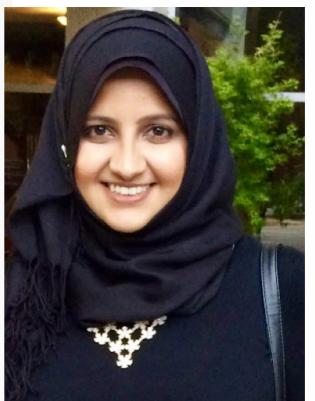
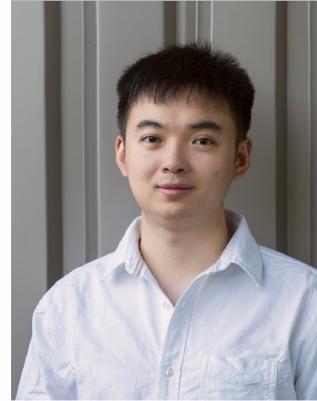


EMNLP 2021 Tutorial

Knowledge-Enriched Natural Language Generation



Wenhao Yu¹,

Meng Jiang¹,

Zhitong Hu²,

Qingyun Wang³,

Heng Ji³,

Nazneen Rajani⁴

1 University of Notre Dame 2 University of California San Diego

3 University of Illinois at Urbana-Champaign 4 Salesforce Research

This part: General principles and methodologies for integrating knowledge into NLG

Overview:

- Knowledge-enhanced **model architectures**
 - Attention/copy mechanisms
 - Graph neural models
- Knowledge-enhanced **learning**
 - Auxiliary **loss/tasks**
 - Reinforcement learning with knowledge-informed **rewards**
 - Learning with knowledge **constraints**
- Knowledge-enhanced **inference**
 - Steered decoding
 - Prompts

Knowledge-enhanced inference



- Integrate knowledge during the text decoding process
- Can be applied to pretrained language models (e.g., GPT-2/3, T5) for knowledge-enhanced NLG

