Hu Hanyang

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EDUCATION

National University of Singapore, B.Sc. (Hons) with Major in Mathematics — Aug 2021 – May 2025

- **GPA**: 4.66/5.0
- Participant of the **Special Programme in Mathematics (SPM)** for selected students with strong aptitude.
- **Specialization**: Operations Research & Data Analytics
- **Relevant Courses:** Artificial Intelligence, Bayesian Statistics, Computer Organization, Convex Optimization, Data Structures and Algorithms, Differential Geometry, Discrete Mathematics, Game Theory, Information Theory, Numerical Analysis, Stochastic Operations Research, Stochastic Processes, Theory of Computation

EXPERIENCE

Software Team Lead, NUS Calibur Robotics – Singapore — Aug 2022 – July 2024

- Led data collection and curation of over 6000 images to train lightweight models for armor plate detection.
- Applied the SORT algorithm and Kalman filters for motion tracking and prediction.
- Achieved 2nd place as a team in the RoboMaster University League (RMUL) 2023, Seattle.
- Conducted multiple workshop sessions in the DarkNUS program to teach participants about our aimbot systems.
- Implemented particle filters and various path planning algorithms in simulations, including A* and DWA; and investigated reinforcement learning-based navigation through implicit Q learning and reward shaping.

PROJECTS

Gaussian Processes for Model-Based Reinforcement Learning — Aug 2024 - now

Mathematics Capstone Project (MA4198+MA4288x) | *Supervisor: Prof. Jonathan Scarlett.*

- **Ongoing Plan**: (1) Investigate and develop scalable, online, and non-stationary GP regression models;
  (2) Apply state abstraction methods and regularizations to enhance GP-based planning.
- Implemented efficient update of the mean cache and LOVE cache, achieved approximately 100x speedup in runtime on the Elevator dataset ($\approx$ 10k data points) for frequent fantasization compared to the implementation of exact GP with LOVE in GPyTorch.
- Implemented Farthest Point Sampling (FPS) and other subsampling methods using KeOps, achieved at least 60x speedup on the 3D Road dataset ($\approx$ 400k data points) compared to PyTorch-based implementations.

Nonlinear Dimensionality Reduction with UMAP — Aug 2024 - Dec 2024

Course Project for Data Modelling and Computation (MA4270) | *Instructor: Prof. Soh Yong Sheng*

- Studied and summarized the curse of dimensionality and the (parametric) UMAP algorithm in a written report.
- Implemented parametric UMAP from scratch using PyTorch. Tested on synthetic and real-world datasets.
- Applied concepts in smooth manifolds to estimate intrinsic dimension (via probabilistic PCA on tangent spaces).

Unstructured High-Dimensional Bayesian Optimization — May 2024 - Aug 2024

Advanced UROPS in Mathematics (MA3288) | *Supervisor: Prof. Jonathan Scarlett.*

- Investigated the unknown hyperparameter issue of Bayesian optimization in high-dimensional settings, without imposing assumptions on low-dimensional structures or restricting to local regions.
- Proposed a soft approximation of Winsorization to address outliers and complex objective functions, achieving more robust results in finding controller parameters for the lunar lander task in OpenAI Gymnasium.
- Delivered a written report and presented findings through an oral presentation.

SKILLS

Languages: English (GRE: 160+168+4.0; IELTS Academic: 8.0), Chinese (Native)
Technical Skills: Python (PyTorch, NumPy, KeOps, OpenCV, etc.), Linux (basic commands, vim, SSH, etc.), LaTeX