Chong Yu Quan

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Education

- **National University of Singapore** — Singapore
  Bachelor of Engineering (Mechanical Engineering) with Honors — *Aug 2018 - May 2022*
  Minor in Physics, Minor in Computer Science, University Scholars Programme, GPA: 4.75
  Courses: *Small Aircraft & Unmanned Aerial Vehicles, Probability, Data Structures and Algorithms, Discrete Structures, Quantum Mechanics, Mechanical Systems Design, Deep Learning For Robotics, Machine Vision, Feedback & Control Systems, Programming Methodology*

- **Dunman High School** — Singapore
  Singapore-Cambridge GCE Advanced Levels (5 Distinctions) — *Jan 2010 - Dec 2015*

Skills Summary

- **Languages**: Python, C/C++, MATLAB, Latex
- **Frameworks**: Scikit, TensorFlow, Keras, PyTorch, ROS, GIT, SolidWorks, Ansys, AutoDesk
- **Soft Skills**: Leadership, Scientific Research, Communication, Time Management, Resource Management, Conflict Resolution

Research Experience

- **National University of Singapore** — Singapore
  Smart Collaborative Drones (under Dr Guillaume Sartoretti) — *Aug 2021 - Present*
  - **Multi-Agent Reinforcement Learning**: Collaborating with Thales, the research focuses on the development of novel algorithms to develop a system for a team of smart drones to act intelligently and collaboratively to achieve common goals (e.g. guarding of high-value assets, searching for hazards) against adversarial teams of drones in a suitably realistic simulated environment.

- **National University of Singapore** — Singapore
  Machine Learning for Drone Detection (under Dr Sutthiphong Srigrarom) — *Feb 2021 - May 2021*
  - **Night-Time Drone Detection**: Explored the concept of night-time drone detection through their thermal signature using thermal imaging. Machine learning utilised a YOLOv3 based model architecture for drone detection.
  - **Drone Motion Input Features**: Utilised a simple yet novel technique of concatenating past image frames to encapsulate drone motion as input feature to improve differentiation between similar flying objects such as birds.

- **National University of Singapore** — Singapore
  Deep Reinforcement Learning (under Dr Guillaume Sartoretti) — *Aug 2020 - May 2021*
  - **Onitama AI**: Investigated with peer on various approaches to create artificial intelligent agents to play the board game Onitama with beyond human-level performance.
  - **Traditional Approaches**: Explored traditional AI approaches such as the Minimax algorithm with alpha-beta pruning and the Monte Carlo Tree Search (MCTS) algorithm.
  - **Modern Reinforcement Learning**: Traditional AI agents are used as competing agents with a specified learning curriculum to train an agent using Deep Deterministic Policy Gradients (DDPG). Explored various model architectures to train agent to learn good and legal moves efficiently.

- **National University of Singapore** — Singapore
  Machine Learning for Predictions (under Dr Shen Lei) — *Feb 2020 - May 2020*
  - **Novel Battery Electrodes Voltage Predictions**: Used supervised machine learning on chemical data from The Materials Project to train a model that is able to predict the electrodes voltage of novel/theoretical electrodes that has yet to been researched in depth. A robust model with good test performance can be used to shortlist top candidates of potentially good electrodes to efficiently focus research efforts on.

- **A* STAR, Institute of Infocomm Research** — Singapore
  Colourimetry for Purpose of Disease Detection (under Dr Zhou Xiao Qun) — *Jan 2014 - Dec 2014*
  - **Prostate Cancer Detection Device**: Collaborated with peers to develop a device to detect the level of Prostrate-Specific Antigen (PSA) through colourimetry on commercially used test kits to diagnose for prostate cancer. Device is made for medical and home diagnostics applications given that it is portable, simple and accurate. The work is presented in Singapore Science & Engineering Fair 2014 finals and won the Merit Award.

- **National University of Singapore** — Singapore
  Optimization of Glutaminase Inhibitors (under Dr Sivaraman Jayaraman) — *Jan 2013 - Dec 2013*
  - **Cancer Therapeutics**: Collaborated with peers to crystallised and study the active site inhibitor of glutaminase, 6-diazo-5-oxo-L-norleucine (DON)-a glutamine analog, and kidney type glutaminase (KGA). Obtained crystals are used for study of cKGA-DON complex mechanism, which is necessary for the structure based drug design for cancer therapeutics. The work is presented in the 18th Youth Science Conference and won the 3M Best Poser Award for the top 3 finalists. The work is also presented in Singapore Science & Engineering Fair 2013 finals and won the Merit Award.