Inference (I): Steered decoding

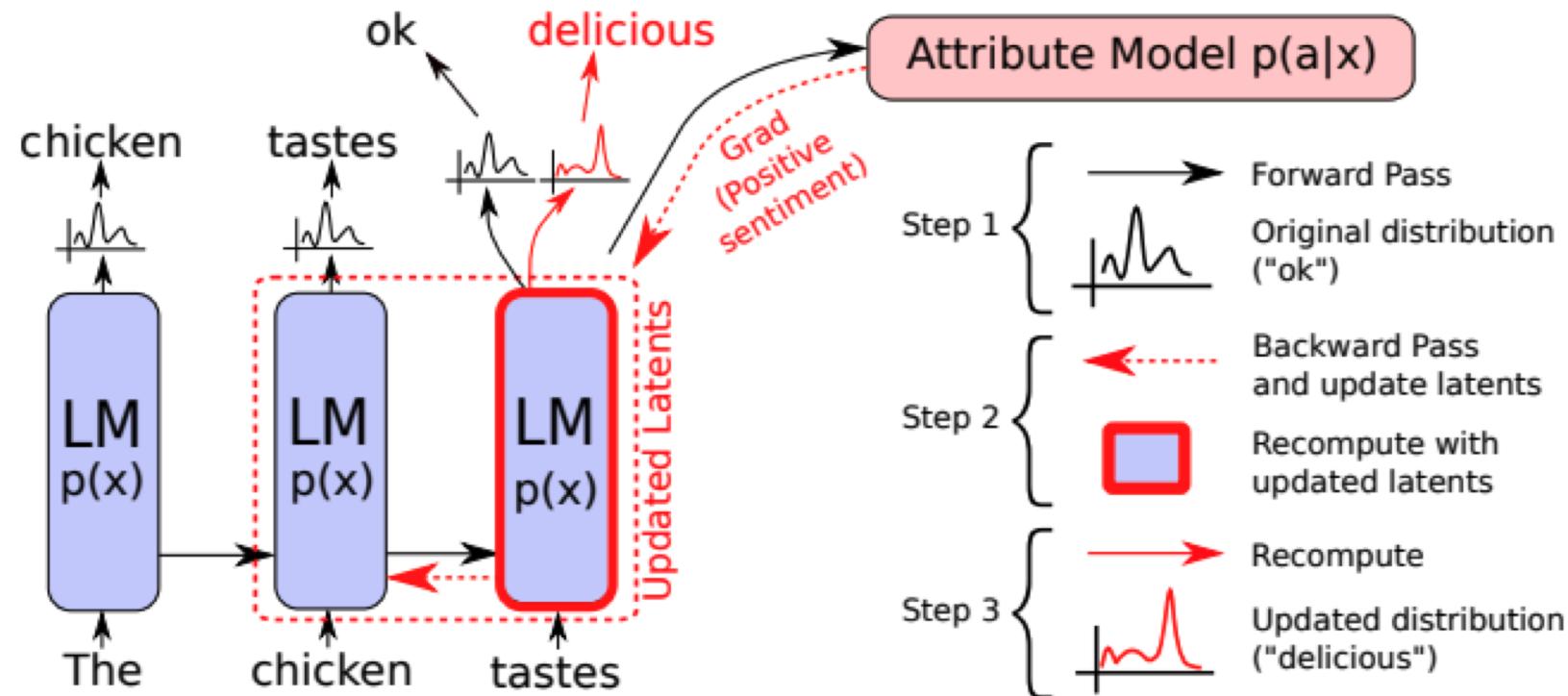


- Guide the decoding by changing the generation distribution
- Controlling LMs with another (relatively smaller) model trained for desired attributes
- Examples: PPLM, GeDi, DeLorean, DExperts, FUDGE, MoFE

Inference (I): Steered decoding



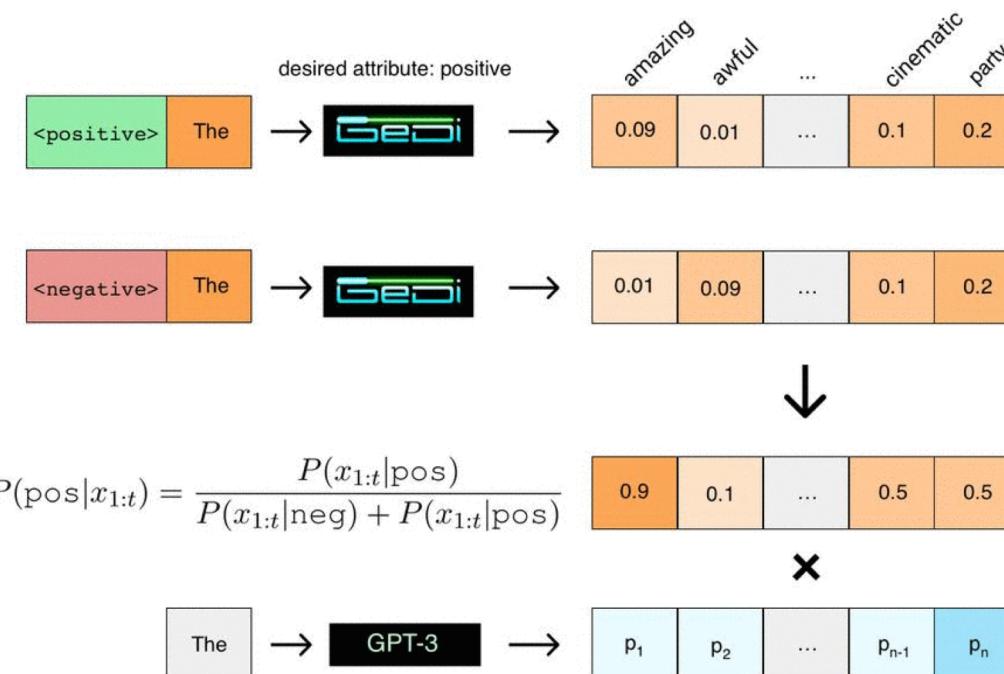
- Use a single-layer discriminative classifier as the guide



