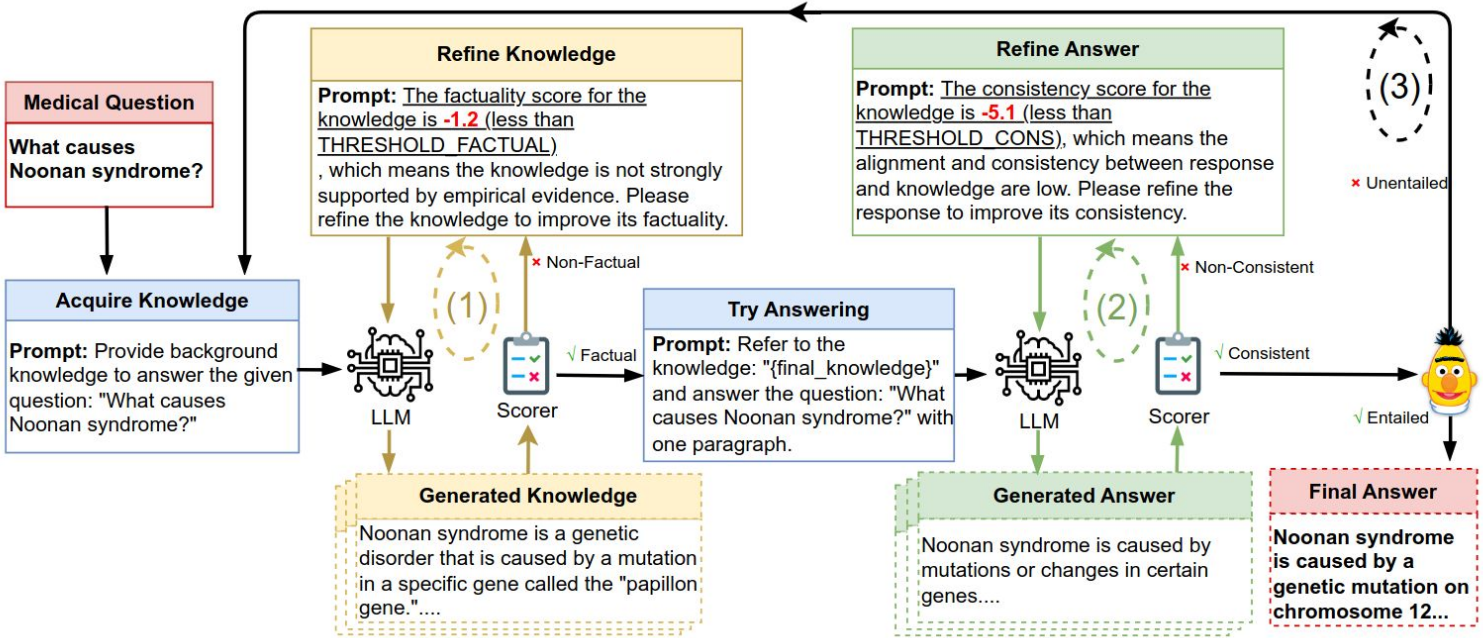
- Prompting strategies
  - Improving reliability
  - Detecting and mitigating self-contradictions through reasoning

