Jiarui Feng

https://jiaruifeng.github.io/
feng.jiarui@wustl.edu

EDUCATION

- **Washington University in Saint Louis** — Saint Louis, MO, USA
  Ph.D in Computer Science and Engineering — Aug. 2021 to Now
  Advisors: Prof. Yixin Chen, Dr. Fuhai Li
- **Washington University in Saint Louis** — Saint Louis, MO, USA
  M.S. in Data analytics and statistics — Aug. 2019 to May. 2021
  GPA: 4.00/4.00
- **South China University of Technology** — Guangzhou, Guangdong, China
  B.S. in Polymer Materials and Engineering — Sep. 2015 to June 2019
  GPA: 3.87/4.00, Rank: 2/131

RESEARCH INTEREST

My main research area lies in solving fundamental problems in graph representation learning and graph neural networks (GNNs). Particularly, my works focus on the following aspects:

- Understanding and improving the expressiveness of GNNs.
- Improving the structure learning ability of GNNs in an efficient way.
- Designing foundational GNN model for solving various tasks in the graph domain.
- The application of GNNs in precision medicine, with a particular interest in the gene interaction network discovery.

PUBLICATIONS

Accepted Papers

1. A Visual Active Search Framework for Geospatial Exploration, **2024 WACV**
   Anindya SarKar, Michael Lanier, Scott Alfeld, **Jiarui Feng**, Roman Garnett, Nathan Jacobs, Yevgeniy Vorobeychik
2. Extending the Design Space of Graph Neural Networks by Rethinking Folklore Weisfeiler-Lehman, **2023 NeurIPS**
   Jiarui Feng, Lecheng Kong, Hao Liu, Dacheng Tao, Fuhai Li, Muhan Zhang, Yixin Chen.
3. Distance-Restricted Folklore Weisfeiler-Leman GNNs with Provable Cycle Counting Power, **2023 NeurIPS Spotlight**
   Junru Zhou, **Jiarui Feng**, Xiyuan Wang, Muhan Zhang.
4. MAG-GNN: Reinforcement Learning Boosted Graph Neural Network, **2023 NeurIPS**
   Lecheng Kong, **Jiarui Feng**, Hao Liu, Dacheng Tao, Yixin Chen, Muhan Zhang.
5. Multi-omics data integration via novel interpretable k-hop graph attention network for signaling network inference **2023 ICIBM**
   Ruoying Yuan*, **Jiarui Feng***, Heming Zhang*, Yixin Chen, Philip Payne, Fuhai Li (* equal contribution)
6. Reward Delay Attacks on Deep Reinforcement Leanring, **2022 GameSec**
   Anindya Sarkar, **Jiarui Feng**, Yevgeniy Vorobeychik, Christopher Gill, Ning Zhang
7. How Powerful are K-hop Message Passing Graph Neural Networks, **2022 NeurIPS**
   Jiarui Feng, Yixin Chen, Fuhai Li, Anindya Sarkar, Muhan Zhang
8. Predicting mortality risk for preterm infants using deep learning models with time-series vital sign data
   npj Digital Medicine
   Jiarui Feng, Jennifer Lee, Zachary A. Vesoulis, Fuhai Li
9. Investigating the relevance of major signaling pathways in cancer survival using a biologically meaningful deep learning model
   BMC Bioinformatics
   Jiarui Feng, Heming Zhang, Fuhai Li
10. Signaling interaction link prediction using deep graph neural networks integrating protein-protein interactions and omics data, **2021 ICIBM**
    Jiarui Feng, Amanda Zeng, Yixin Chenm Philip Payne, Fuhai Li
11. Predicting Tumor Cell Response to Synergistic Drug Combinations Using a Novel Simplified Deep Learning Model, **2020 AMIA**
    Heming Zhang, **Jiarui Feng**, Amanda Zeng, Philip Payne, Fuhai Li