Inference (I): Steered decoding



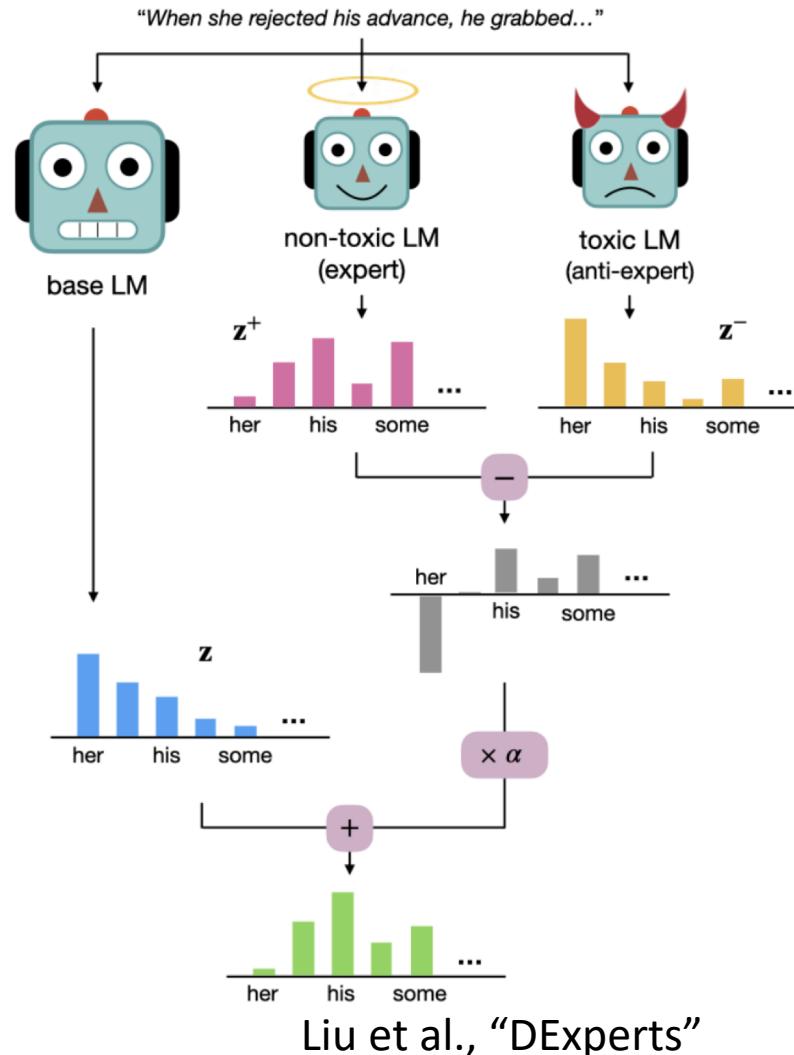
- Use another LM as a generative discriminator to guide decoding
- Examples: GeDi (Krause et al., '20) and FUDGE (Yang et al., '21)



