



Zihao Zhao

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EDUCATION

University of Science and Technology of China (USTC) Hefei, China
PHD candidate: Information Retrieval, Advisor: Prof. Xiangnan He 2020.09 – Current
University of Science and Technology of China (USTC) Hefei, China
Bachelor of Engineering: Electronic Information Engineering, GPA: 3.63/4.3 2016.09 – 2020.06

COURSEWORK

Courses: Linear Algebra, Data Structure and Algorithm, Computer Networks, Information Theory, Statistical Learning, Matrix Analysis and Application, Fundamentals of Data Science, Information Retrieval and Data Mining, Digital Image Analysis
Awards: National Encouragement Scholarship, USTC First-class PhD scholarship

RESEARCH INTERESTS

AI4Healthcare, Large Language Models, Recommendation System, Causal Inference

SKILLS

Languages: Python, L^AT_EX, C, Matlab
Tools: VS Code, Git/GitHub, Unix Shell, PyCharm

PROJECTS

- Large Language Models (LLMs) for Medication Recommendation** Aug. 2023 – Current
- Utilized unstructured clinical notes, a valuable yet overlooked data source in existing models.
 - Engineered a novel model leveraging an open-source Large Language Model (LLM), achieving a performance enhancement exceeding 10% over the State-of-the-Art (SOTA) on this specific task.
 - Acquired proficiency in understanding the mechanics of LLMs and adeptness in fine-tuning them for various downstream tasks.
- Medication Recommendation for Rare Disease Patients** Nov. 2022 – Jul. 2023
- Specialized in catering to patients afflicted with rare diseases and obscure procedure codes, for whom existing models often fail to provide precise medication recommendations.
 - Pioneered the development of a cutting-edge medication recommendation model that not only attained state-of-the-art accuracy but also effectively mitigated fairness concerns.
 - Acquired extensive knowledge in Electronic Health Records (EHRs) and various clinical prediction tasks.
- Incorporation of Biomedical Knowledge Graph (BKG) with EHRs** Apr. 2022 – Oct. 2022
- Mapped the extensive BKG (PrimeKG) to the widely utilized EHR dataset MIMIC-III.
 - Gained understanding of the components and structure of BKGs and medical code systems.
- Mitigation of Popularity Bias in Recommendation Systems** Oct. 2020 – Mar. 2022
- Distinguished between benign and harmful biases within recommendation algorithms.
 - Explored methodologies for debiasing techniques in recommendation systems.

EXPERIENCE

University of Technology Sydney (UTS) Sydney, Australia
Visiting Student: Sport Video Processing June 2019 – August 2019

- Implemented athlete tracking algorithms for football and basketball videos.
- Developed bounding box detection and trajectory generation techniques.

Teaching Assistant at USTC Hefei, China
Foundations of Data Science, under the guidance of Prof. Xiangnan He September 2021 – February 2022

PUBLICATIONS

Zihao Zhao, Jiawei Chen, Sheng Zhou, Xiangnan He, Xuezhi Cao, Fuzheng Zhang, Wei Wu (2022). Popularity Bias is Not Always Detrimental: Disentangling Benign and Harmful Bias in Recommendation Systems. *IEEE Transactions on Knowledge and Data Engineering (TKDE)*.

- The prevalence of popularity bias in recommendation systems can be attributed to two distinct factors: item quality (benign) and user conformity (harmful), necessitating a nuanced approach in addressing it.
- Our analysis reveals that popular items often exhibit higher average user ratings, indicative of their superior quality. However, a deeper examination reveals that, when scrutinizing specific items over time, there exists a negative correlation between item ratings and their temporal popularity, highlighting the influence of user conformity.
- To mitigate this bias, we advocate for the utilization of temporal information, as the two underlying factors manifest distinct temporal patterns: item quality, reflective of inherent properties, remains stable and static, whereas conformity, contingent on recent user interactions, is highly time-sensitive.

Zihao Zhao, Yi Jing, Fuli Feng, Jiancan Wu, Chongming Gao, Xiangnan He (2024). Leave No Patient Behind: Enhancing Medication Recommendation for Rare Disease Patients. Under review at ACM International Conference on Research and Development in Information Retrieval (SIGIR).

- Medication recommendation models often encounter fairness challenges, disproportionately favoring patients with common diseases over those with rare conditions.
- We address this issue by employing a pretrain-finetune learning paradigm to improve the representation of rare diseases, thereby enhancing prediction accuracy for this demographic.
- Our approach involves the development of two pre-training tasks: Sequence Matching Prediction and Self-Reconstruction. These tasks facilitate the acquisition of specialized medication needs and interrelations among clinical codes, crucial for accurate medication recommendations.

Zihao Zhao, Xiqiao Xiong, Chenxiao Fan, Fuli Feng (2024). Integrating PrimeKG for Knowledge-enhanced Medication Recommendation. Under review at International World Wide Web Conferences (WWW).

- The significance of incorporating knowledge into medication recommendation has garnered widespread recognition, leading to the integration of biomedical knowledge graphs (BKGs) into recent models. However, a precise mapping approach from BKGs to Electronic Health Records (EHRs) remains elusive.
- PrimeKG, a recently proposed framework, encompasses comprehensive clinical knowledge, delineating 17,080 diseases with 4,050,249 relationships across ten major biological scales. This resource holds immense potential for augmenting medication recommendation systems.
- We meticulously investigated clinical code systems and devised a robust mapping strategy to align PrimeKG with the MIMIC-III dataset, thereby enriching the contextual understanding of diseases within the clinical domain.

PATENTS

- **Zihao Zhao**, Xuezhi Cao, Wei Wu. Developed methods, devices, electronic equipment, and storage media for recommending model training. CN. Patent Application CN202210446818.0, filed in August 2022, and issued in May 2023.
- Xiangnan He, **Zihao Zhao**, Fuli Feng. Proposing an intelligent drug recommendation method, device, and medium for rare diseases. CN. Patent Application CN202311481544.X, filed in November 2023. Currently pending patent status.