



**Huawei** **Scientist  
Committee**

**Edinburgh Coffee House**

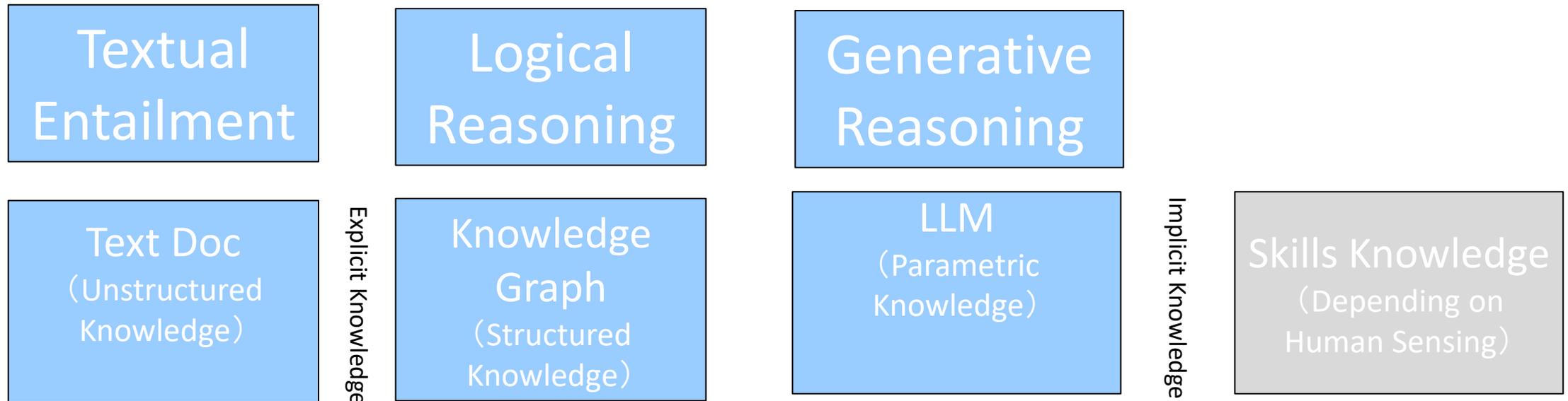
## Session: Knowledge Computing

**Jeff Pan**

(Chair of Knowledge Graph Group at Alan Turing Institute)

# What is Knowledge?

- **Verified** belief, opinion, and practical skills (such as playing guitar)
- How to classify knowledge?



- Fact
- Schema

# Large Language Model (implicit knowledge)

**Highlight:** Strong associative reasoning ability, able to engage in dialogue, automatically generate text and code, and multitask everything, shifting AI from "behind the scenes" to "spotlights".

Step 1

**Collect demonstration data and train a supervised policy.**

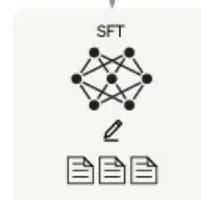
A prompt is sampled from our prompt dataset.



A labeler demonstrates the desired output behavior.



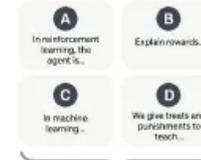
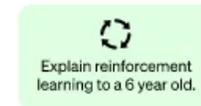
This data is used to fine-tune GPT-3.5 with supervised learning.



Step 2

**Collect comparison data and train a reward model.**

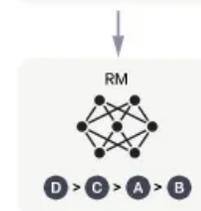
A prompt and several model outputs are sampled.



A labeler ranks the outputs from best to worst.



This data is used to train our reward model.



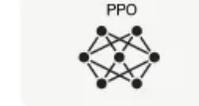
Step 3

**Optimize a policy against the reward model using the PPO reinforcement learning algorithm.**

A new prompt is sampled from the dataset.



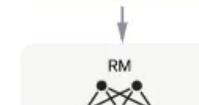
The PPO model is initialized from the supervised policy.



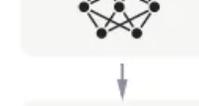
The policy generates an output.



The reward model calculates a reward for the output.