Inference (I): Steered decoding



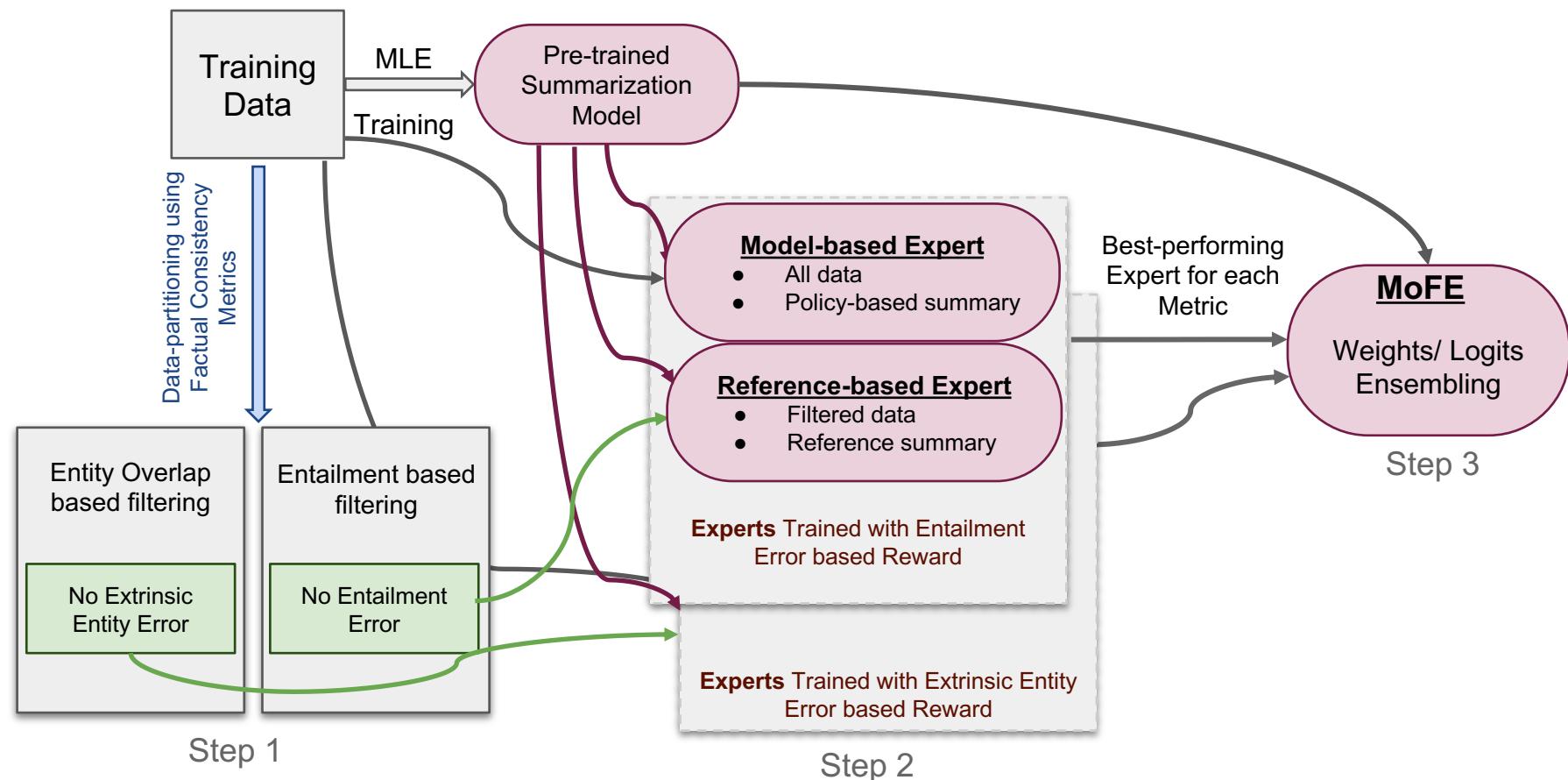
- Use two LMs to constrain decoding



