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*
& Institute for AI Industry Research, Tsinghua University, Beijing, China
Joint Training MS in Applied Mathematics & Artificial Intelligence
Academic focus: Graph Neural Networks, Optimal Transport, Bioinfomatics

Tufts University, Medford and Somerville, Massachusetts, United States *June 2018-August 2018*
Exchange Student

RESEARCH EXPERIENCE

—— Optimal Transport (Wasserstein Metric) ——

Approximation Algorithms in Optimal Transport Wasserstein Distance Adviser: Prof. Li Cui
Computational Mathematics Laboratory, Beijing Normal University *May 2018 - May 2019*

· Studied Sinkhorn algorithm based on entropy regularization theory
· Researched Gibbs-OT algorithm based on Boltzmann distribution
· Implemented Sinkhorn and Gibbs-OT algorithm in MINST dataset

Wasserstein Distributionally Robust Optimization (WDRO) Adviser: 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
· Applied WDRO in ML problems (classification, regression, MLE, MMSE estimation)

OT + X

· SigC**W**GAN in Financial Sequential Data Generation (Intern in Beijing Ai-Quant Ltd)
· Inferring Relationships between scRNA-seq Data and Spatial Transcriptomics Data with **OT** Mapping

—— Graph Neural Networks ——

Spatial-Temporal Attention Graph Neural Networks (STAGNN) Advisor: Prof. Wenbing Huang
Institute for AI Industry Research, Tsinghua University *March 2022 - Now*

· Constructed novel GNNs structure to capture the spatial dependencies in graphs
· Introduced attention mechanisms to model the temporal dynamics of the time series
· **Traffic** flow prediction (& Baidu)

  - The adjacency matrix were learned from the historic traffic flow data instead of being pre-defined

  - Performed multi-task learning to predict the future path flow

  - Utilized semi-supervised learning to do path restoration and flow prediction in missing data scenario
· **Protein** molecular dynamics (& Tencent AI lab)

  - Utilized the equivariant geometric graph neural networks in spatial modeling

  - Predicted the future position of every atom

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

· Two-phase training scheme:

  - Pre-training phase: constructed a bio-informed NN based on KEGG Database and pre-trained it

  - Training phase: added penalty to the genes out of prior pathways and continued to train NN

· Pathways Expansion: expanded the prior pathways based on trained weights
· Downstream analysis of Expanded Pathways:

  - Compared the performance of expanded pathways with prior pathway and several baselines

  - Performed the single-gene survival analysis and the literature evidences searching to identify the key cancer disease drivers.

  - Performed enrichment analysis and recoverability testing to prove the model validity

STGAN: Spatial Transcriptomics Data Generation   Adviser: Prof. Lingyu Wu
Operations Research Laboratory, Academy of Mathematics and Systems Science   *September 2022 - Now*

· Generator: utilized adjacency matrix as conditional information to generate SC-ST relation matrix and then constructed ST data from SC data
· Discriminator: leveraged GNNs to discriminate the generated ST data and true data

ADDITIONAL INFO AND AWARDS

Skilled in Python, Pytorch, Keras, Matlab, C, R, LaTex

Toefl : 99

First-class Scholarship of Beijing Normal University (3 consecutive years)   *2017-2020*

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

Third-class Prize of National Mathematics Competition   *November 2018*

Honorable Mention of MCM   *April 2019*