- Improving through iterative feedback
  - Generate-score-refine loop

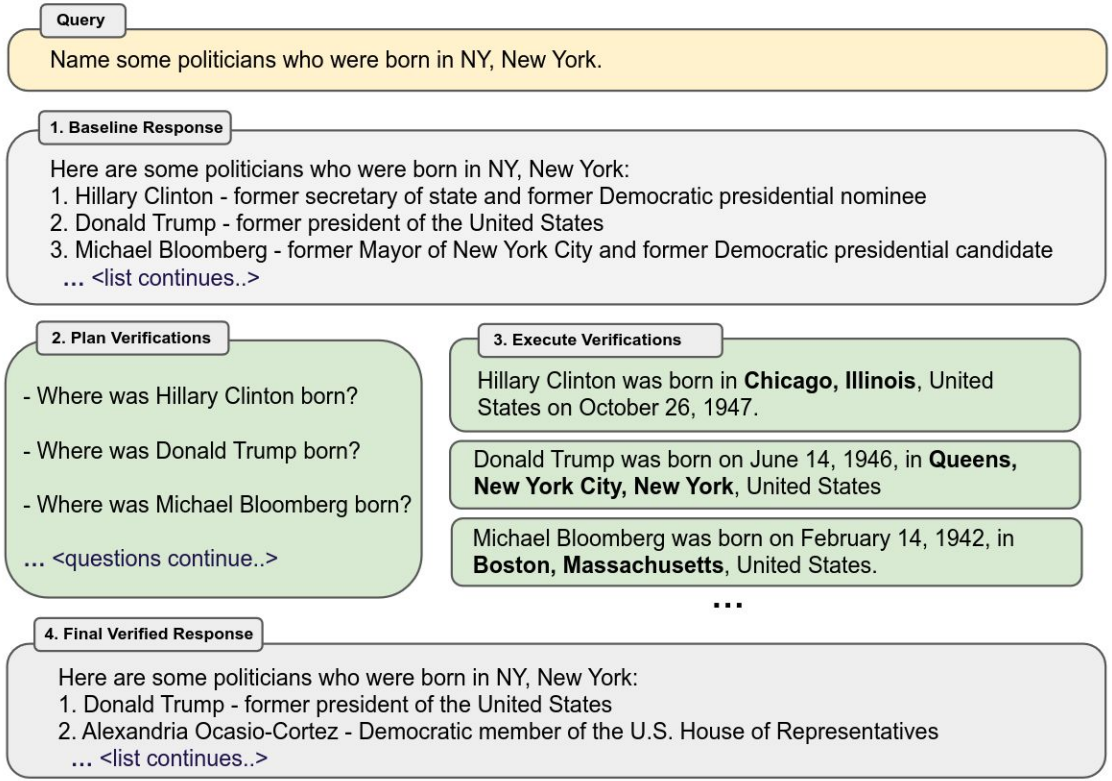
- Chain-of-Verification (CoVe)
  - Automatic fact-checking through verification questions

- Chain of Natural Language inference (CoNLI)

