Xingjian Tao

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Education

Georgia Institute of Technology, Atlanta, GA ***Aug 2025 - Present***

H. Milton Stewart School of Industrial and Systems Engineering
PhD Student in Algorithms, Combinatorics, and Optimization (ACO)

- ISYE 7661: Linear Inequalities (A)
- ISYE 7686: Advanced Combinatorial Optimization (A)
- ISYE 7687: Advanced Integer Programming (A)
- ISYE 6663: Nonlinear Optimization (A)

Georgia Institute of Technology, Atlanta, GA ***Aug 2023 - Aug 2025***

H. Milton Stewart School of Industrial and Systems Engineering
Master of Science in Operations Research
GPA (4.0 scale): 4.0

- MATH 7016: Combinatorics (A)
- ISYE 6661: Linear Optimization (A)
- ISYE 6662: Discrete Optimization (A)
- ISYE 6664: Stochastic Optimization (A)
- CSE 6140: Computational Science and Engineering Algorithms (A)
- CSE 6230: High-Performance Parallel Computing (A)

Nanjing University, Nanjing, Jiangsu, China ***Sep 2018 - Jun 2022***

Bachelor of Economics in Financial Engineering
GPA (100 scale): 91.0

- C++ and Object-Oriented Programming (96/100)
- Ordinary Differential Equations (93/100)
- Operating System and Linux Programming (92/100)
- Data Structure and Algorithm Design (91/100)
- Numerical Methods for PDEs (graduate level, 90/100)

Research Experience

Randomized Rounding for Solving MINLP Models of Symbolic Regression ***May 2024 - Present***

Graduate Research Assistant — Supervised by Dr. Nikolaos Sahinidis

- Developed MINLP formulations for symbolic regression using expression-tree representations, with a focus on formulation strength, numerical stability, and relaxation quality.
- Designed randomized-rounding procedures for selecting expression-tree structures from continuous relaxations, followed by coordinate-descent line search satisfying the Armijo condition for optimizing constants.
- Studied formulation refinements including perspective reformulation, operator-specific value decompositions, and binary-variable reductions based on separating operators from operands.
- Analyzed simplified settings showing that loose continuous-variable bounds can make randomized-rounding probabilities arbitrarily uninformative, motivating tighter and structure-aware bounds.
- Solved 38% of the Feynman benchmark problems within 8 hours on a single CPU, outperforming nearly all top-performing methods in SRBench.
- Parallelized randomized rounding and constant optimization in CUDA-Fortran, achieving up to a $6\times$ speedup.

Thesis Project: Volatility Models for the Mean-Reversion Process of Daily Average Temperatures ***Jun 2022***

- Built two volatility models for modeling the daily average temperatures based on the Ornstein-Uhlenbeck mean-reversion process and the jump process model.
- Applied the Basin hopping global optimization method with the Nelder–Mead algorithm to find the Maximum Likelihood Estimation (MLE) of model parameters, and validated the effectiveness of proposed models compared to the homoscedastic Brownian volatility model through Monte Carlo simulation.

School Projects

Project for High-Performance Parallel Computing ***Apr 2024***

GPU-Accelerated Smoothed Particle Hydrodynamics for Fluid Simulation

- Developed a GPU-accelerated fluid simulation using Smoothed Particle Hydrodynamics (SPH), leveraging its parallelization advantages over grid-based methods.

- Optimized particle sorting for cache locality, reducing processing time by 30%, and implemented a lockless ring queue for I/O, achieving a 6x speedup in file-writing.
- Compared serial, OpenMP, and CUDA implementations, cutting runtime from 836s to 9s on NVIDIA H100 GPUs. Validated accuracy with 3D visualization and demonstrated scalability through large-scale runtime analysis.

Projects for Stochastic Processes II ***Feb 2024 - Apr 2024***

Optimization of Uber Ride-Sharing System Using Continuous-Time Markov Chains

- Modeled Uber's Atlanta ride-sharing system as a Continuous-Time Markov Chain (CTMC) with transition rates estimated from anonymized event data.
- Designed and assessed proactive driver relocation policies to minimize unserved ride requests and rider abandonment.

Dynamic Pricing Policy Design for Uber Using Brownian Motion Approximation

- Modeled Uber's ride-sharing system in the Buckhead area as a Continuous-Time Markov Chain (CTMC) and derived a Brownian motion approximation to analyze rider and driver dynamics.
- Analyzed expected profits of static pricing policies and developed a dynamic pricing policy with superior performance.

Projects for Financial Engineering System I ***Jan 2021 - May 2021***

Monte Carlo method for pricing Asian options

- Developed Monte Carlo simulations to price Asian options with varying averaging periods, estimated Greeks (Delta, Vega) and their errors, and reduced the pricing variance using the Antithetic Variate method.

Numerical methods for pricing American options

- Applied the Crank-Nicolson scheme with the Projected Successive Over-Relaxation (PSOR) method at each time step to price American options and compute Greek values. Adapted PSOR to the LU decomposition reconstructed by Ikonen and Toivanen (2007) based on the Brennan & Schwartz algorithm, achieving comparable performance.

Internships

Berkeley Brothers, Shanghai, China ***Jul 2022 - Jan 2023***

C++ Development Intern

Project: Quote Receiving and Order Book Aggregating Code Development

- Developed and maintained code to receive quotes and aggregate real-time order book data from multiple exchange connections.
- Utilized Protocol Buffers to serialize aggregated order book data and publish it to remote machines. Created client code to pull, verify, and compare order book data, writing it to shared memory for simultaneous access by high-frequency trading strategies.

Hengtai Securities, Hangzhou, China ***Apr 2022 - Jul 2022***

Quantitative Development Intern

Project: Header-Only Vector Math Library implemented with SIMD instructions

- Implemented vector operations using GCC AVX-512 intrinsics, including element-wise logarithmic and exponential functions.
- Employed the Remez Algorithm to find polynomial approximations of logarithmic and exponential functions, accelerated the element-wise calculation with SIMD instructions, achieving over 5x speedup compared to naive benchmarks.
- Please see `https://github.com/hubery-tao/fast_math` for code.

Project: Lock-Less Queues for Inter-Thread Communication

- Designed a lockless circular queue for inter-thread communication using Atomic Compare-and-Swap (CAS) instructions, optimized for multiple producers and a single consumer.
- Achieved 1.6M transactions per second with a ring size of 8192 bytes, 16 producers, and 1 consumer.

Skills

Programming and Tools

- C/C++, Fortran, Python, MATLAB, CUDA, GNU/Linux, Git, CMake, LaTeX