ZEXI FAN

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Personal Homepage
X ◇ Github ◇ 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

Simulation-Calibrated Scientific Machine Learning (SCaSML) for Solving High-Dimensional Partial Differential Equations (Preprint) submitted
Contribution: First Author

RESEARCH EXPERIENCE

Exploring Training Strategy of GAN via MCST in Go Sep 2019 - June 2020
Supervisors: Dr. Hailong Qin HIT

· Proposed an algorithm that leverages MCST algorithm in AlphaGo to balance the training of discriminator and generator in GAN
· Implemented an experiment on MINST to illustrate the efficiency of the algorithm in early stages
· This is an award-winning paper of the National Innovation Competition of Youth(at Beijing), a research-oriented competition for high schoolers

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) Feb 2024 - June 2024
Supervisors: Prof. Yiping Lu and Dr. Dinghuai 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-Crictic and that of GFlowNet by stochastic analysis
- Combining the two solvers for better exploration-exploitation trade-off
- Considering appropriate reparameterization for continuous Soft Actor-Crictic

Simulation-Calibrated Scientific Machine Learning (SCaSML) for Solving High-Dimensional Partial Differential Equations (Codebase) June 2024 - Present
Supervisors: Prof. Yiping Lu and Dr. Yan Sun Northwest,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 Angust 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	*Spring 2023*
Graduate course: Machine learning, Score: 93, taught by Prof. Kedian Mou	*Winter 2023*
Graduate course: Mathematical image processing, Audit, taught by Prof. Bin Dong	*Winter 2023*
Graduate course: High Dimensional Probability, Ongoing, taught by Prof. Zhihua Zhang	*Fall 2024*
Graduate course: Optimization Methods, Ongoing, taught by Prof. Zaiwen wen	*Fall 2024*
Graduate course: Applied Stochastic Analysis, Ongoing, taught by Prof. Tiejun Li	*Fall 2024*
Seminar: Blowup in fluid equations, organized by Prof. Jiajun Tong&Prof. De Huang	*Winter 2023*
Seminar: Stochastic optimal control, organized by Dr. Xinhan Duan	*Spring 2024*
Summer school: Beauty of theoretical computer science, organized by NJU CS Dept.	*Summer 2024*
Seminar: LLM and scientific computing, organized by Prof. Zaiwen Wen	*Winter 2023*

SOCIAL ACTIVITIES

Academic&Innovation Department, SMS Student Union	*Spring 2023*
English Debate Club	*Summer 2024*

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