Matthew Burke

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Education

Macquarie University, Sydney

Doctor of Philosophy in Mathematics 2011-2015

Christ's College, University of Cambridge

Part III Mathematics (MMATH) 2010-2011
Bachelor's degree in Mathematics (BA) 2007-2010

Work experience

Jan 2020 - Present: Lyryx Learning

Senior software developer (11 months); Director of technology (Current)

- Designed, developed and distributed a cross-platform mobile and web application to combine existing textbook content with new interactive questions. Used TypeScript, SQLite and Capacitor.
- Created a local development environment for an existing Java web application. Used Docker, NGINX and Firejail to locally develop features that spanned multiple production servers.
- Constructed a Web API for automatically scheduling examinations. Used Java Servlets and MySQL.

Aug 2019: Cybera Data Science Fellowship

Data science fellow

- Collaborated with an industry partner to clean, explore and analyse 7 years of live events data stored in a PostgreSQL database with over 13 million entries.
- Constructed a generalised linear model (GLM) for analysing count data and a log linear model for analysing sales data. Used Python scripts, Jupyter notebooks and the R programming language.

Sep 2017-Sep 2019: University of Calgary

Postdoctoral scholar

- Designed and completed projects in pure mathematics and computer science leading to a publication in a peer-reviewed journal and another paper under review.
- Created a formal proof of a well-known result in category theory using the Coq proof assistant.
- Provided mentoring support for two PhD students and reviewed two papers for mathematics journals.
- Organised the University of Calgary Peripatetic Seminar (Dec 2017-May 2019) and chaired a session of the Alberta Mathematics Dialogue 2018.
- Used Jupyter notebooks to lecture 4 classes of around 230 students each.

Jun 2016-Aug 2017: MathSpire Ltd.

Software engineer (5 months); Chief technology officer (9 months)

- Developed a cross-platform mobile and desktop application to teach A-level mathematics using interactive graphs, videos and integrated testing. Used F#, .NET and Xamarin.
- Created a web front-end and API for teachers to track student progress.
- Showcased the application at the BETT education technology conference.

Projects

- **Fog of war chess:** (`https://github.com/mwpb/fowc`) Library to play a variant of chess in which the players can only see squares to which they can move. Proof of concept at fogofwarchess.com.
- **Advent of code:** (`https://github.com/mwpb/adventOfCode2019`) Java solutions to all problems in the 2019 advent of code.
- **Cryptopals challenges:** (`https://github.com/mwpb/matasano-go`) Solutions written in Go. First three sets completed.

Publications

- Tangent infinity-categories and Goodwillie calculus, *Memoirs of the American Mathematical Society*, to appear.
- A Synthetic Version of Lie's Second Theorem, *Applied Categorical Structures*, 2018.02.06. Available at `https://doi.org/10.1007/s10485-018-9518-2`.
- Connected Lie Groupoids are Internally Connected and Integral Complete in Synthetic Differential Geometry, *Symmetry, Integrability and Geometry: Methods and Applications*, 2016.06.29. Available at `http://www.emis.de/journals/SIGMA/2017/007/`.