Bingsheng (Arthur) Yao

Research Interest

My research interests lie at the intersection of natural language processing and human-computer interaction. Currently, my research projects focus on enhancing the model's reasoning and explainability with human rationales, developing low-resource learning frameworks (e.g., Active Learning), and improving real-world human-machine interactions with advanced techniques, such as large language models (LLMs).

Technical Skills

∴ Programming Related
- Python, PyTorch, huggingface/transformers, C++, JavaScript

∴ Natural Language Processing
- Question Answering, QA-Pair Generation, Active Learning, Commonsense Reasoning, Machine Explainability, Human-in-the-loop

Professional Experience

Rensselaer-IBM AI Research Collaboration

∴ IBM AIRC Fellowship *2022.05 – 2023.08*
- Objective Human Explanation Evaluation [P. 9]
  - ✧ Proposed a **prompt-based unified data format** for different tasks
  - ✧ Enhanced the established Simulatability score with a **novel metric** to evaluate explanations' helpfulness at fine-tuning and inference
  - ✧ Our metric can evaluate 5 datasets with 2 models (**T5** and **BART**) consistently, while the established metric falls short
- Active Learning for Human Labels and Explanations [P. 10]
  - ✧ Proposed a **dual-model AL framework** to generate natural language explanations as additional information for the prediction model
  - ✧ Designed a novel **AL selection strategy** based on the similarity between unlabeled data and human-annotated explanations
  - ✧ Justified human explanations with our AL framework are beneficial for the prediction model to perform better and converge faster
- Exploit LLMs for NLG in Active Learning (Under Review)
  - ✧ Disclosed **FLAN-T5 zero-shot** is very sensitive to minor structural prompt changes and potential overfitting issues on the NLI task
  - ✧ Demonstrated FLAN-T5 can generate high-quality natural language explanations to boost AL performance for a wide range of tasks

∴ IBM Summer Extern *2021.05 – 2022.01*
- QA-Pair Generation (QAG) for Children Storybooks [P. 6] [P. 8]

- ✧ Implemented a QAG system with 1). a heuristics-based answer extraction module, question; 2). a fine-tuned BART-based question generation module; 3). a DistilBERT-based ranking module to rank and select best QA-pairs
- ✧ Outperformed 2 SOTA QAG systems on the FairytaleQA dataset in terms of the mean average ROUGE-L precision at top 1, 3, 5, and 10 QA-pairs generated per story section
- ✧ Developed an interactive story-telling web application built upon our QAG system and justified its usefulness through a user study with 12 pairs of parents and children

- FairytaleQA Dataset for Children Education [P. 7]
  - ✧ Supervised education experts with carefully designed annotation schema to create 10, 580 QA-pairs on 278 fairytale stories
  - ✧ Benchmarked FairytaleQA dataset can provide helpfulness on Question Answering and Question Generation tasks by fine-tuning various SOTA language models and performing in-depth analysis

Other Research Projects

Summer Research Assistant

∴ Highlighted Projects in Progress *2023.05 – 2023.09*

- LLM's Future Social Impact on Online Communities
- LLM Voice Assistant for Physician-patient Remote Communication
- Instruction-finetune LLM for Mental Issue Detection (Under Review)
  - ✧ Curated high-quality human-annotated datasets for mental issue detection in online communities
  - ✧ Designed prompts for augmented tasks with curated datasets and instruction-fine-tuned an Alpaca model
  - ✧ Benchmarked with SOTA models (e.g., fine-tuned Alpaca-Lora, mental-RoBERTa) and conducted extensive ablation studies on prompt selection, subsampling, and transfer learning
- QA Annotation Framework with Extern KG Support (Under Review)
  - ✧ The framework supports human annotators to select a preferred concept, then retrieve and rank the most relevant Commonsense Knowledge from ConceptNet to facilitate QA-pair annotation
  - ✧ Human evaluation justified that expert-created QA-pairs with our framework are preferred to the ones generated by carefully prompted GPT-3.5 few-shot approaches

Education Experience

∴ Ph.D. in Computer Science

- Advisor: Prof. James A. Hendler (est. early 2024)
- Rensselaer Polytechnic Institute *2019.09 -- Current*

∴ Master of Science in Information Technology and Web Science
- Rensselaer Polytechnic Institute *2019.05*

