David Lewis Fairbairn

MATHEMATICIAN · SOFTWARE DEVELOPER · ENGINEER

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Education

Durham University

Doctor of Philosophy in the Department of Mathematical Sciences   *Oct 2021 - Present*

Part-Time PhD alongside full-time employment.
Research Topic: *Multi-Agent Path-Finding and Algorithmic Graph Theory*
Supervisors: Prof. Norbert Peryimhoff, Dr. George B. Mertzios, Prof. Matthew Johnson
Additional Courses Complete: Advanced Algorithms (COMP4087), Spectra and Geometry of Graphs and Networks (MAGIC096)

Bachelor of Science in Mathematical Sciences   *Oct 2016 - July 2019*

1:1 (First Class Honours)
Awards: 3H Project Prize (Department of Mathematical Sciences) for the highest mark in the final year project

Bede Academy   *Oct 2014 - Sep 2016*

A-Levels

Mathematics A*, Further Mathematics A*, Physics A

Experience

VersaTile Automation   *Blyth*

Mathematician   *May 2024 - present*

Current role following the spin-out of VersaTile Automation from Tharsus.

Tharsus   *Blyth*

Research Collaborator   *May 2024 - present*

Following the spin-out of VersaTile Automation, I have continued collaborative research with Tharsus and partner universities to develop novel algorithms for multi-agent systems and foster innovation in artificial intelligence.

Mathematician   *Oct 2022 - May 2024*

- Led the development of novel algorithms for simulation of multi-agent systems and performed foundational software development in C++, Python, and CUDA to support the design and implementation of advanced robotics and automation systems.
- Collaborated with cross-functional teams to develop customized solutions that met the unique needs of each client.
- Conducted data analytics in PowerBI, Python, Excel, SQL, and Cosmos DB supporting decision-making and process improvements.
- Implemented collaborative research from multiple universities into production code driving innovation for Tharsus and its clients.
- Lead AI research within an Innovate UK funded project to develop a novel algorithm for multi-agent systems.
- Provided technical guidance, mentorship and developed workshops for team members.
- Coordinated and managed a year in industry collaboration.
- Led the recruitment of mathematicians and data scientists and assisted in recruitment of software developers.
- Responsible for planning and organisation of work experience placements and outreach events.
- Representing Tharsus within a £10 million consortium of companies and universities to research and develop new techniques in artificial intelligence.
  Technical Skills: C++, Python, CUDA, Docker, PowerBI, Excel, SQL, Cosmos DB, Mathematical Modelling, Algorithm Design, Data Analysis, Data Visualisation, Robotics, Automation, Agile, Scrum.
  Soft Skills: Cross-functional collaboration, communication, leadership, mentorship, project management, recruitment, outreach.

Graduate Data Engineer   *Mar 2020 - Oct 2022*

- Developed algorithms and bespoke simulations of multi-agent systems to optimize system performance to inform system design.
- Applied mathematical modelling techniques and data analysis techniques to support the optimisation of multi-agent systems.
- Designed and implemented data analysis processes using Excel and SQL to support business decision-making and process improvements.
- Contributed to the development of Bump, including development of Android applications and non-standard Bluetooth communication.
- Used Bluetooth low energy (BLE) to develop accurate and high frequency ranging of multiple devices for social distancing applications.
- Participated in code reviews, testing, and debugging to ensure high-quality software development practices.
- Developed CI/CD pipelines using Azure DevOps to automate the build, test, and deployment of multiple distributed software systems.
- Full stack development of web applications using React, Node.js, Azure, Azure Functions, Cypress, and Jest.
- Created embedded software for production hardware.
- Developed Factory Acceptance Testing (FAT) software in electron for commissioning of hardware.
  Technical Skills: C++, Python, Excel, SQL, Android development, Bluetooth communication, Bluetooth Low Energy, React, Node.js, Azure, Azure Functions, Cypress, Jest, Embedded software, Electron.
  Soft Skills: Cross-functional collaboration, communication, project management, problem-solving, teamwork, leadership.

Simba Sleep *London*

Operations Coordinator *July 2018 - Oct 2018*

- Developed and implemented a new warehouse management system to streamline the order processing and fulfillment process.
- Collaborated with warehouse personnel to identify areas of improvement and ensure smooth communication channels between teams.
- Managed the transition to the new system and provided ongoing support to ensure its success.
- Led cross-functional teams to execute on projects and achieve business objectives.
- Contributed to the development of processes and procedures to improve overall customer experience.
  Technical Skills: Warehouse management systems, Excel VBA, Automatic PDF Parsing, Python, 3PL integration.
  Soft Skills: Cross-functional collaboration, communication, leadership, project management.

Skills and Interests

Programming Skills	**Expert:** C++, Python, LaTeX, **Proficient:** CUDA, Docker, PowerBI (Power Query), SQL, Power Automate, **Familiar:** Azure Functions, Android development, C, JavaScript, Azure Pipelines, Cosmos DB **Basic:** React, Node.js, Cypress, Jest, Excel VBA, Haskell, Prolog, R, Azure IOT, OpenCV, Arduino, **Worked with:** Electron, Firebase, Hugo, Tensor Flow, Unity, Unreal Engine.
Miscellaneous Skills	Mathematical Modelling, Algorithm Design, Data Analysis, Data Visualisation, Robotics, Automation, Agile, Scrum.
Research Interests	Multi-Agent Path-Finding (MAPF), Multi-Agent Systems, Artificial Intelligence, Algorithmic Graph Theory, Geometry, Swarm Intelligence, Game Theory, Spectral Graph Theory, Complexity Theory, Data Science, Machine Learning.
Languages	English (Native), Mandarin Chinese (Introductory).

Achievements

2021	**Finalist (Rising Star Award)**, The North East's IT and Technology Awards (Dynamites 2021)	*Newcastle-upon-Tyne*
2019	**Presenter**, Rising Star Research Symposium	*Durham University*
2019	**3H Project Prize**, Department of Mathematical Sciences	*Durham University*
2018	**President's Vote of Thanks**, St Mary's College	*Durham University*
2017	**Bronze Award**, Duke of Edinburgh's Award	*Bede Academy*

Publications

CONFERENCE PROCEEDINGS

Exploiting Geometric Constraints in Multi-Agent Pathfinding
  Dor Atzmon, Sara Bernardini, Fabio Fagnani, David Fairbairn
  Proceedings of the International Conference on Automated Planning and Scheduling (ICAPS), 2023

Multi-Agent Path-Finding and Algorithmic Graph Theory (Student Abstract)
  David Fairbairn
  Proceedings of the Symposium on Combinatorial Search (SoCS), 2023

ARTICLES

NP-Completeness of the Combinatorial Distance Matrix Realisation Problem
  David L. Fairbairn, George B. Mertzios, Peyerimhoff Norbert
  ArXiv 2406.14729 (Preprint), 2024

Computational Methods in Graph Connectivity
  David Fairbairn
  The Durham Institute of Research, Development, and Invention (Website), 2019

Volunteering

First Generation Scholars - Durham University *Durham*

Guest Speaker *Oct 2022 - Present*

TechUp Women *Durham / Bath*

Mentor *Nov 2021 - Nov 2022*

International Mathematical Olympiad   *Bath*

Team Guide - Slovenia   *Jul 2019*

Organisations

Institute of Mathematics and its applications (IMA)   *United Kingdom*

Member   *June 2023 - Present*

Durham Institute of Research, Development, and Invention (DIRDI)   *Durham*

Member   *Mar 2023 - Present*

Algorithms and Complexity in Durham (ACiD)   *Durham*

Research Student   *Oct 2021 - Present*

References available upon request.