Inference (I): Steered decoding



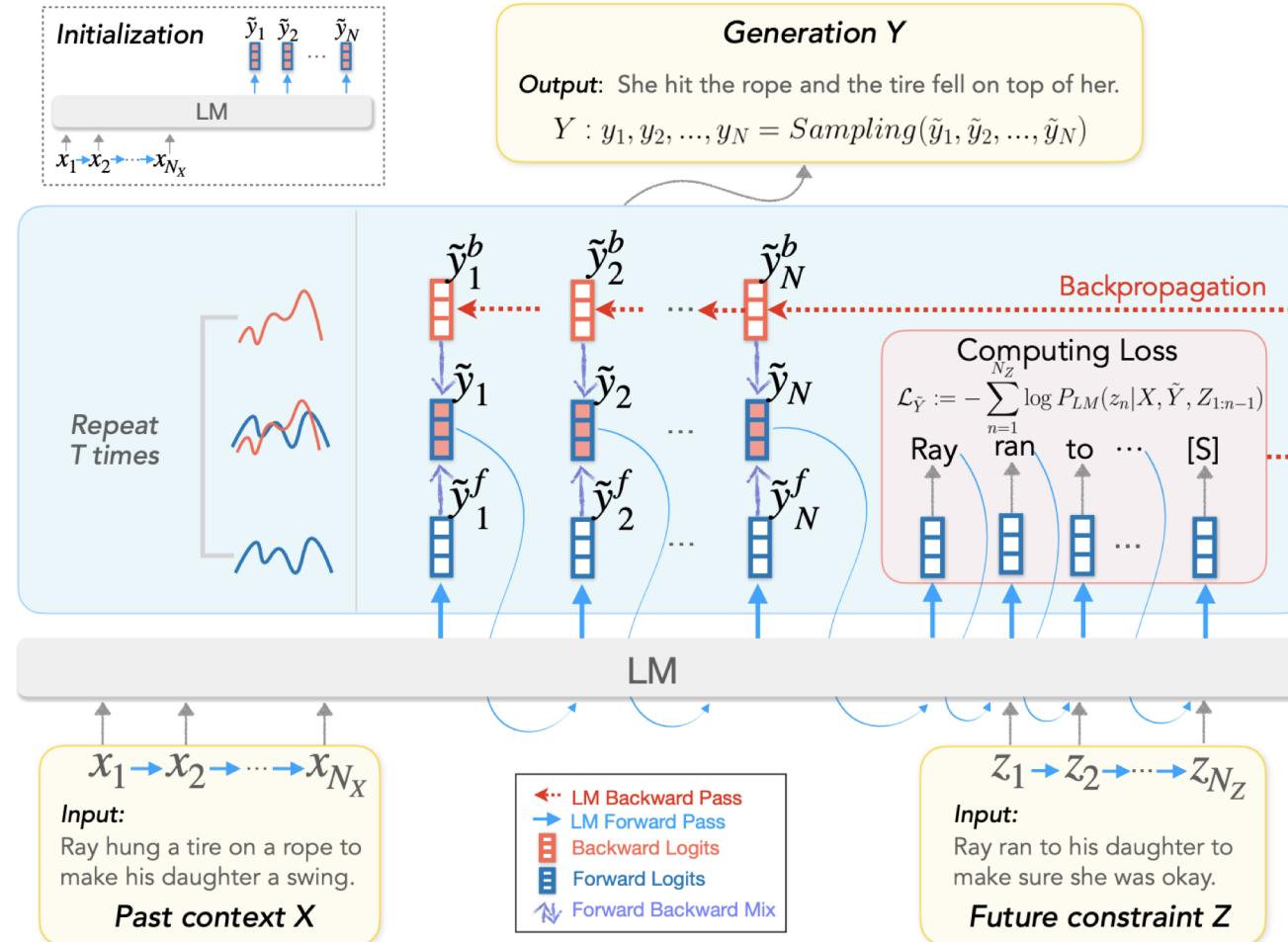
- Using RL to constrain decoding for factual consistency



