

Personal Information

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Profile

I am pursuing my final year of a Master's degree in Integrated Mechanical and Electrical Engineering at the University of Bath. The course included a placement year in industry where I worked as a Machine Learning Engineer in the Artificial Intelligence unit at the technology company Prosus in Amsterdam, Netherlands. Currently, I am doing research with the University of Bath's Centre for Bioengineering and Biomedical technologies on exploring the two-way relationship between natural and artificial intelligence in brain-computer interfaces. I aspire to combine my interests in theoretical neuroscience and machine learning to gain experience in the research of creating general purpose learning systems with positive real-world impact.

Education

MEng(Hons) Integrated Mechanical & Electrical Engineering 2019 - 2024

University of Bath, Somerset, United Kingdom

- Current overall average: **74% - 1st Class Honours**
- Relevant modules include: Mathematics 1 (81%), Mathematics 2 (96%), Digital Electronics (88%), Robotics Design (73%), Signal Processing (85%), Control Engineering (76%), Computational Intelligence (70%)

A Levels: Physics, Maths, Further Maths, Art: A*A*BB 2017 - 2019

Harrow School, London, United Kingdom

GCSEs: 11A*s, 1A 2014 - 2017

Harrow School, London, United Kingdom

Research Experience

Master's Thesis: 2023 - 2024

Graph Convolution Neural Network Based Classification for Motor Imagery Electroencephalography (EEG) Brain-Computer Interfaces (BCIs) - Supervisor: Dr Dingguo Zhang

- **Objective:** To improve the generalization ability of motor imagery BCI systems by achieving increased signal decoding accuracy across several subjects. Thesis aims to develop a novel classification methodology of EEG signals using graph convolution networks (GCNs) which considers the functional topological relationship of electrodes.
- **Technical skills** include: Python fluency, experience with PyTorch, data processing, experimental research procedures.

Comprehensive Literature Review: 2023

Neural Decoding of Electroencephalography (EEG) Signals for Brain-Computer Interfaces with Deep Learning - Supervisor: Dr Dingguo Zhang

- **Objective:** Reviewed the current status of deep learning methods used to classify EEG signal data. Discussed recent developments and critical issues for commercial deployment. Replicated and evaluated several algorithms on public data-sets to provide direct comparisons between methods. The research methodology involved a final set of 50 peer-reviewed journal publications. My final work is currently being reviewed by my supervisor and his PhD student, who are developing it further for publication.
- **Technical skills** include: literature research, critical analysis and reference managing.

Work Experience and Projects

Team Bath Robotics Humanoid Project 2023

Motion control and kinematic design of the University of Bath's new open-source humanoid robot platform - Supervisor: Dr Uriel Martinez Hernandez

- Analysed which control algorithms provided the most stability to the joint states, and which inverse kinematic methods generated the most efficient trajectories. Developed all software on ROS (Noetic) to facilitate the development, integration, and control of the multiple subsystems. Programming was done primarily in C++ and Python.

- Evaluated control and kinematic methods by creating a full physics simulation of the humanoid configured in the Gazebo environment. The digital twin of the robot is still being used within the University's robotics group to test and integrate new functionalities.

Machine Learning Internship at Prosus

2021 - 2022

Placement year gaining experience of applying machine learning and data science skills to practical applications in consumer services at Prosus (Amsterdam, Netherlands) - Supervisor: Dr Dmitri Jarnikov

- **Semantic product search through query expansion for Takealot:**
Successfully trained and deployed 10 neural word embedding models that are now implemented in Takealot's search system to improve their customer product search experience. The models were trained off past user data that learned high-dimensional vector representations of search session interactions, leading to effective semantic query expansion. See my blog post for additional information:
<https://medium.com/takealot-engineering/improving-product-search-using-machine-learning-1d127a296bc3>
- **Technical skills** gained include: Python fluency, experience with TensorFlow, data analysis, MLOps foundations using AWS, deployment of docker containers and cloud computing.

OpenAI Hackathon for Climate Change

Nov. 2022

Achieved highly commended in the virtual hackathon hosted by OpenAI that explored how their current models can accelerate solutions to climate change.

- Built an application for investment analysts that provides a quick and **effective review of company sustainability reports** by summarizing and distilling key information using their large language model **GPT-3**.
- My team mate and I believed that by giving investors a tool to easily grasp how companies are transitioning to become more sustainable, the faster we will be able to achieve a net-zero economy. A link to the project's code repository can be found here:
https://github.com/Robert-H-Gan/OpenAI_Sustainability_report_summarization

IBM Coursera Machine Learning with Python course

July 2021

Topics included regression, classification, clustering, recommender systems, and how to implement them using the Python libraries sci-kit learn and SciPy.

- Reinforced my knowledge of the basic supervised/unsupervised ML algorithms through implementing them for practical applications in Python.
- My final project involved various **multi-class classification** algorithms by training a model to predict whether loans of a sample customer data set would be paid-off or defaulted. I used Jupyter Notebook in IBM Watson Studio.

Technical Skills

Programming languages:

- **Python:** Highly fluent level. All projects completed during my placement at Prosus involved pythonic development. Additional experience includes the IBM ML with Python course and my current thesis work.
- **MATLAB:** Second year module 'Modelling Techniques': Programming numerical solutions to ordinary and partial differential equations. Extensive experience in robotics and control engineering experiments.
- **C/C++:** Multiple projects involving the embedded programming of Micro-controllers using Arm's MBed OS, Raspberry Pi and Arduino.

Software engineering skills:

- **AWS:** My experiences of building and deploying machine learning models to real-world applications required me to learn cloud computing fundamentals using Amazon Web Services. I have developed architectures that involve AWS Lambda functions, API gateways and DynamoDB services.
- **Docker:** Through Udemy's 'Deploying AI Machine Learning Models for Business with Python' I have gained experience of writing and building docker files which helped me deploy machine learning models in practice during my placement.
- **ROS:** Developed the system control architecture of Bath's humanoid robot using the Robot Operating Software as a framework.

Additional Information

- Awarded **Academic** and **Art Scholarships** to senior school. Enjoyed combining the challenges posed by Mathematics and Physics with my more creative side in Art and Design.
- Achieved a **Crest Gold Award** for a school engineering club project on *A Proposed Evacuation System for High Rise Buildings*.
- Given the opportunity to develop my leadership skills as **Deputy Head of School** and **Head of House**.
- Enjoy working as part of a team. I participated in **water polo** and **athletics** teams at school & university and the **electric Formula Student** project.
- Completed the **Duke of Edinburgh Gold and Silver Award** and have done volunteer work for various charities, including the **Lalela charity** in South Africa where art is used as a tool to help disadvantaged children in townships.
- Fluent speaker in **English**, **Afrikaans** and **Dutch**. I took **French** in my first year of A-levels and can speak to an advanced, comfortable level. I studied **Mandarin** and **German** for GCSEs in which I gained an A* for both.