TANSHENG ZHU

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EDUCATION

Tsinghua University Incoming at Sept. 2025
Ph.D. student in Computer Science, Institute for Interdisciplinary Information Sciences *Beijing, China*
Advisor: Prof. Jian Li

Shanghai Jiao Tong University Aug. 2021 – June 2025
B.S. in Mathematics and Applied Mathematics (Hons), Minor in Finance, Zhiyuan College *Shanghai, China*
Advisor: Prof. Zhenli Xu

The Chinese University of Hong Kong Jan. 2024 – May 2024
Exchange Student, Department of Mathematics *Hong Kong, China*

COURSEWORK

Research Interests: Deep Learning Theory, Machine Learning, Optimization.
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 ODE & PDEs,
Probability, Stochastic Process, Financial Mathematics, Differential Geometry.

RESEARCH EXPERIENCE

Scaling Limits of Infinitely Deep Neural Networks Jan. 2024 – Present
Advisor: Prof. Fenglei Fan, The Chinese University of Hong Kong

- 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 Nov. 2022 – Present
Advisor: Prof. Zhenli Xu, Shanghai Jiao Tong University

- 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 Aug. 2023
School of Mathematical Sciences, East China Normal University, Shanghai, China

- 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 in Shanghai Jiao Tong University (Awarded to 6 undergraduates in Zhiyuan College)	2023
Zhiyuan Outstanding Leader Scholarship for excellent leadership in Zhiyuan College	2022
1st Prize for Academic Excellence in Shanghai Jiao Tong University (Top 2% undergraduates)	2022
Merit Student in Shanghai Jiao Tong University	2022
Zhiyuan Honors Scholarship for academic excellence in Zhiyuan College	2021, 2022, 2023

COURSE PROJECTS

Dendritic Computing with Bilinear Rules and Artificial Neural Networks Fall 2023

Team leader, advised 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

Individual project, advised by Prof. Zhi-Qin John Xu (got the highest score)

- 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

Team leader, advised by Prof. Dan Hu (got the highest score)

- 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

Individual project, advised 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, LaTeX, Markdown
Toolkits: NumPy, SciPy, Sklearn, Pandas, Statsmodels, Matplotlib, PyTorch, Numba, Gurobi, Copt
Language Proficiency: Mandarin (native), English (fluent, CET-6: 560), Hokkien (native)
Leadership: Class monitor from 2021 to 2023, executive of Mathematical Modelling Association of SJTU

REFERENCES

Jian Li, lijian83@mail.tsinghua.edu.cn,
Professor of Tsinghua University, Beijing, China.

Zhenli Xu, xuzl@sjtu.edu.cn,
Professor of Shanghai Jiao Tong University, Shanghai, China.

Fenglei Fan, flfan@math.cuhk.edu.hk,
Research Assistant Professor of The Chinese University of Hong Kong, Hong Kong, China.