Inference (I): Steered decoding



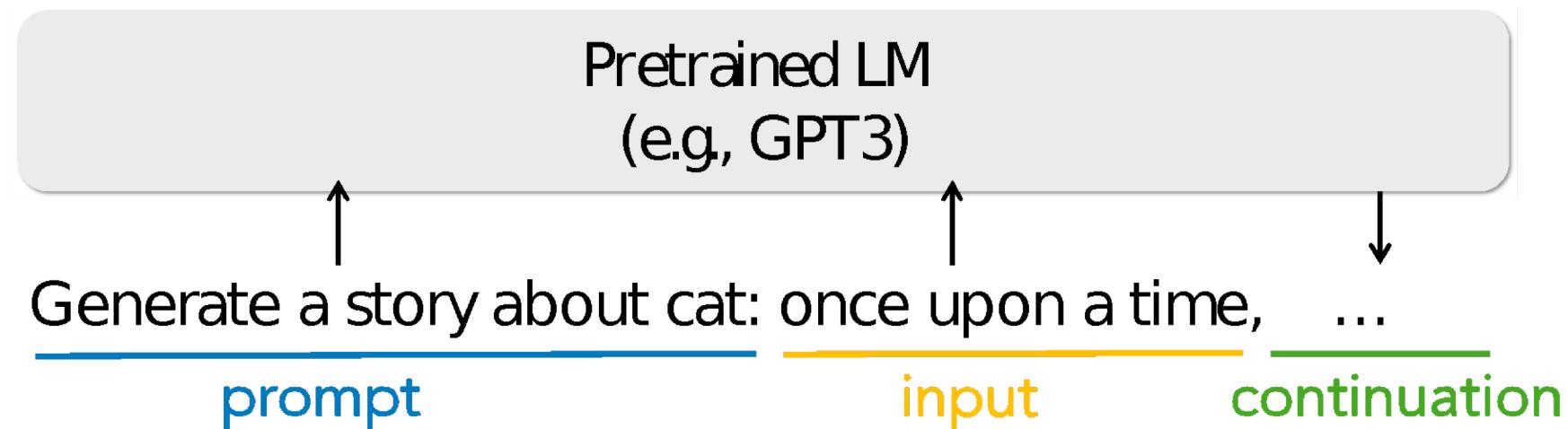
- Using text to constrain decoding



Inference (II): Prompts



- Guide the decoding by changing the generation distribution
- Low parameter alternative to finetuning LMs