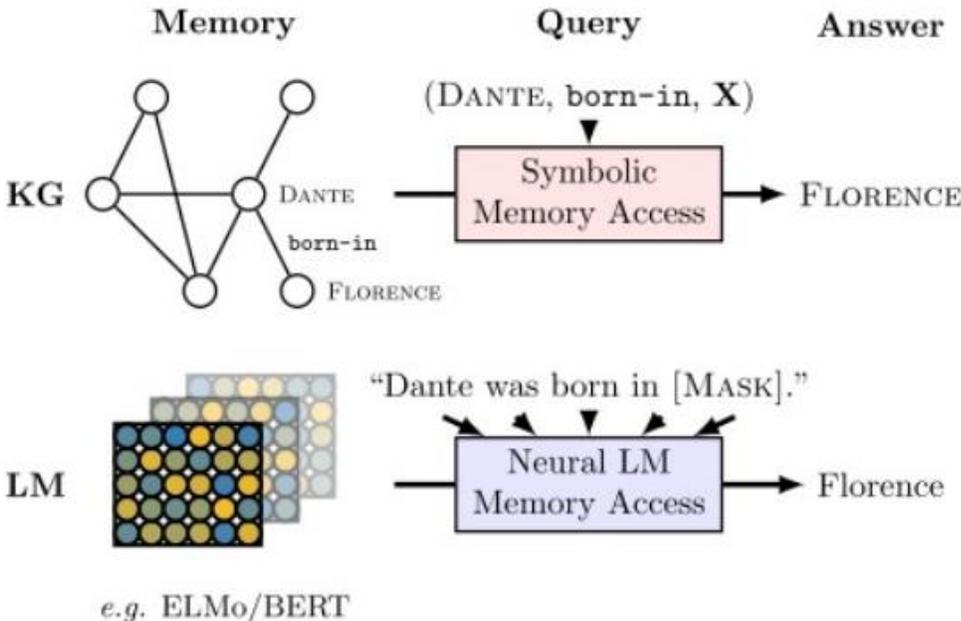
The reward is used to update the policy using PPO.



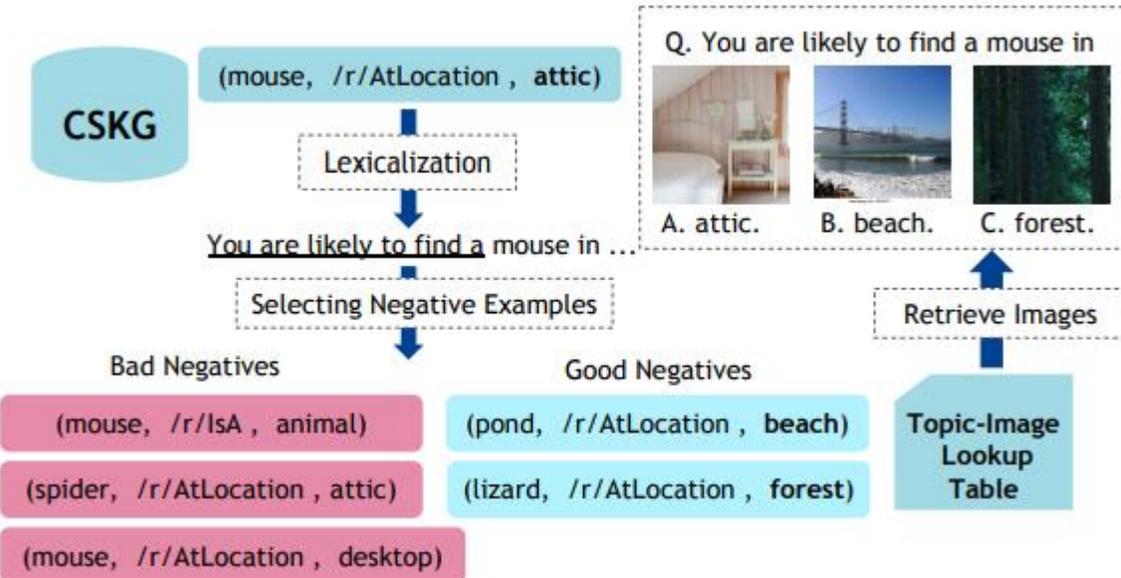
# Speedup the Construction of Knowledge Graphs

- Contain more knowledge than people previously expect
- Reduce the need of training data for the knowledge extraction task