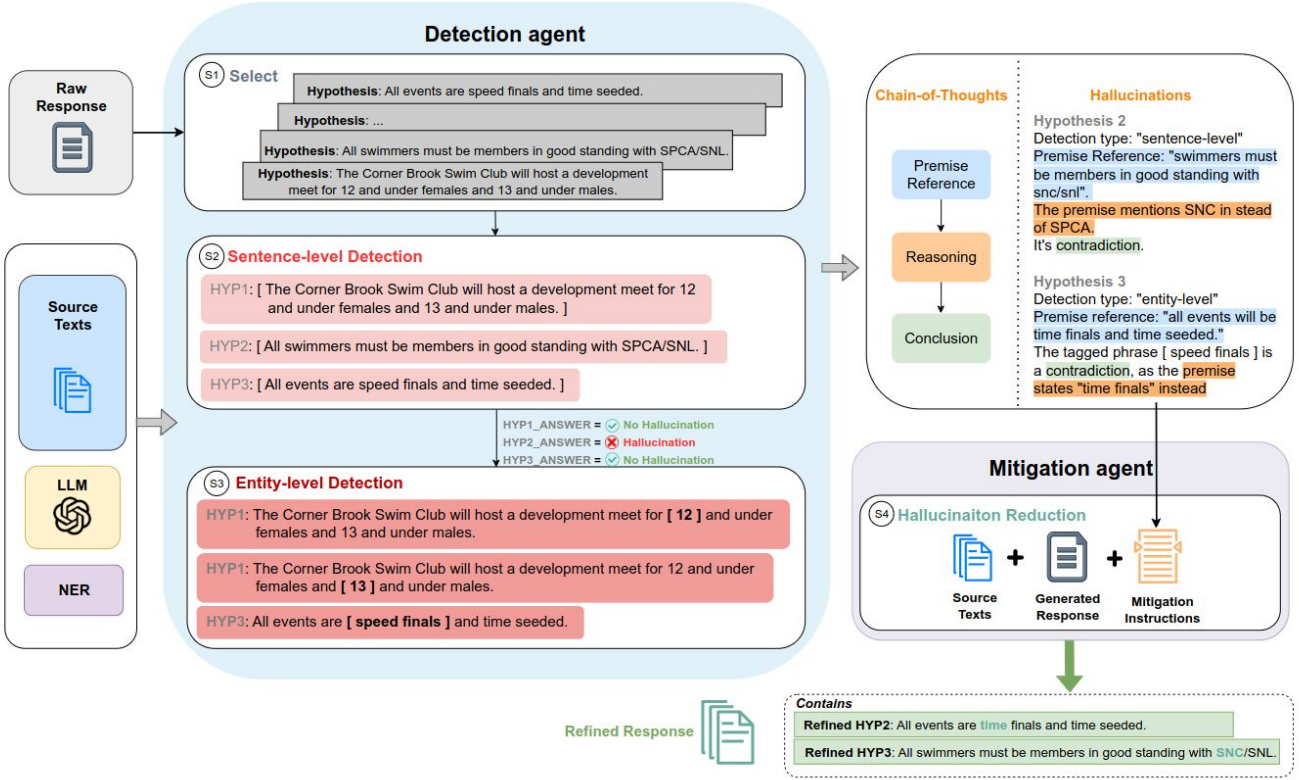
Self-Reflection



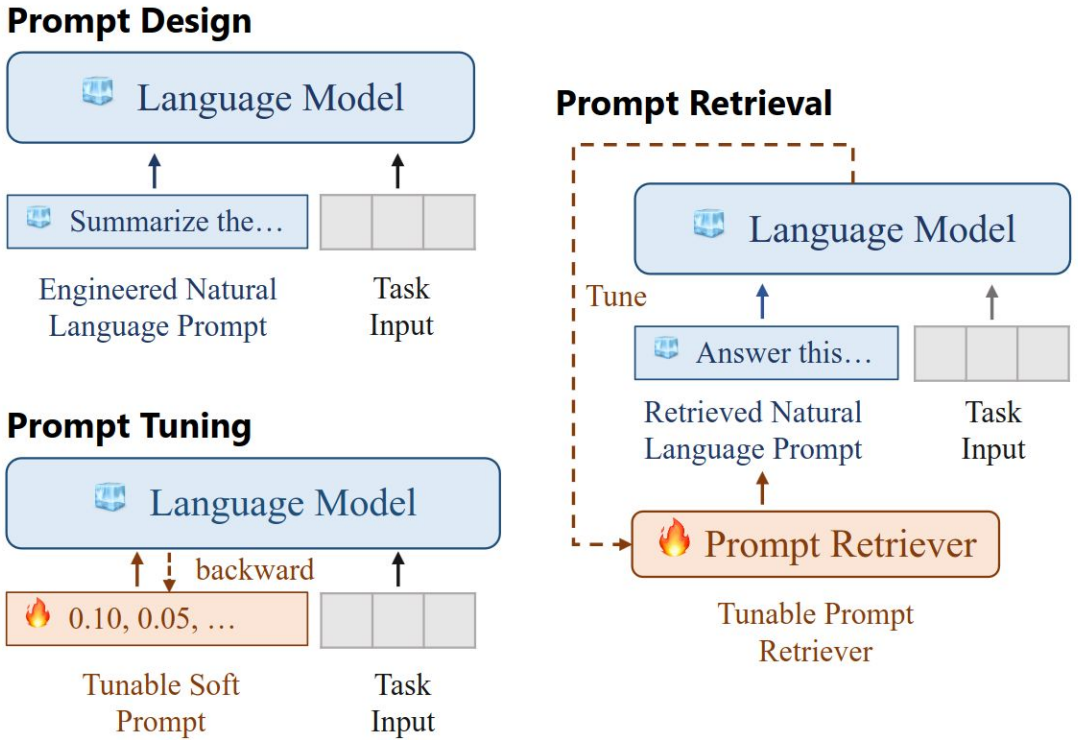
Chain-of-Verification (CoVe)



Chain of Natural Language inference (CoNLI)

