Yifei Wang

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RESEARCH TOPICS

Machine Learning, Deep Learning, Efficiency, Optimization, Generative AI, Interpretable AI, AI4Science, AI For Drug Discovery, AI For Biomedical Applications.

EDUCATION

- **Brandeis University**   *Jan 2020 - Feb 2025*

  Ph.D. student in Computer Science   Massachusetts, USA
  - GPA: 4.0/4.0.   GSAS Fellowship, Travel and Research Grant.

  - Research Focus: Deep Learning, Large Language Model, Generative AI, AI4Science, AI for Drug Discovery.

- **Tsinghua University**   *Aug 2015 - Jul 2019*

  Bachelor of Pure and Applied Mathematics   Beijing, China
  - GPA: 3.6/4.0.   Top 10% Undergraduate Thesis.

  - Major Focus: Statistics, Algorithm Design, Optimization, Machine Learning.

WORK EXPERIENCE

- **Biogen**   *Feb 2025 - Present*

  Machine Learning Research Fellow   Massachusetts, USA
  - Developing AI tools to accelerate drug discovery

  - Designing Generative AI approaches for synthesizable small molecule design

- **Brigham and Women's Hospital**   *Aug 2022 - Jan 2025*

  Research Trainee   part-time   advised by Li Zhou, Ph.D., M.D. and Liqin Wang, Ph.D.   Massachusetts, USA
  - Improved reliability and interpretability of healthcare AI models using EHR data across ML and LLMs.

  - Detected and evaluated fairness and bias in healthcare AI decision systems.

- **XtalPi Inc.**   *July 2019 - Dec 2019*

  Algorithm Intern for AI-aided drug discovery   Shenzhen, China
  - Implemented a transformer-like architecture for retrosynthetic reaction path prediction.

  - Improved model architectures and training strategies. Refined the pipeline of reaction prediction.

SELECTED PUBLICATIONS

[1] **Yifei Wang***, Yunrui Li*, Pengyu Hong, Hao Xu. "Advancing Drug Discovery with Enhanced Chemical Understanding via Asymmetric Contrastive Multimodal Learning." *Journal of Chemical Information and Modeling*, 2025.

[2] Xinsong Du*, Zhengyang Zhou*, **Yifei Wang***, Ya-Wen Chuang, Yiming Li, Richard Yang, Pengyu Hong, David W. Bates, and Li Zhou. "Performance and improvement strategies for adapting generative large language models for electronic health record applications: A systematic review." *International Journal of Medical Informatics*, 2025.

[3] **Yifei Wang**, Liqin Wang, Zhengyang Zhou, John Laurentiev, Joshua R. Lakin, Li Zhou, and Pengyu Hong. "Assessing fairness in machine learning models: A study of racial bias using matched counterparts in mortality prediction for patients with chronic diseases." *Journal of Biomedical Informatics*, 2024.

[4] **Yifei Wang***, Zhengyang Zhou*, Liqin Wang, John Laurentiev, Peter Hou, Li Zhou, Pengyu Hong. "Counterpart Fairness – Addressing Systematic Between-group Differences in Fairness Evaluation" In *NeurIPS* Workshop, 2024.

[5] **Yifei Wang**, Shiyang Chen, Guobin Chen, Ethan Shurberg, Hang Liu, and Pengyu Hong. "Motif-Based Graph Representation Learning with Application to Chemical Molecules." *Informatics*, vol. 10, no. 1, p. 8. MDPI, 2023.

[6] Tong Yang*, **Yifei Wang***, Long Sha*, Jan Engelbrecht, and Pengyu Hong. "Knowledgebra: An Algebraic Learning Framework for Knowledge Graph." *Machine Learning and Knowledge Extraction* 4, no. 2 (2022): 432-445.

[7] Li, Peizhao, **Yifei Wang**, Han Zhao, Pengyu Hong, and Hongfu Liu. "On dyadic fairness: Exploring and mitigating bias in graph connections." In *International Conference on Learning Representations (ICLR)*, 2021.

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*Equal contribution.

PROJECTS

- **Project 1: An Algebraic Learning Framework for Knowledge Graph** [📄 *Paper*] [O *Code*]
  - Developed an algebraic framework for learning consistent relation embeddings in knowledge graphs and proposed an algebraic-based instantiation for a knowledge graph embedding model.
  - Proposed simplified variants for learning low-dimensional relation embeddings using shared block settings and regularization-based method to integrate human logic rules.

- **Project 2: Motif-based Graph Representation Learning on Molecules** [📄 *Paper*][O *Code*]
  - Designed a novel convolution module for graph representational learning on molecules with an efficient pretraining strategy, enabling the capture of local structural and semantic information from graph motifs.
  - Demonstrated the superiority of the proposed model in molecular learning across multiple dimensions: (1) better results in various molecular property prediction tasks, (2) more stable training, and (3) improved interpretability.

- **Project 3: Explainable Contrastive Multimodal Learning on Molecules** [📄 *Paper*][O *Code*]
  - Proposed Asymmetric Contrastive Multimodal Learning, an effective and training-efficient framework tailored for molecules, promoting cross-modality understanding between the molecular graph and other chemical modalities.
  - Demonstrated the effectiveness and interpretability of the proposed framework in various key tasks: (1) large-scale cross-modality retrieval, (2) isomer discrimination, and (3) molecular property prediction.

- **Project 4: Exploring and Mitigating Bias in Graph Connections** [📄 *Paper*]
  - Investigated the disparity of graph embedding for link prediction bridging on intra- and inter-sensitive groups. Proposed a chain of theoretical analyses on how graph connections could affect dyadic fairness.
  - Accordingly introduced an algorithm for fair link prediction by adjusting the adjacency weight matrix to address the fairness-utility trade-off.

- **Project 5: Unveiling Systematic Differences in Group Fairness Evaluation in Healthcare Contexts**[📄 *Paper*][O *Code*]
  - Explored the influence of systematic differences and confounding effects on group fairness estimation and proposed a counterpart-based fairness (CFair) index to improve fairness estimation by mitigating these influences.
  - Studied long-term mortality prediction of patients with chronic diseases, utilizing CFair to assess racial disparities in model predictions and offering insights into the influence of racial bias on model performance.

SKILLS

- **Programming Languages:** Python (familiar with most deep learning packages and platforms such as Sklearn, Pytorch, Pytorch Geometric, Transformers, Peft, HuggingFace, etc.), MATLAB, R.
- **Languages:** English (proficient), Chinese (native).
- **Research Skills:** Algorithm Development, Theoretical Proof, Quantitative Analysis, Experiment Design, Interdisciplinary collaboration, Presentation, Writing and Communication.
- **Soft Skills:** Time Management, Problem Solving, Project Management, Collaboration, Mentorship.

SERVICES

- **Reviewer:** NeurIPS, ICLR, ICML, COLING, KDD Workshop, AMIA Annual Symposium, International Journal of Medical Informatics, BMC Medical Informatics and Decision Making
- **Teaching Assistant:** Computation Theory, Spring 2024 & Statistical Machine Learning, Fall 2020, 2021, 2022.
- **Undergraduate Thesis Advisor:** Supervised a thesis that earned the Kukin Moskowitz Prize for Excellence 2024.