

ZEXI FAN

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Personal Homepage

X $\diamond$ Github $\diamond$ LinkedIn

EDUCATION

Peking University(PKU)

Sep 2022 - Present

B.S. in Computational Mathematics

Major GPA: 3.6/4.0

Selected Courses: Abstract Algebra(93), Machine Learning(93), Advanced Algebra 2(90)

Advanced Mathematical Skills: Stochastic Analysis&Control,Scientific Machine Learning,PDE

GRE: (164+169+4)/(170+170+6)

Aug 2023

TOPICS I HAVE WORKED ON

- Multilevel Monte Carlo and its Applications
- Diffusion Models and Other Stochastic Interpolants(Optimal Transport, Schrodinger Bridge, Transition Path)
- Scientific Machine Learning
- High Dimensional PDE Solver
- Contextual Bandit

I am also open to work on other topics in Machine Learning and Applied Mathematics.

PUBLICATIONS

Physics-Informed Inference-Time Scaling for Solving High-dimensional PDE via Simulation Calibrated Scientific Machine Learning (SCaSML)

Comming Soon

Contribution: First Author

RESEARCH EXPERIENCE

Unbiased Square Root Convergent Estimation for High-Dimensional Semilinear Parabolic Heat Equation

Sep 2023 - Feb 2024

Supervisors: Prof. Yiping Lu

NYU

- Proposed an estimator for solving high-dimensional semilinear parabolic heat equations based on Multilevel Picard Iteration and randomized Multilevel Monte Carlo
- Proved the unbiasedness of the estimator
- Showcasing the estimator has bounded variance

Flow Calibrated RL for Transition Path Sampling (Slides & Notes)

Feb 2024 - June 2024

Supervisors: Prof. Yiping Lu and Dr. Dinghua Zhang

NYU,Mila

- Proposed an algorithm for sampling distribution-to-distribution transition paths under SDE framework
- Formulated the problem into a rigid stochastic optimal control problems that can be solved in RL
- Developed continuous versions of Soft Actor-Critic and that of GFlowNet by stochastic analysis
- Combining the two solvers for better exploration-exploitation trade-off
- Considering appropriate reparameterization for continuous Soft Actor-Critic

Simulation-Calibrated Scientific Machine Learning (SCaSML) for Solving High-Dimensional Partial Differential Equations (Codebase for PINN)(Codebase for GP)

June 2024 - Present

Supervisors: Prof. Yiping Lu and Dr. Yan Sun

Northwestern, Gatech

- Helped develop a family of simulation-based estimators to calibrate the error of PINN
- Proved the rate improvements in convergence for Multilevel Picard Iteration estimators
- Demonstrated the effectiveness of SCaSML by numerical experiments on multiple 100d+ PDEs

Continuous State Contextual Bandit with Pessimism Regularization August 2024 - Present
Supervisors: Prof. Ying Jin Havard

- Constructed an adaptation Pessimism Regularization for contextual bandit with continuous state space
- Proved the suboptimality of the estimator does not require uniform overlapping assumption

ACADEMIC ACTIVITIES

Graduate course: Combinatorics, Score: 92, taught by Prof. Chunwei Song	<i>Spring 2023</i>
Graduate course: Machine learning, Score: 93, taught by Prof. Kedian Mou	<i>Winter 2023</i>
Graduate course: Mathematical image processing, taught by Prof. Bin Dong	<i>Winter 2023</i>
Graduate course: High Dimensional Probability, taught by Prof. Zhihua Zhang	<i>Fall 2024</i>
Graduate course: Optimization Methods, taught by Prof. Zaiwen Wen	<i>Fall 2024</i>
Graduate course: Applied Stochastic Analysis, taught by Prof. Tiejun Li	<i>Fall 2024</i>
Seminar: Blowup in fluid equations, organized by Prof. Jiajun Tong&Prof. De Huang	<i>Winter 2023</i>
Seminar: Stochastic optimal control, organized by Dr. Xinhua Duan	<i>Spring 2024</i>
Summer school: Beauty of theoretical computer science, organized by NJU CS Dept.	<i>Summer 2024</i>
Seminar: LLM and scientific computing, organized by Prof. Zaiwen Wen	<i>Winter 2023</i>

SOCIAL ACTIVITIES

Academic&Innovation Department, SMS Student Union	<i>Spring 2023</i>
English Debate Club	<i>Summer 2024</i>

SKILLS/HOBBIES

Programming Languages	Python, Matlab, Latex, Markdown
Machine Learning Tools	Pytorch, Tensorflow, Numpy, Jax, Wandb, DeepXDE
Hobbies	Animation and Program Designing
Languages	English and Chinese