Inference (II): Prompts



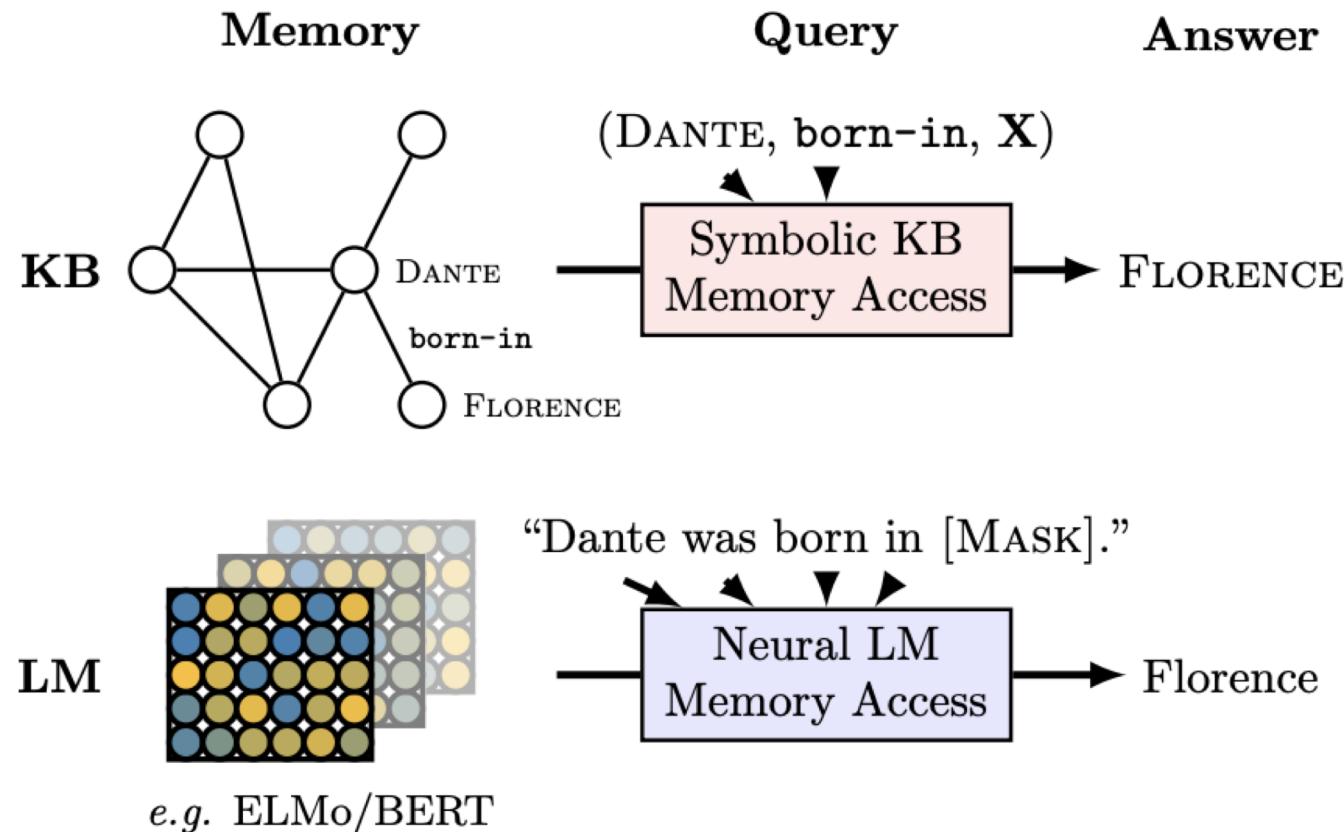
3 broad directions to infer knowledge using prompts:

1. zero-shot, eg: “The capital of Canada is [MASK]”
2. few-shot, eg: “The capital of France is Paris. The capital of Canada is [MASK]”
3. with additional context, eg: “Ottawa sits on the Ottawa River at the border between Quebec and Ontario. The capital of Canada is [MASK].”

