

# Hu Hanyang

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## SUMMARY

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I am a final-year undergraduate student in Mathematics at the National University of Singapore (NUS). I have obtained solid foundational knowledge and honed my problem-solving skills through rigorous coursework, along with practical experience in machine learning and robotics through academic and extracurricular projects.

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

## EDUCATION

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**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

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

- Led data curation and annotation of over 3000 images for training a YOLOv7-tiny armor plate detection model.
- 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

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

*Mathematics Capstone Project (MA4198+MA4288x) | Supervisor: 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, 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) | 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 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.