Preprints

1. One for All: Towards Training One Graph Model for All Classification Tasks
   Hao Liu*, **Jiarui Feng***, Lecheng Kong*, Ningyue Liang, Dacheng Tao, Yixin Cheng, Muhan Zhang (* equal contribution)
2. sc2MeNetDrug: A computational tool to uncover inter-cell signaling targets and identify relevant drugs based on single cell RNA-seq data
   Jiarui Feng, S. Peter Goedegebuure, Amanda Zeng, Ye Bi, Ting Wang, Philip Payne, David DeNardo, William Hawkins, Ryan C. Fields, Fuhai Li

3. Graph Contrastive Learning Meets Graph Meta Learning: A Unified Method for Few-shot Node Tasks
   Hao Liu, **Jiarui Feng**, Lecheng Kong, Dacheng Tao, Yixin Chen, Muhan Zhang
4. Decipher macrophage-fibroblast-cardiomyocyte signaling interactions associated with heart failure using deep graph neural network models and single-cell RNA-seq data
   Wenyu Li, **Jiarui Feng**, Philip Payne, Yixin Chen, Fuhai Li

SELECTED RESEARCH PROJECTS

One for All: Towards Training One Graph Model for All Classification Tasks June. 2023 to Now
Propose the first general framework OFA that allows one GNN model to perform different tasks (node, link, graph, ...) in different domains (citation, social, molecule, ...) and different scenarios (supervised, few-shot, zero-shot, ...).

- Proposed text-attributed graph to unify graph data from different domains by describing node and edge features in natural language.
- Introduced the concept of nodes-of-interest to standardize different tasks with a uniform task representation.
- Proposed graph prompting paradigm that adds prompting substructures to the input graph, which enables the model to perform tasks in various scenarios without fine-tuning.

Extending the design space of graph neural networks Jan. 2023 to Oct. 2023
Propose the first general framework that can design GNNs flexibly under different time and space requirements.

- Proposed (k, t)-FWL and theoretically proved that (k, t)-FWL can construct an expressive hierarchy under any fixed space complexity.
- Proposed k-FWL+, which extend the definition of neighbors for each k-tuple from all nodes to any equivariant set.
- Proposed (k, t)-FWL+ by combining both (k, t)-FWL and k-FWL+ and theoretically proved that (k, t)-FWL+ can be used to implement many existing high-expressive GNNs.
- Designed N^2-GNN based on $(2, 2)$-FWL+, which can surpass 3-WL with only $O(n^2)$ space complexity and encode many substructure. The proposed N^2-GNN achieved new SOTA on ZINC-subset (0.059), ZINC-full (0.013), and BREC (71.8%) datasets.

How Powerful are K-hop Message Passing Graph Neural Networks Feb. 2022 to Dec. 2022
Theoretically analyze and improve the expressive power of K-hop GNNs.

- Formally defined the K-hop GNNs and two different kernels of K-hop (the shortest path distance kernel and graph diffusion kernel).
- Theoretically analyzed the expressive power of k-hop GNNs, proved it is more powerful than 1-WL but bounded by 3-WL.
- Proposed KP-GNN, which hugely improves the expressive power of k-hop GNNs by adding information of peripheral subgraph. KP-GNN can partially outperform 3-WL with only $O(n^2)$ time complexity and $O(n)$ space complexity.

AWARDS AND HONORS

- Neurips 2023 travel award.
- ICIBM 2021 travel award.

WORKING EXPERIENCE

- **Alibaba Cloud** Hangzhou, Zhejiang, China
  Software Development Engineer Intern June 2019 to July 2019
- **Credit Card Center, Bank of Guangzhou** Guangzhou, Guangdong, China
  Data Analyst Intern Dec. 2018 to Mar. 2019
- **E Fund Management Co., Ltd.** Guangzhou, Guangdong, China
  Summer Intern July 2018 to Aug. 2018

SERVICES

- **Conference reviewer:** 2023 CVPR, 2023 NeurIPS, 2024 ICLR, 2024 CVPR.