∴ Bachelor of Science in Computer & System Engineering
- Minor in Psychology
- Rensselaer Polytechnic Institute *2018.05*

Honor Society

∴ Member of **Upsilon Pi Epsilon** *2019*
- The International Honor Society for the Computing and Information Disciplines

∴ Member of **Gamma Nu Eta** *2019*
- The National Information Technology Honor Society

Leadership Experience

Graduate Teaching Assistant
- Computer Organization (230+ students) *Fall 2018*
- Introduction of AI (200+ students) *Spring 2019*

Publications (‡ denotes equal contribution)

2023

[P. 10] Yao, Bingsheng, Ishan Jindal, Lucian Popa, Yannis Katsis, Sayan Ghosh, Lihong He, Yuxuan Lu, Shashank Srivastava, James Hendler, and Dakuo Wang
Beyond Labels: Empowering Human with Natural Language Explanations through a Novel Active-Learning Architecture
arXiv preprint arXiv:2305.12710

[P. 9] Yao, Bingsheng, Prithviraj Sen, Lucian Popa, James Hendler, and Dakuo Wang
Are Human Explanations Always Helpful? Towards Objective Evaluation of Human Natural Language Explanations
arXiv preprint arXiv:2305.03117
ACL 2023 Oral Presentation

2022

[P. 8] Yao, Bingsheng, ‡Dakuo Wang, Tongshuang Wu, Zheng Zhang, Toby Li, Mo Yu, and Ying Xu
It is AI's Turn to Ask Humans a Question: Question-Answer Pair Generation for Children's Story Books
ACL 2022 - Proceedings of the 60th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)

[P. 7] Xu, Ying, ‡Dakuo Wang, ‡Mo Yu, ‡Daniel Ritchie, ‡Bingsheng Yao, Tongshuang Wu, Zheng Zhang et al.

Fantastic Questions and Where to Find Them: FairytaleQA--An Authentic Dataset for Narrative Comprehension
ACL 2022 - Proceedings of the 60th Annual Meeting of the Association for Computational Linguistics (Volume 1: Long Papers)

[P. 6] Zhang, Zheng, ‡Ying Xu, Yanhao Wang, Bingsheng Yao, Daniel Ritchie, Tongshuang Wu, Mo Yu, Dakuo Wang, and Toby Jia-Jun Li
Storybuddy: A human-ai collaborative chatbot for parent-child interactive storytelling with flexible parental involvement
CHI 2022 - Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems

[P. 5] Xu, Guangxuan, ‡Paulina Toro Isaza, ‡Moshi Li, Akintoye Oloko, Bingsheng Yao, Aminat Adebeyi, Yufang Hou, Nanyun Peng, and Dakuo Wang
Nece: Narrative event chain extraction toolkit
arXiv preprint arXiv:2208.08063

[P. 4] Yao, Bingsheng, Ethan Joseph, Julian Lioanag, and Mei Si
A Corpus for Commonsense Inference in Story Cloze Test
LREC 2022 - Proceedings of the Thirteenth Language Resources and Evaluation Conference

[P. 3] Mou, Xiangyang, Mo Yu, Bingsheng Yao, and Lifu Huang
Efficient Long Sequence Encoding via Synchronization
arXiv preprint arXiv:2203.07644

2021

[J. 1] Mou, Xiangyang, ‡Chenghao Yang, ‡Mo Yu, Bingsheng Yao, Xiaoxiao Guo, Saloni Potdar, and Hui Su
Narrative Question Answering with Cutting-Edge Open-Domain QA Techniques: A Comprehensive Study
TACL 2021 - Transactions of the Association for Computational Linguistics 9 (2021)

2020

[P. 2] Mou, Xiangyang, Mo Yu, Bingsheng Yao, Chenghao Yang, Xiaoxiao Guo, Saloni Potdar, and Hui Su
Frustratingly Hard Evidence Retrieval for QA Over Books
Proceedings of the First Joint Workshop on Narrative Understanding, Storylines, and Events

[P. 1] Drozdal, Jaimie, Justin Weisz, Dakuo Wang, Gaurav Dass, Bingsheng Yao, Changruo Zhao, Michael Muller, Lin Ju, and Hui Su
Trust in AutoML: exploring information needs for establishing trust in automated machine learning systems
IUI 2020 - Proceedings of the 25th international conference on intelligent user interfaces