Tariq Soliman

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Education

The University of Queensland (UQ) — St Lucia, QLD
Bachelor of Engineering (Hons) and Master of Engineering, Major in Mechatronics — *Feb. 2019 – Nov. 2024*
First Class Honours - 6.8/7 GPA

National University of Singapore (NUS) — Singapore
Exchange Program — *Aug. 2022 – Feb. 2023*

Westpac — Singapore
W100 Asian Exchange Scholar & Leadership Development Program — *Sep. 2022*

Experience

Graduate Digital Engineer — Jan. 2024 – Present
Hatch — *Brisbane, QLD*

Dugald River Mine (DRM) Flotation Twin | *Python, C#, Tensorflow, Azure Devops*

- Supported a digital twin of Dugald River Mine (DRM) zinc flotation processing plant (fixing bugs/adding features). The digital twin utilises neural networks to simulate the operations and Particle Swarm Optimisation to optimise the control variables for profit based on zinc grade and recovery
- Engaged with clients in weekly meetings to get feedback and prioritise features
- Investigated error detection and correction techniques for the DRM Flotation Twin and added explainability metrics for model training (e.g Sobol Sensitivity Analysis, SHAP Values)
- Introduced unit testing into ci-cd pipelines that run in Devops on Azure

Master's Thesis Placement | *Python, C++, ROS2, Computer Vision*

- Researched applications of drones with computer vision for asset monitoring and predictive maintenance
- Implemented a combination of deep learning with Bayes' Filter and traditional computer vision techniques for locating concrete pillars and segmenting surface voids (analogous to defects)
- Utilised research in Visual Simultaneous Localisation and Mapping with RGB and RGBD cameras for mapping GPS denied environments

Research Assistant — Dec. 2024 - Present
The University of Queensland — *St Lucia, QLD*

- Investigated dimension importance estimation with embeddings generated by Large Language Models (LLMs) for information retrieval
- Building on work from Matryoshka Respresentation Learning and Dimension Importance Estimation for Dense Information Retrieval to try and improve retrieval performance by choosing a subset of dimensions for each query

Tutor — Mar. 2019 – Nov. 2024
The University of Queensland, ITAR, Cluey Learning & Privately — *St Lucia, QLD*

- UQ Courses: Programming for Engineers, Introduction to Computer Systems, Robotics and Automation
- Lead tutor for courses at UQ. Responsibilities included running tutorials and presenting technical content, training new tutors, helping students with assignments, helping course coordinators draft assessments, helping to write tests for code, marking assessments
- Also for the Indigenous Tutorial Assistance and Retention (ITAR) program, online for Cluey Learning, privately for high school students

Research Assistant — Dec. 2022 – Feb. 2023
Singapore Sports Institute — *Singapore*

- Implemented a custom deep learning model in keras that could classify a subset of fencing movements based on data from four Inertial Measurement Units
- Collected data from seven athletes for training the model and achieved 75-80% accuracy on windows of data from an eighth unseen athlete
- Developed an application with a GUI in PyQt (Qt for Python) that automatically suggested labels

First Year Engineering Student Mentor Feb. 2022 – Apr. 2022
The University of Queensland *St Lucia, QLD*

- Welcomed new engineering students to UQ and helped to answer questions about starting university
- Encouraged engagement in university life and culture

Research Assistant Nov. 2021 – Feb. 2022
The University of Queensland *St Lucia, QLD*

- Helped to develop the GUI for a MacOS app for sonification of astronomical surveys (like Google Maps for space with sound)
- Used SwiftUI and helped modify a Javascript library that used JQuery for the surveys

Projects

Pose Detection with Pretrained ViTs | *Python, PyTorch* Feb. 2023 – June 2023

- Performed transfer learning on ViTs pretrained using DINO, MAE and MSN methods inspired by the paper *ViTPose: Simple Vision Transformer Baselines for Human Pose Estimation*
- Training with the COCO Keypoints dataset led to 0.847 $AP_{.5}$ and 0.569 $AP_{.5:.95}$
- Presented a live inference demonstration using the top-down approach with YOLO for detecting people
- Visualised attention maps

Admin App for Tutoring Business | *React, Expo (React Native), Typescript, Firebase* Jan. 2021 – March 2024

- Developing a mobile app that allows tutors to report their hours
- Developing a web app interface for admin

Robotics Projects | *Python, ROS2, C, C++, Keras, Embedded Programming* Feb. 2019 – Present

- Designed and manufactured a robot that could autonomously collect coffee beans buried in sand. I was responsible for localisation using a camera and ArUco markers and control algorithms
- Designed and manufactured a robot that can find the centre of a test area and shoot infra-red targets with a laser pointer
- Implemented an IoT robot that could turn to face people by recognising their shoes
- Used ROS2 to program a robot to perform Simulataneous Localisation And Mapping (SLAM) with autonomous path planning in order to map and explore an unseen test area
- Helped manufacture and program a robot to collect coffee beans autonomously from a sand pit with localisation using ArUco markers

Misc. Projects | *Verilog, Vivado, Assembly (ARM), Solidity, React, Javascript* Aug. 2022 – Dec. 2022

- Implemented parts of an ARM processor at RTL level with verification on an FPGA
- Created a multisignature wallet on the blockchain with Solidity with a web app interface
- Created a personal blog to share things I am learning about.
- Completed Advent of Code 2023 and 2024 with all 50 stars in C++
- Set up a homelab/server using spare PC parts. Runs Virtual Machines in Proxmox including Ubuntu Server and TrueNAS with access via Wireguard VPN. Other services are run in docker containers on the Ubuntu Server VM

Technical Skills

Languages: Python, C, C++ (modern), JavaScript, TypeScript, Java, Bash, Promela, Matlab, Swift, Lua, Verilog, Assembly (AVR & ARM), Solidity
Frameworks: React, Expo (React Native), Node.js, PyTorch, Tensorflow (with keras), ROS2, PyQt, Simulink, FreeRTOS, Firebase
Developer Tools: Git, Linux, (Neo)Vim, tmux, i3wm, VS Code, Vivado, Jupyter Notebook, Jira, Latex
Libraries: Pandas, NumPy, Matplotlib, SciPy, scikit-learn, scikit-image, OpenCV, huggingface, ultralytics
Misc. Skills: Altium (PCB design), Solidworks (CAD), ANSYS (FEA), Circuit Analysis, Signal Processing, PID Control, State Space Modelling, Non-linear Control with Lyapunov Functions, Analysis of MDOF Systems, Modal Analysis, Systems Theoretic Process Analysis (STPA)