Inference (II): Prompts



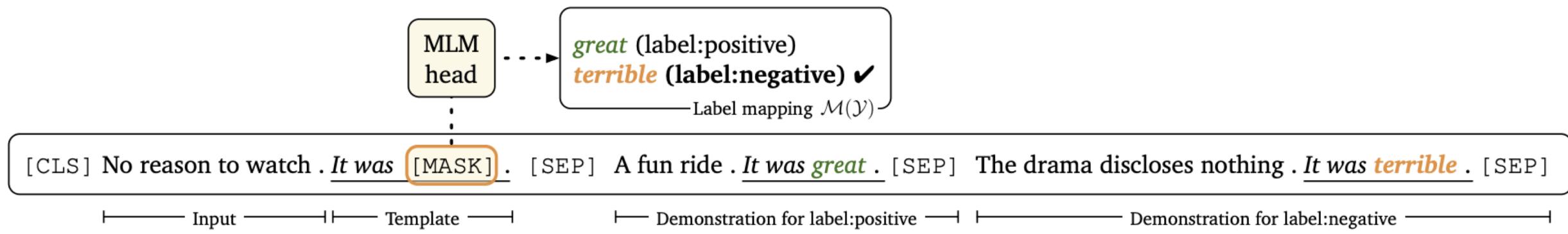
Zero-shot setting



Inference (II): Prompts



Few-shot setting/ via demonstration

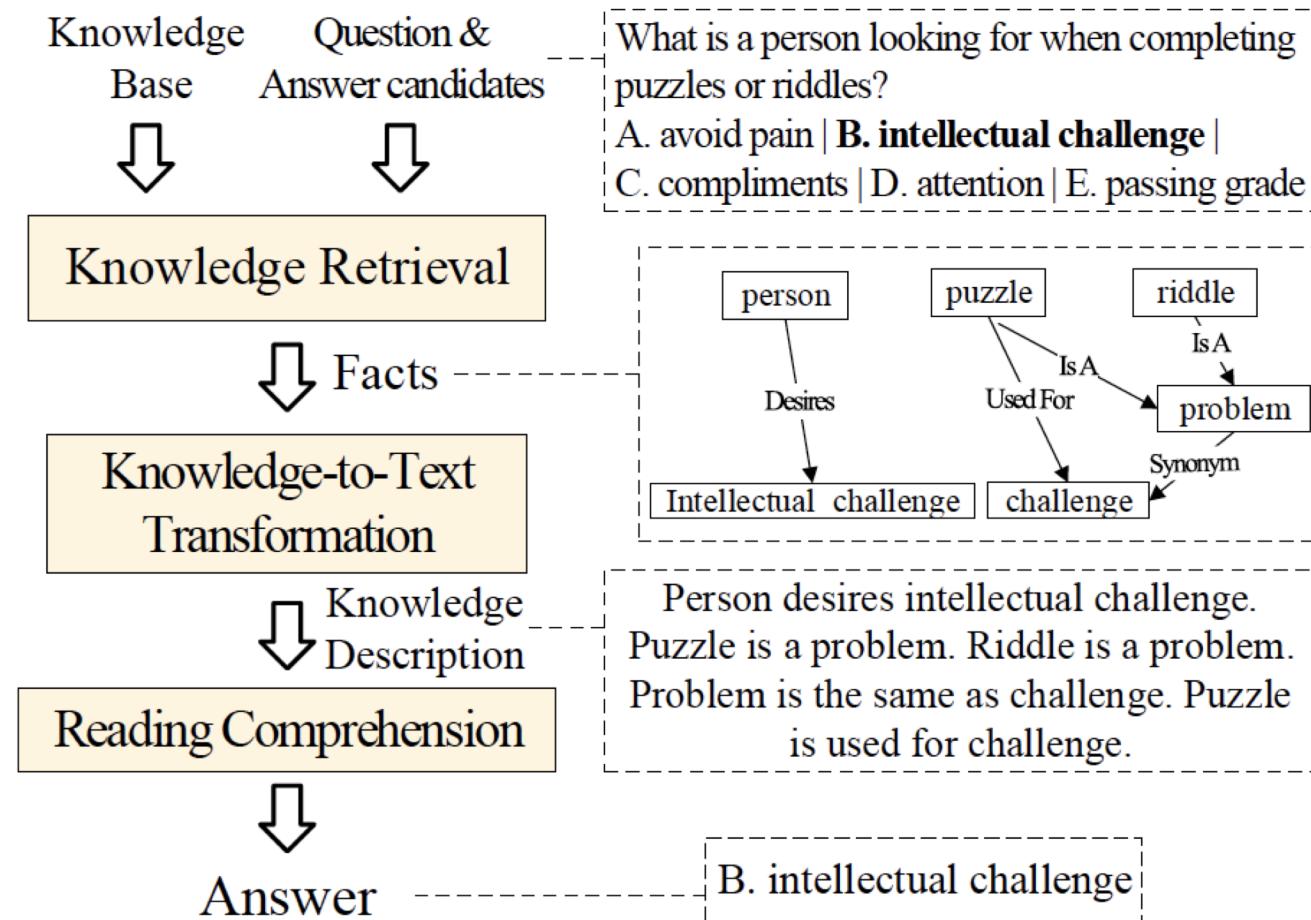


Gao et al., 2021

Inference (II): Prompts



With additional context



Conclusion



This part: General principles and methodologies for integrating knowledge into NLG

- Knowledge-enhanced **model architectures**
- Knowledge-enhanced **learning**
- Knowledge-enhanced **inference**
 - Steered decoding
 - Prompts