

JIAJUN ZHU

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EDUCATION

Zhejiang University

Sept. 2020 - Now

B.S. in Mathematics

Rank: Top 5%

- Major GPA: 3.85/4.00 (top 1/64 in sophomore year)
- Math Average: 91.3
- Core Courses:
 - Ordinary Differential Equation: 95
 - Mathematical Software: 99
 - Advanced Algebra II: 95
 - Mathematical Analysis II/III: 93
 - Mathematical Statistics: 92
 - Abstract Algebra: 90
 - Real Variable Analysis: 93
 - Point Set Topology: 93
 - Geometry: 90

PUBLICATION

1. **Jiajun Zhu**, Peihao Wang, Ruisi Cai, Jason D. Lee, Pan Li, Zhangyang Wang. Rethinking Addressing in Language Models via Contextualized Equivariant Positional Encoding, *The Thirteenth International Conference on Learning Representations (ICLR)*, 2025. Submitted.
2. **Jiajun Zhu**, Siqi Miao, Rex Ying, Pan Li. Towards Understanding Sensitive and Decisive Patterns in Explainable AI: A Case Study of Model Interpretation in Geometric Deep Learning, *Nature Machine Intelligence*, 2024. Under review. (Manuscript is deposited on arXiv)
3. Peihao Wang, Ruisi Cai, Yuehao Wang, **Jiajun Zhu**, Pragya Srivastava, Zhangyang Wang, Pan Li, Understanding Bottlenecks of State Space Models through the Lens of Recency and Over-smoothing, *The Thirteenth International Conference on Learning Representations (ICLR)*, 2025. Submitted.
4. Yifei Sun, Qi Zhu, Yang Yang, Chunping Wang, Tianyu Fan, **Jiajun Zhu**, Lei Chen. Fine-tuning Graph Neural Networks by Preserving Graph Generative Patterns, *The Thirty-Eighth AAAI Conference on Artificial Intelligence (AAAI)*, 2024.

SELECTED RESEARCH

LLM-based Agent for Automatic Cell Type Annotations

May. 2024 - Now

Supervised by Prof. Zhiting Hu

University of California San Diego

- Proposed a framework that enables LLM-based agents to generate hypotheses, conduct experiments, run evaluations, and iteratively refine hypotheses based on evaluation results.
- Benchmarked existing methods and our approach on cell type annotation datasets.
- Developed a streamlined user interface for scientists and conducted a user study.

Equivariant Positional Encoding for Long-Context Transformers

May. 2024 - Sept. 2024

Supervised by Prof. Zhangyang Wang

University of Texas at Austin

- Introduced TAPE, a framework that enhances positional embeddings in transformers by incorporating sequence content across layers and enforcing permutation and orthogonal equivariance for generalization.
- Proposed conventional positional embeddings into multi-dimensional representations, enabling seamless integration into pre-trained models and facilitating parameter-efficient fine-tuning.
- Showed empirically TAPE excels in language modeling and downstream tasks like arithmetic reasoning and long-context retrieval, achieving state-of-the-art performance and reducing perplexity for long sequences.

Interpretability of Geometric Deep Learning for Scientific Tasks

Dec. 2022 - Apr. 2024

Supervised by Prof. Pan Li

Georgia Institute of Technology

- Adapted 12 interpretability techniques from graph neural networks to geometric deep learning models, which are widely employed in scientific tasks, and benchmarked their performance.
- Proposed the definition of two critical concepts in the domain of interpretability: *sensitive patterns* and *decisive patterns*, highlighting their misalignment, an aspect previously overlooked by researchers.
- Established fundamental observations that clarify the different applications of the two categories of interpretability techniques.

Structural Divergence in Graph Neural Networks Fine-tuning

Aug. 2022 - Oct. 2022

Supervised by Prof. Yang Yang

Zhejiang University

- Implemented five baseline methods and analyze their performances across eight molecular datasets.

- Proposed a theoretical analysis of our method from the perspective of Taylor decomposition.
- Finalized theoretical analysis and experimental sections of the paper.

FULL EXPERIENCE

Interactive Reasoning of Visual Language Models

Dec. 2023 - Apr. 2024

Research Intern Supervised by Prof. Yaochu Jin

Westlake University

- Proposed a paradigm enabling interaction with visual language models (VLMs) through visual reference, specifically "click and segment" actions, to augment interactivity and enhance reference accuracy.
- Enhanced the performance of VLMs in reasoning image segments by fine-tuning on Enhanced the reasoning performance of VLMs in image segments by fine-tuning them on our constructed multimodal dataset.

Introduction to Advanced MCMC Methods

Jul. 2022 - Aug. 2022

Team Leader

Online Exchange Program of Zhejiang University

- Conducted literature research for the development of MCMC methods and guided members to complete a literature report together.
- Performed toy experiments of three classical methods to compare the convergence rate and sampling efficiency.

Graph Neural Networks for Electronic Property Prediction

Jan. 2022 - Jun. 2022

Team Leader Supervised by Prof. Renjun Xu

Zhejiang University

- Collected 100k+ data of electronic density and band structure from material database.
- Adapted CGCNN and MEGNet for electronic property prediction.

Brain-computer Interface for Sleep Monitoring

Oct. 2021 - Feb. 2022

Research Assistant

FlexLink Technology Co., Ltd.

- Tested several sleep-staging algorithm-based evaluation methods of EEG signal quality
- Drew Bland-Altman agreement, linear regression plots for statistics analysis.

ADDITIONAL INFORMATION

- Programming languages: Python, C/C++, CUDA.
- Software & Frameworks: LaTeX, Git, PyTorch, PyTorch Geometric, Transformers.
- Interests: Guitar (performed at the school's New Year party), Skiing, Basketball, Snooker.