Freddie Bullard

fsb29@cam.ac.uk | linkedin.com/in/freddiebullard | website: fs-bullard.github.io

PERSONAL PROFILE

A current Part III Mathematics student at the University of Cambridge and Durham University physics graduate interested in applying machine learning and numerical methods to solve image-related problems across disciplines. Strong programmer with software engineering and research computing experience.

EDUCATION

University of Cambridge, Cambridge, UK — Oct. 2024 – Present
MASt Applied Mathematics and Theoretical Physics

Durham University, Durham, UK — Oct. 2021 – July 2024
BSc Physics
- **Grade**: First-class honours - ranked 4th in cohort
- **Relevant Topics**: Linear Algebra, Calculus, Electromagnetism, Quantum Mechanics, Thermodynamics, Condensed Matter Physics, Stars and Galaxies, Classical Mechanics, ODEs, PDEs, Nuclear Physics, Statistical Physics, Complex Analysis, Computational Physics
- **Awards**: Durham Physics Award for Outstanding Achievement, Stars and Galaxies Module Prize, Computing Project Poster Prize

RESEARCH EXPERIENCE

Visiting Researcher, Remote — Sept 2024 – Present
MLID group, Helmholtz-Zentrum Dresden-Rossendorf
- Continuing work on the project remotely.

Research Intern, Dresden, Germany — July – Aug. 2024
MLID group, Helmholtz-Zentrum Dresden-Rossendorf
- Applying numerical and neural PDE solvers to extract information from 3-dimensional microscopy.

Classical and Quantum Monte Carlo Optimisation ○ 🗎 — Oct. 2023 – Mar. 2024
Department of Physics, Durham University
- Conducted a comparative study of simulated and quantum annealing as heuristics, using the Travelling Salesman Problem as a test example
- Employed Monte Carlo techniques to implement simulated and quantum annealing in Python

Complex Structure Stress Analysis with Machine Learning 🗎 — Autumn 2023
Department of Physics, Durham University
- Investigated the use of stress-induced birefringence in studying the stresses and strains in complex structures under load
- Implemented a CNN based on UNet to extract stress information from photoelasticity images
- Added a physical constraint layer to allow training over fewer epochs and improve generalisation on experimentally obtained data

Investigating the Dark Matter Content of Spiral Galaxy M82 🗎 — Spring 2023
Department of Physics, Durham University
- Investigated the dark matter content of the spiral galaxy M82 through analysis of its rotation curve from HI and CO emission lines, and its luminosity as a function of distance from the galactic centre
- Applied image processing techniques, including dark and bias subtraction and flat-field corrections, to reduce uncertainty in our data

Professional Experience

Software Development Engineer Intern   Summer 2023
Expedia Group, London
- Worked in a team of 10, developing and maintaining the ad delivery and tracking services
- Enhanced and extended a RESTful API service to track events related to ad impressions, utilised Kotlin and Spring to implement new tracking functionalities

Software Engineer Intern   Summer 2022
Spectrum Logic, London
- Designed and implemented an image segmentation algorithm in Python to automate region-of-interest detection in low contrast, 16-bit greyscale images for their Western Blot CMOS 1:1 image scanner

Personal Projects

Noise Reduction Web App ⌗ | Python (Flask, NumPy)   Summer 2022
- Implemented Gaussian, Median and Bilateral filters from scratch in Python with NumPy
- Improved code efficiency through vectorisation, concurrency and filter-separation
- Developed a full-stack web application using Python with Flask, hosted on Google Cloud Platform

Online Courses

Finding Hidden Messages in DNA (Bioinformatics I)   Summer 2023
UC San Diego via Coursera

Neural Networks and Deep Learning   Summer 2023
DeepLearning.AI via Coursera

6.006 Introduction to Algorithms   Summer 2022
MIT OCW

6.0001 Introduction to Computer Science and Programming in Python   Summer 2022
MIT OCW

Technical Skills

Languages: Python, Kotlin, HTML/CSS, LaTeX, SQL
Libraries and Frameworks: NumPy, SciPy, Matplotlib, Flask, FEniCSx
Other: VS Code, IntelliJ, Git, Linux, MacOS, Windows, ImageJ

References

Available upon request