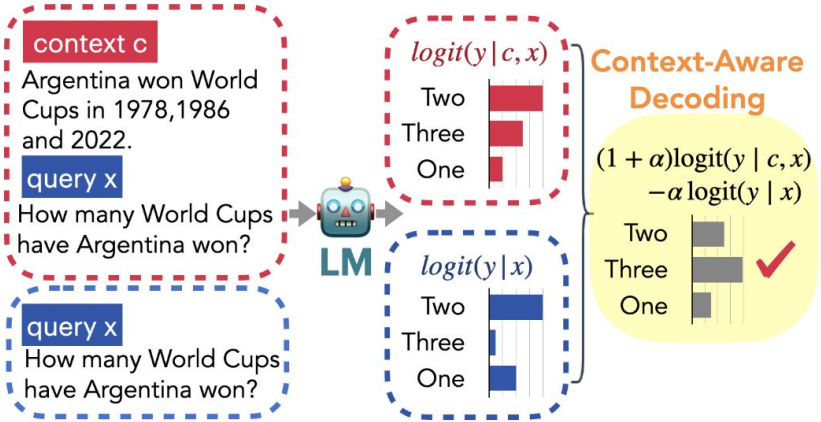


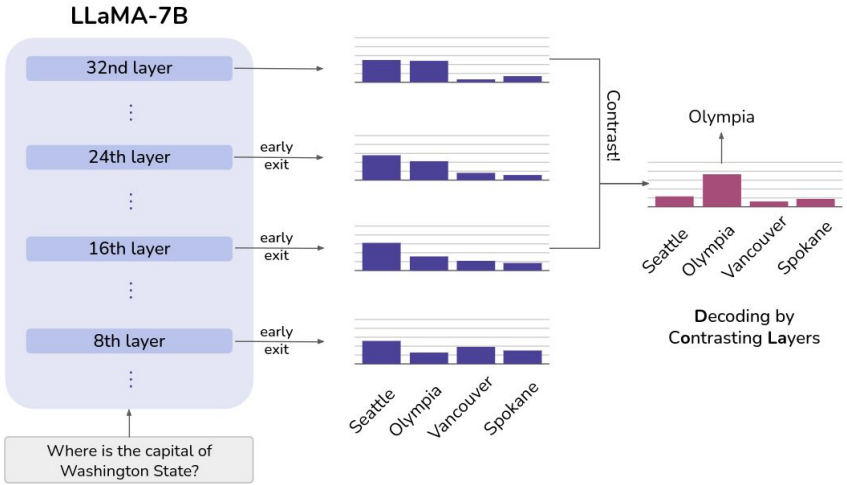
Prompt Engineering: Prompt Tuning



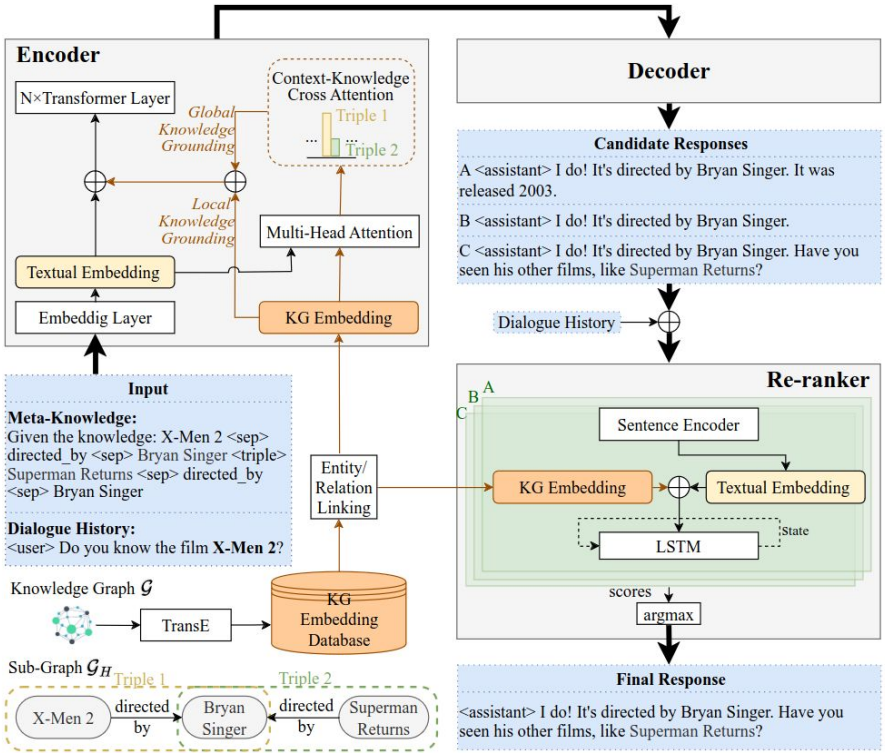
Developing Models

Developing Models: New Decoding Strategy





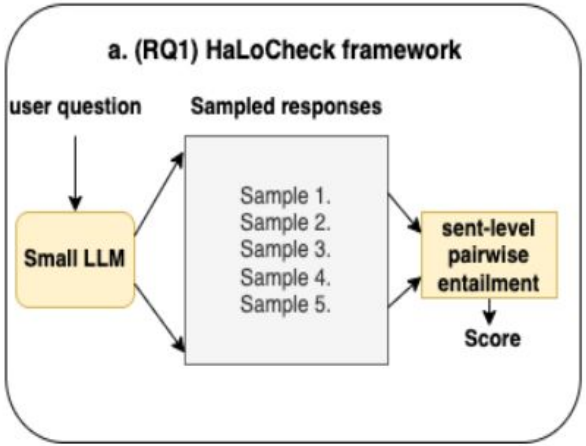
Developing Models: Utilization of Knowledge Graph

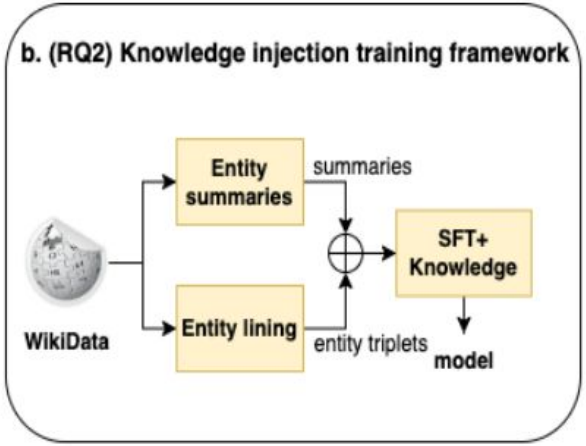


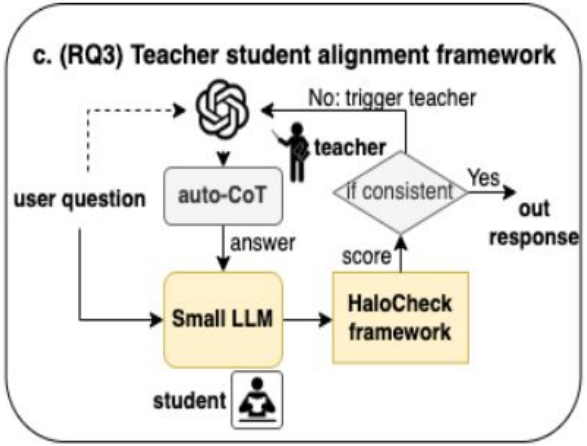
Developing Models: Introducing faithfulness based loss function

- Designing new metrics
  - How closely model's outputs match input data or ground truth labels

Developing Models: Supervised fine-tuning (SFT)







Developing Models: Supervised fine-tuning (SFT)

A question from TriviaQA

Question: Who is the author of the fiction books Lace (published in 1982), Lace 2 (1985), Savages (1987), Crimson (1992), Tiger Eyes (1994), Revenge of Mimi Quinn (1998) and The Amazing Umbrella Shop (1990)?

↓

Hallucination Augmented Recitation (HAR)

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Document: Judy Blume has written many novels, including Forever, Tiger Eyes, Are You There God? It's Me, Margaret, Freckle Juice, and Blubber, which are popular among young women. Her books are so popular, that they have been translated into 31 different languages. She is the author of the fiction books Lace (published in 1982), Lace 2 (1985), Savages (1987), Crimson (1992), Tiger Eyes (1994), Revenge of Mimi Quinn (1998) and The Amazing Umbrella Shop (1990). She has also written many other books for children and adults. She is the recipient of the Library of Congress Living Legends award.
Answer: Judy Blume
(Shirley Conran)

Developing Models: Supervised fine-tuning (SFT)