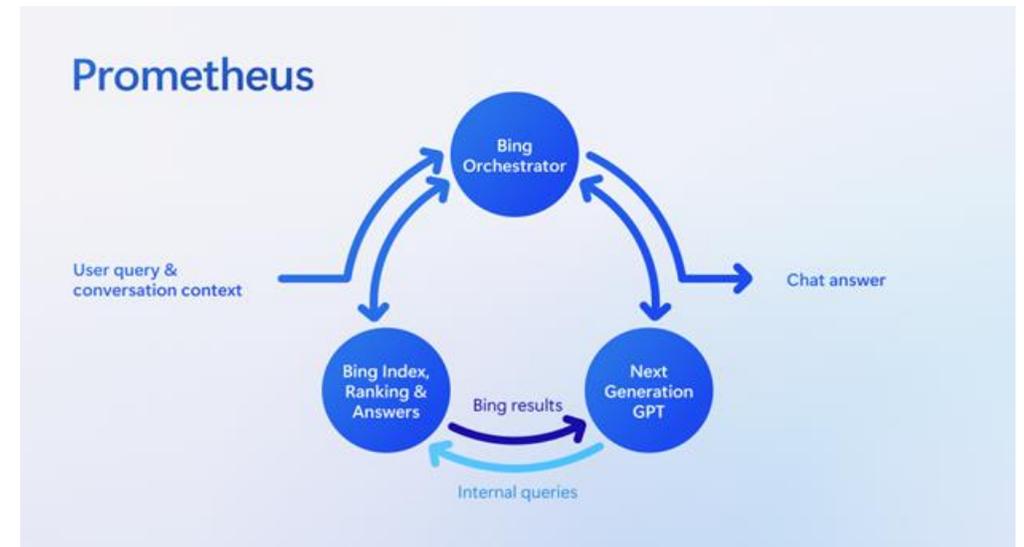
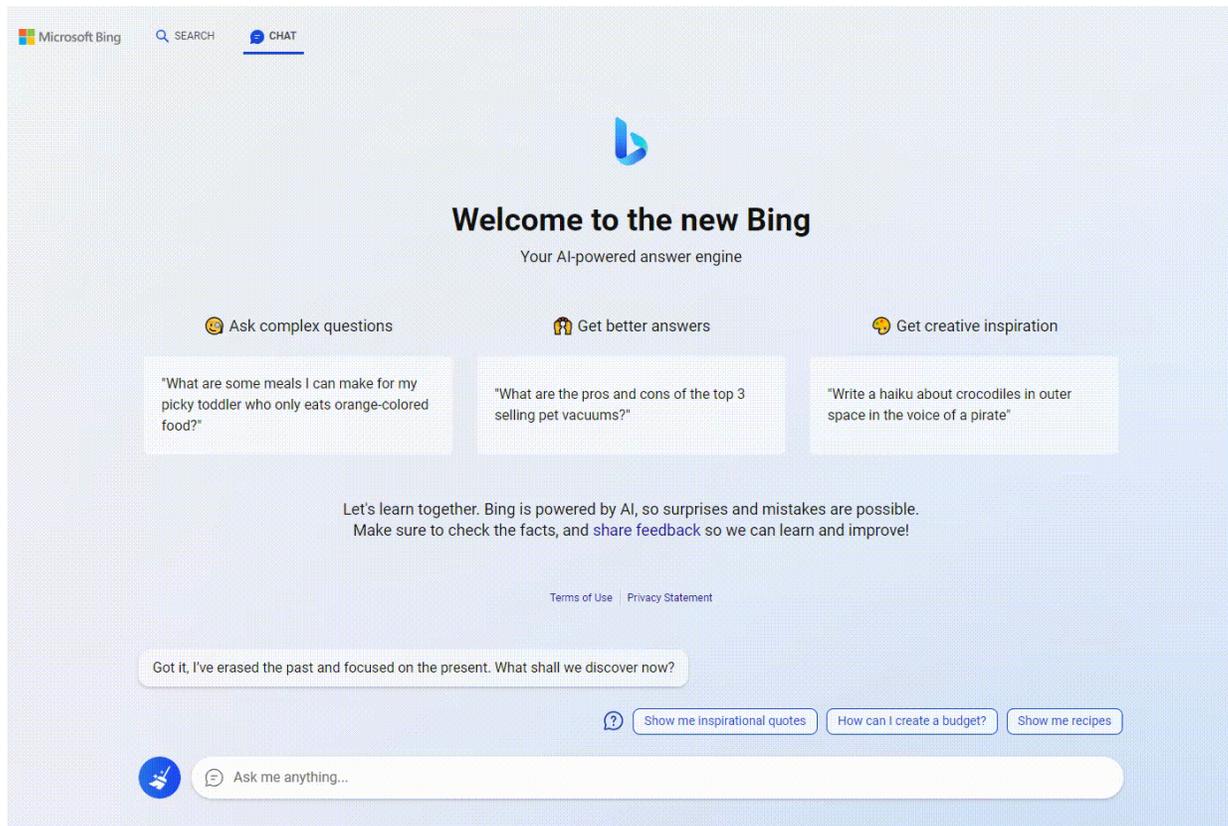
## Language Models as Knowledge Bases? (Meta, EMNLP2019)



## Are Visual-Linguistic Models Commonsense Knowledge Bases? (ICCL 2022)



# Generative Search Engine



# Today's Session: Two Technologies to Revolutionise NLP/KC

- Quantum NLP
- Large Language Models



Hybrid Recurrent Architectures for Quantum-Classical NLP



Going beyond the benefits of scale by reasoning about data



Inference in the time of GPT



Nonparametric Language Models: Trading Data for Parameters  
(and Compute) in Large Language Models

# Round Table Discussion: Large Language Models



**Mark Steedman**



**Edward Grefenstette**



**Luke Zettlemoyer**



**Edoardo Ponti**



**Steve Clark**