ZHICHAO HOU

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EDUCATION

Beijing Normal University, Beijing, China *September 2016 - June 2020*
- BS in Applied Mathematics GPA: 92.67/100
- Liyun Class by the National Top-notch Talent Cultivation Plan

Academy of Mathematics and Systems Science, Beijing, China *September 2020-June 2023*
- MS in Applied Mathematics
- Research focus: Optimal Transport, Deep Learning, Bioinformatics

Institute for AI Industry Research, Tsinghua University, Beijing, China *March 2022 - Now*
- Research Assistant
- Research focus: Graph Neural Networks

Tufts University, Medford and Somerville, Massachusetts, United States *June 2018-August 2018*
- Coding Bootcamp

PUBLICATIONS & MANUSCRIPTS

- **Zhichao Hou**, Jiacheng Leng, Jiating Yu, Zheng Xia, Ling-Yun Wu. PathExpSurv: Pathway Expansion for Explainable Survival Analysis and Disease Gene Discovery. Submitted to *2022 Bioinformatics*. Under review. [BioRxiv]
- Jiating Yu, Duanchen Sun, **Zhichao Hou**, Ling-Yun Wu. Single-Cell ATAC-seq analysis via Network Refinement with peaks location information. Submitted to *2022 Nature Methods*. Under review. [BioRxiv]

RESEARCH EXPERIENCE

—— Machine Learning (GNNs, Intepretable ML) ——

Molecular Dynamics Prediction with ST-EGNN Advisor: Prof. Wenbing Huang
Institute for AI Industry Research, Tsinghua University
AI Lab, Tencent *May 2022 - Now*

· Introduced FFT to extract equivariant features from molecular dynamics trajectory
· Leveraged equivariant geometric GNNs capture the spatial dependencies in molecular graph
· Constructed a novel equivariant attention-based encoder to model the temporal dynamics of the time series

PathExpSurv: Pathway Expansion and Factor Discovery Advisors: Prof. Lingyu Wu & Zheng Xia
Operations Research Laboratory, Academy of Mathematics and Systems Science
Computational Biology Laboratory, Oregon Health and Science University

· Proposed a two-phase training scheme to pre-train bioinformed net with prior information and continue to train it to explore the possible expansion of prior pathways.
· Expanded prior pathways expansion based on trained link weights under 100 random experiments.
· Performed reliable downstream analysis to validate the model interpretability and improvement.

SCARP: scATAC-seq analysis via Network Refinement Advisor: Prof. Lingyu Wu
Operations Research Laboratory, Academy of Mathematics and Systems Science

· Constructed the relation matrix based on the cell-peak accessible relationships and peak-peak co-accessibility.
· Aggregated information with the Network Refinement (NR) diffusion method.
· Leveraged SCARP to improve cell clustering performance and reveal new significant cell subpopulations.

Wasserstein Distributionally Robust Optimization (WDRO) Advisor: Prof. Lingyu Wu
Operations Research Laboratory, Academy of Mathematics and Systems Science *August 2019 - June 2020*

· Studied the theory of WDRO and deduced the analytical form of dual DRO with a complete proof
· Performed analysis of WDRO in classical ML problems (classification, regression, MLE, MMSE)
· WDRO achieved better generalization and robustness against classical method (SVM, Gaussian MLE, KF)

Approximation Algorithms in Wasserstein Distance Advisors: Prof. Li Cui & Jun Liu
Computational Mathematics Laboratory, Beijing Normal University *May 2018 - May 2019*

· Studied intensively on fundamental theories about the Sinkhorn and Gibbs-OT algorithms
· Completed the mathematical proof of the algorithm principle, iteration method and convergence analysis.
· Implemented Sinkhorn and Gibbs-OT algorithm in image registration problem

INDUSTRIAL EXPERIENCE

Spatial-Temporal Attentional GNN in Traffic Flow Prediction Mentor: Prof. Wenbing Huang
Institute for AI Industry Research, Tsinghua University
Intelligent Transportation Department, Baidu *March 2022 - June 2022*

· Proposed Graph Learner to learn the dynamic graph structure from traffic flow data
· Constructed STAGNN to capture the spatial and temporal dependencies of the traffic graph time series
· Achieved 25% performance improvement comparing to Baidu official baseline

Financial Time Series Data Generation with SigCWAN Mentor: Dr. Ge Wang
AI-Quant Ltd, Beijing *June 2021 - Septemper 2021*

· Got insight into the drawbacks of GAN & WGAN in data generation
· Researched on SigCWGAN which leveraged path signature as a tool to improve WGAN
· Achieved stable training process and the generated data passed six financial data tests

SCHOLARSHIPS & AWARDS

First-class Scholarship of Beijing Normal University *2017, 2018, 2019*

Champion of Mingyue Cup Basketball Match of Beijing Normal University *2017, 2018*

Second-class Prize of BNU Mathematical Modeling Contest *2018*

First-class Prize of National Mathematical Modeling Contest *2018*

Third-class Prize of National Mathematics Competition *2018*

Honorable Mention of MCM *2019*

PROGRAMMING & LANGUAGE SKILLS

Programming Python, PyTorch, R, MATLAB, C, Keras, LaTeX

TOEFL iBT 99/120