Hu Hanyang

hanyang_hu@u.nus.edu | +65 8884 9021 | hanyang-hu.github.io

SUMMARY

I am a final-year undergraduate student pursuing a degree in Mathematics at the National University of Singapore (NUS). I have obtained solid foundational knowledge and problem-solving skills through studies in mathematics and gained practical experience with machine learning and relevant tools through various projects.

My research interests include learning-based decision-making, particularly in planning and reinforcement learning. I am currently focused on enhancing the data and computation efficiency of uncertainty-aware models, as well as enabling the online acquisition of new knowledge.

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 Coursework:** Discrete Mathematics, Data Structure and Algorithms, Computer Organization, Artificial Intelligence, Bayesian Statistics, Differential Geometry, Convex Optimization, Numerical Analysis, Game Theory, Information Theory, Theory of Computation, Stochastic Processes, Stochastic Operations Research

EXPERIENCE

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

- Led data collection and annotation of over 3000 images for armor plate detection to train a YOLOv7-tiny model.
- Applied the SORT algorithm and Kalman filters to track and predict the target's spatial motion.
- Competed in RMUL 2023 (Seattle), where our team earned 2nd place in the competition.
- Conducted three workshop sessions in the DarkNUS program, teaching participants how to deploy our system.
- Led implementations of particle filters and path planning algorithms (e.g., A^* and DWA) in simulations.
- Implemented implicit Q learning and reward shaping to investigate learning-based navigation in simulations.

PROJECTS

Gaussian Processes for Model-Based Reinforcement Learning   Aug 2024 - now
Mathematics Capstone Project (MA4198+MA4288x) | Supervised by Prof. Jonathan Scarlett.

- **Initiative**: Focus on applying GPs in the MBRL setting to leverage the data efficiency, uncertainty quantification, and incremental ability of GPs, and incorporate the flexibility of neural networks in architectures and training objectives. Meantime, attempt to retain computation efficiency for real-time applications.
- **Ongoing Plan**: (1) Investigate and develop scalable, online, and non-stationary GP regression model; (2) Study and apply state abstraction techniques in reinforcement learning, combined with regularizations to enhance GP-based planning.
- **Current Progress**: Applied Lanczos estimation to update both mean cache and LOVE cache (inspired by existing papers), achieving approximately 100x speedup in runtime on the Elevator dataset for frequently fantasizing the model compared to the implementation of exact GP with LOVE in GPyTorch.

Unstructured High-Dimensional Bayesian Optimization   May 2024 - Aug 2024
Advanced UROPS in Mathematics (MA3288) | Supervised by 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 and investigated its ability to deal with issues of outliers and objective functions of high complexity.
- Delivered a written report and presented findings through an oral presentation.