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

Feb 2022 - Present: Quantinuum (prev. Cambridge Quantum Computing)
Software developer

- Designed, developed and maintained a metering and billing system. Included setting up infrastructure to record meter readings, custom aggregates and quota guard checks.
- Collaborated with two software development teams to design and implement an authentication system taking into account users from two existing systems. Used AWS Cognito, FastAPI and HTMX. Included local accounts, MFA and Federated identities.
- Developed pipeline for automated benchmarks, notification emails and a website to view results. Created library for compiler developers to benchmark experimental code. Used Python venvs, FastAPI and HTMX.
- Created development environments using Docker Compose and Kubernetes both locally and on Azure VMs.
- Helped migrate Kubernetes clusters from Azure AKS to AWS EKS. Set up ingress, automated SSL certificates, automated CNAME records and realtime PostgreSQL database replication. Used Terraform and psql CLI.

Jan 2020 - Jan 2022: Lyryx Learning
Senior software developer (11 months); Director of technology (13 months)

- Worked closely with CEO to identify new product areas and gaps in existing product coverage.
- 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: Cyber 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 leading to a publication in a peer-reviewed journal.
- 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

- **Mathsolio** (https://mathsolio.com) Interactive games and training for various mathematical techniques. Uses AWS Lambda, DynamoDB, SvelteKit and SST (Serverless Stack deployment framework).

- **Fog of war chess:** (https://fogofwarchess.com) Play a variant of chess in which the players can only see squares to which they can move. Uses Next.js, Docker Compose, Caddy, MongoDB and an Oracle Cloud VPS.
- **Advent of code:** (https://github.com/mwpb/adventOfCode2019) Java solutions to all problems in the 2019 advent of code.
- **Colimits in Coq:** (https://github.com/mwpb/postulated-colimits-in-coq). Computer verification of a result in category theory using the coq proof assistant.