

TANSHENG ZHU

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EDUCATION

Shanghai Jiao Tong University

B.S. in Mathematics (Zhiyuan Honors Program), Minor in Finance
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, High-dimensional Probability.

GPA: 90.34/100; 3.92/4.3.

Selected Courses: Foundations of Data Science (97/100), Probability (96/100),
Optimization Methods (97/100), Mathematical Programming (94/100),
Numerical Analysis (91/100), Numerical Methods for ODEs and PDEs (96/100).

RESEARCH EXPERIENCE

Scaling Limits of Infinitely Deep Neural Networks

Jan. 2024 – Present

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

- Established the theoretical framework of neural networks with infinite depth and finite width by weakly dependent random processes.
- Analyzed the Gaussian process behavior and neural tangent kernels of infinitely deep networks, and leveraged the ergodic theory to interpret the width-depth equivalence of neural networks.

Density-based Exploration Strategy for Scalable Bayesian Optimization

Feb. 2024 – June 2025

Advisor: Prof. Zhenli Xu, Shanghai Jiao Tong University

- Proposed the Bayesian optimization by kernel regression and density-based exploration (BOKE) algorithm, which generalized the count-based exploration to Bayesian optimization, and proved its global convergence
- Conducted experiments to verify its competitive performance in space-filling design and optimization.

Monte-Carlo Tree Search in Continuous Action Spaces via Kernel Regression

Nov. 2022 – Feb. 2024

Advisor: Prof. Zhenli Xu, Shanghai Jiao Tong University

- Proposed the BOKR-MCTS algorithm to leverage Monte-Carlo tree search into continuous state-action spaces.
- Conducted experiments to show its computational efficiency and competitive performance in online planning tasks.

HONORS AND AWARDS

MATHEMATICS COMPETITIONS

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 Region of Chinese Mathematics Competitions	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

PUBLICATIONS

- [1] **Tansheng Zhu**, Hongyu Zhou, Ke Jin, Xusheng Xu, Qiufan Yuan, and Lijie Ji*. *Bayesian Optimization by Kernel Regression and Density-based Exploration*. 2025. arXiv: 2502.06178 [math.OC]. Submitted.
- [2] Ke Jin, **Tansheng Zhu**, Hongyu Zhou, Xusheng Xu, Qiufan Yuan, and Lijie Ji*. *Bayesian-Optimized Progressive Widening via Kernel Regression for Monte Carlo Tree Search in Continuous Action Spaces*. Submitted.

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. Analyzed 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

- Analyzed 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++

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

Leadership: Class President, *Zhiyuan College, Shanghai Jiao Tong University* 2021 – 2023

Leadership Team Member, *Mathematical Modelling Association of SJTU* 2022 – 2024

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.