Industry Experience

- **Thales** Singapore
  Multi-Agent Reinforcement Learning *Jun 2021 - Jul 2021*
  - **Smart Collaborative Drones**: Design and develop a system for a team of smart drones to act intelligently and collaboratively to achieve common goals (e.g. guarding of high-value assets, searching for hazards) against adversarial teams of drones using reinforcement learning in a suitably realistic simulated environment.
- **Defence Science and Technology Agency (Land Systems)** Singapore
  Data Analytics and Visualisation for Vehicular Maintenance *Aug 2020 - Dec 2020*
  - **Fleet Management**: Designed and developed a data visualisation interface using QlikSense to display relevant vehicular fleet status and maintenance information for command.
  - **Anomaly Detection**: Interfaced data visualisation using QlikSense scripts with a QlikSense Python Server Side Extension with machine learning tools. This enabled the usage of clustering on vehicular maintenance data using Hierarchical Density-Based Spatial Clustering of Applications with Noise (HDBSCAN) for anomaly detection. This allows for preventive maintenance capabilities to reduce operational costs and maintain fleet readiness.
- **Defence Science and Technology Agency (Air Systems)** Singapore
  Modular Drone Design *Jun 2019 - Aug 2019*
  - **Gripper Module**: Designed a gripper module with an attachment mechanism and modified an existing modular drone body design such that the modules can be easily attached by operators without any training. Gripper module allows a drone to grip around rod-like structures such as tree branches and pipes, allowing the drone to hang without thrust from its motors to save battery. The work has applications in long distance surveillance operations in urban or forested environments.
  - **3D Printable**: The gripper module is designed have all components to be easily 3D printed for rapid and modular manufacturing purposes.
- **Defence Science and Technology Agency (Building and Infrastructure)** Singapore
  Blast Propagation Analysis *Feb 2018 - May 2018*
  - **Infrastructure Design**: Simulate various scenarios of blast propagation's in the building designs of critical infrastructures using Ansys AutoDyn. Assess results of simulation based on industrial standards and make recommendations to improve the existing building designs.
- **Republic of Singapore Navy, Navy Medical Service** Singapore
  Navy Medical Operations Service Medic *Apr 2016 - Feb 2018*
  - **Shipboard Medic**: Operationally trained as a shipboard medic in charge of the medical coverage of ship crew during naval operations. Sailed with various warships for various exercises, such as Exercise Pacific Griffin to Guam in 2016. Involved in the vaccination of ship crew members and day to day running of the medical center when not shipboard. Learned an array of skills such as leadership, time and resource management, conflict resolution, teamwork and communication during process.

Projects

- **Flapping-Wing Micro-Aerial Vehicle (Deep Reinforcement Learning & Flapping Wing Flight)**: Collaborated with peers to modify an existing state-of-the-art Flapping-Wing Micro-Aerial Vehicle (FW MAV). Involved with the design modifications, manufacturing and assembly of the FW MAV as well as the development of an integrated system setup consisting of a motion capturing system, transmitters and learning agent interfaced using ROS with C++ and Python to train the FW MAV to fly. (May 2021)
- **Training a modelled Spider Robot to locomote (Deep Reinforcement Learning)**: Collaborated with a peer in course project to design a Spider Robot model in CAD. The model is transferred into a simulated environment in PyBullet and trained to locomote with using several state-of-the-art reinforcement learning models. Successful model using Deep Deterministic Policy Gradients managed to locomote in a straight line for the specified distance despite a large number of degree of freedom joints wise. Obtained full marks and topped the cohort in the graduate course as an undergraduate in the third year. (Nov 2020)
- **AIAA Design Build Fly Competition 2019 (Mechanical Design & Electronics)**: Designed , manufactured and assembled an Unmanned Aerial Vehicle (UAV) as a member of the NUS UAV Team 2019. Took roles in the theoretical calculations for aerodynamics and mechanisms of UAV, designing components of the UAV using Computer-Aided Design, resource acquisition, manufacturing of components, integration of electronics as well as team management. (Apr 2019)

Publications

- **Conference Paper**: Y. Q. Chong, L. W. Ong and S. Sutthiphong, "Identification of Drone Thermal Signature by Convolutional Neural Network," in International Conference on Unmanned Aircraft System, Athens, 2021. **(Accepted)**

Honors and Awards

- Defence Science and Technology Agency Scholarship - 2018
- NUS Faculty of Engineering Dean's List - 2019