

TANSHENG ZHU

✉ tsuthansing@sjtu.edu.cn / ✉ tshzhu@gmail.com  [tshzhu](https://github.com/tshzhu)  [tshzhu.github.io](https://github.com/tshzhu)

EDUCATION

Shanghai Jiao Tong University

B.S. in Mathematics (Hons), Minor in Finance, Zhiyuan College

Advisor: Prof. Zhenli Xu

Aug. 2021 – June 2025 (expected)

Shanghai, China

The Chinese University of Hong Kong

Exchange Student, Department of Mathematics

Jan. 2024 – May 2024

Hong Kong, China

COURSEWORK

Research Interests: Machine Learning Theory, Optimization, Information Theory.

Grade: 90.40/100, **GPA:** 3.92/4.3.

Courses: Optimization Methods, Mathematical Programming, Foundations of Data Science, Numerical Analysis and Scientific Computing, Numerical Methods for ODEs and PDEs, Probability, Stochastic Process, Time Series, Financial Mathematics, Game Theory.

RESEARCH EXPERIENCE

Scaling Limits of Infinitely Deep Neural Networks

Advisor: Prof. Fenglei Fan, The Chinese University of Hong Kong

Jan. 2024 – Present

- Built the theoretical framework for a special class of shortcut networks with infinite depth and finite width by weakly dependent process theory. Generalized the neural tangent kernel (NTK) properties from infinitely-wide networks to infinitely-deep networks and helped understanding the width-depth equivalence of neural networks.

Kernel Estimation-based Bayesian Optimization and Monte-Carlo Planning

Advisor: Prof. Zhenli Xu, Shanghai Jiao Tong University

Nov. 2022 – Present

- Proposed the improved kernel regression upper confidence bound (IKR-UCB) algorithm under the Bayesian optimization framework, which is derived from the count-based exploration and the error bound of Nadaraya-Watson kernel regression. Conducted experiments and plotted graphs to verify its performance on quasi-uniform sampling and optimization.
- Proposed the IKR-UCT algorithm to generalize Monte-Carlo tree search into continuous state-action spaces. Conducted experiments to show its computational efficiency and competitive performance in online planning tasks.

Summer School on Mathematical Methods in Science and Engineering

School of Mathematical Sciences, East China Normal University, Shanghai, China

Aug. 2023

- Implement convolutional neural networks using NumPy and apply to image classification tasks.
- Learn the principles of filtering and compressive sensing methods and apply them to image denoising.

AWARDS AND HONORS

COMPETITIVE MATHEMATICS

Winning Prize in S.-T. Yau College Student Mathematics Contest on Appl. & Comp. Mathematics	May 2024
Finalist Winner in Mathematical Contest in Modeling (Top 3% in 18000+ teams)	May 2024
1st Prize in Shanghai Division of Chinese Mathematics Competitions	Nov. 2023
2nd Prize in Asia and Pacific Mathematical Contest in Modeling	Nov. 2023
1st Prize in “Huashu Cup” National Mathematical Contest in Modeling	Aug. 2023
1st Prize in Chinese High School Mathematics League	Oct. 2020

HONORS

Huawei Scholarship (Top 5%, Shanghai Jiao Tong University)	2023
Zhiyuan Outstanding Leader Scholarship (25 winners each year, Shanghai Jiao Tong University)	2022
A-class Academic Excellence Scholarship (Top 1%, Shanghai Jiao Tong University)	2022
Merit Student (Top 1/21, Shanghai Jiao Tong University)	2022
Zhiyuan Honors Scholarship (Top 10%, Shanghai Jiao Tong University)	2021, 2022, 2023

COURSE PROJECTS

Dendritic Computing with Bilinear Rules and Artificial Neural Networks

Fall 2023

Topic Course III, 95/100, lectured by Prof. Douglas Zhou

- Constructed bilinear rules of dendrite integration from theory to practice. Implemented artificial neural network models hLN and DBNN to fit real neuron data, and discussed the limitation of ANN's parametric space.

Solving Differential Equations with Deep Learning

Fall 2023

Foundations of data science, 97/100, lectured by Prof. Zhi-Qin John Xu

- Implemented the framework of physics-informed neural network (PINN) for both direct and inverse problems. Analysed the components of prediction error and improved them by incorporating more physics information.

Modeling and Optimization of Biological Transport Networks

Spring 2023

Topic Course II, 99/100, lectured by Prof. Dan Hu

- Analysed the dynamics of the biological transport network. Implemented different optimization algorithms, and explained the entangled-network phenomenon of results based on the spectrum of the graph Laplacian matrix.

Computational Mean-field Optimal Control

Spring 2023

Numerical Methods for ODEs and PDEs, 96/100, lectured by Prof. Lei Li

- Studied a class of reaction-diffusion equation mean-field information dynamics. Implemented the primal-dual hybrid gradient algorithm to solve the concerned saddle point problem.

SKILLS

Programming Languages: Python, Matlab, C/C++, R

Toolkits: NumPy, SciPy, Sklearn, Pandas, Statsmodels, Matplotlib, PyTorch, Numba, CVXPY, COPT

Leadership: Class monitor from 2021 to 2023; Executive of Mathematical Modelling Association of SJTU

REFERENCES

Zhenli Xu, xuzl@sjtu.edu.cn,

Professor of Shanghai Jiao Tong University, Shanghai, China.

Fenglei Fan, hitfanfenglei@gmail.com,

Assistant Professor of the City University of Hong Kong, Hong Kong, China.