Research Statement

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Background

My primary research interests are data science, machine learning and AI. My primary research area for machine learning is to build applications of machine learning models for healthcare data and educational data. In addition to data science and machine learning, I am also interested in (1) building systems to assist an entire machine learning pipeline from data collection to model refinement and then to providing human-interpretable feedback; and (2) combining machine learning with decisions making and optimization problems.

Research Areas

AI Applications for Healthcare Data

My research will focus on leveraging deep learning and multimodal AI techniques to enhance diagnostic accuracy and personalized treatment in clinical settings. By developing robust algorithms that integrate longitudinal electronic health records with other modes of medical data, including images, voices and even videos, I aim to create predictive models to assist medical professionals, and then to save their time and efforts. I strive to build tools for medical professionals, so that AI technologies are seamlessly integrated into existing healthcare frameworks. Therefore, such tools optimize hospital workflows and improving patient outcomes through human-AI collaboration.

Pedagogical Research

One interesting question in pedagogical research is how to make education more effective. In this aspect, I think it is necessary to apply data mining and machine learning techniques to study students' behavior data, and to derive more effective strategies to improve teaching effectiveness.

To be more accurate in quantifying students' learning, I have also proposed to combine with context to model how students are learning in a pedagogical knowledge graph. This should not be limited to just one course; it can be extended to a programme or to a conventional stage of education. Therefore, I have been diligently seeking research grants that can support my research in pedagogy. I have considered both education grants for primary and secondary education, as well as education grants for adult learning. My aim in educational research is (1) to alleviate teachers from mundane tasks, allowing them to dedicate more time to foster creativity; and (2)

to nurture students' self-directed learning and match the evolving trends of changes in education.

Optimization Research

The third research question I am working on is on decision making and optimization research. In particular, how do we optimize vehicles and routing with coalited objectives or objectives at different levels of priority. These are common questions to logistic companies, and I wish to apply machine learning techniques to enhance such decision-making process.

Gen AI Validation

Gen AI has gone beyond human's ability in handling images and language processing. This leaves a big question to us, how would human know what Gen AI generates is "correct". More research is needed to find out a systematical framework in validating AI's output. This direction is what I plan to put more effort into in the next few years.

Selected Publications and Outputs

Label correlated contrastive learning for medical report generation, by Xinyao LIU, Junchang XIN, Bing Tian DAI, Qi SHEN, Zhihong HUANG, Zhiqiong WANG (2025). Computer Methods Programs Biomedicine 258: 108482

Fuel-saving route planning with data-driven and learning-based approaches: A systematic solution for harbor tugs, by Shengming WANG; Xiaocai ZHANG; Jing LI; Xiaoyang WEI; Hoong Chuin LAU; Bing Tian DAI; Zhe XIAO; QIN, Zheng (2024). *The Thirty-Third International Joint Conference on Artificial Intelligence* (IJCAI-24): 7483-7490. https://doi.org/10.24963/ijcai.2024/828

MWPToolkit: An Open-Source Framework for Deep Learning-Based Math Word Problem Solvers, by Yihuai Lan, Lei Wang, Qiyuan Zhang, Yunshi Lan, Bing Tian Dai, Yan Wang, Dongxiang Zhang, Ee-Peng Lim (2022). *The Thirty-Sixth AAAI Conference on Artificial Intelligence* (AAAI 2022): 13188-13190.

The Gap of Semantic Parsing: A Survey on Automatic Math Word Problem Solvers, by ZHANG, Dongxiang; WANG, Lei; ZHANG, Luming; DAI, Bing Tian; SHEN, Heng Tao. (2020). *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 42 (9), 2287-2305. https://doi.org/10.1109/TPAMI.2019.2914054

Integrated telegram and web-based forum with automatic assessment of questions and answers for collaborative learning, by CHEONG, Michelle L.F.; CHEN, Jean Y. C.; DAI, Bing Tian. (2018). *Proceedings of IEEE International Conference on Teaching, Assessment and Learning for Engineering TALE 2018: Wollongong, Australia, 2018 December 4-7,* Piscataway, NJ: IEEE. https://doi.org/10.1109/TALE.2018.8615137