

Ph.D completion: December 2021

* Relevant Background: I am a Ph.D student studying category theory, and I have several years industry experience in data science and programming languages.

* One-sentence summary of research: Tools for applied category theory; specifically graphical reasoning with string diagrams for symmetric monoidal categories.

* Availability: I am able to come to oxford for the full two weeks - I can commute from London if necessary.

* Project Preference: (most preferred first)

- David Spivak - Toward a mathematical foundation for autopoiesis

- Tobias Fritz - Partial evaluations, the bar construction, and second-order stochastic dominance

- Miriam Backens - Simplifying quantum circuits using the ZX-calculus

- Bartosz Milewski - Traversal optics and profunctors

- Mehrnoosh Sadrzadeh - Formal and experimental methods to reason about dialogue and discourse using categorical models of vector spaces

- Pieter Hofstra - Complexity classes, computation, and Turing categories

EDUCATION & QUALIFICATIONS

University of Southampton

December 2018 - Present

Ph.D Candidate, Computer Science

University of Bristol

September 2007 - July 2011

MEng, Computer Science and Electronics (awarded 2.1, average grade 65)

Offensive Security Certified Professional (OSCP)

February 2018

penetration testing professional qualification

Interests

Mathematics, Bayesian statistics, programming languages, formal methods, functional programming

WORK

AIG

London, United Kingdom

Full Stack Developer

September 2016 - December 2018

- Launched broker.aig.com - a web application to sell commercial insurance via brokers

Permutive

London, United Kingdom

Software Engineer

August 2015 - July 2016

- Designed a variant of SQL for unstructured JSON data. Implemented a compiler in Haskell targeting a Javascript backend, as well as an interpreter written in Haskell.
- Built initial version of a public-facing self-serve web dashboard using Elm.
- Implemented Haskell REST services to support the query language, (e.g. compiler API and query evaluator) service. Worked with AWS services like DynamoDB and S3. Set up automated deployment on AWS EC2 + ECS.

Jagex

Cambridge, United Kingdom

Data Scientist

May 2013 - August 2015

- Real-time network monitoring and DDoS attack alerting using changepoint detection algorithms, including an interactive dashboard summarising attacks and their impact on the player base for the MMO game *RuneScape*.
- Real-time interactive dashboards for game client performance metrics for the FPS *Block N Load*.
- HTML5/Javascript visualisations, including an in-game activity replay tool, and an interactive weighted flow diagram of the game economy for *Transformers Universe*.
- Bayesian model of player activity to identify AFK players in *Transformers Universe*
- Taught python to analysts for use in Hadoop streaming MapReduce jobs

Featurespace Ltd.

Cambridge, United Kingdom

Analyst Developer

September 2011 - October 2012

- Implemented machine learning algorithms in C#, including the C4.5 decision tree and a Bayesian online change-point detection algorithm.
- Designed and implemented infrastructure for online machine learning applications
- Organised weekly reading group on new machine learning research

New Oriental School

Changsha, Hunan Province, China

English Teacher

July - August 2010

Taught english to 12-14 year-old students. Planned and taught lessons to complement a textbook. Corrected writing, held speaking practice session, and organised activities.

PERSONAL AND OPEN SOURCE PROJECTS

Probabilistic Programming (library)

Haskell

An embedded domain-specific language for specifying and doing inference in Bayesian machine learning models.

Hackage-Fu

Javascript

A Chrome plugin for adding useful links to Hackage. Available on the chrome web store and github.

lens-aeson

Haskell

Original author of lens-aeson, a Haskell package using the Lens library to access JSON values in a law-abiding way.

SKILLS

Haskell: Good knowledge, contributor to several open source libraries

Python: Extensive use for data analysis, machine learning. Experience writing REST APIs.

Amazon Web Services: Familiar with many AWS products, including EC2, Route53, RDS and S3.

Elm: Good knowledge, used in building user-facing dashboard.

Scala: Some experience writing and deploying backend services

R: Experienced, especially for data analysis and visualisation.

Hadoop/Hive/Pig: Used extensively for ETL & analysis on datasets of up to hundreds of gigabytes in size

HTML, CSS & Javascript: Proficient, built several web apps (frontend + node.js backend).

Git: Intermediate (github account: <http://github.com/statusfailed>).

C, C++, C#, Java: Experienced, used in a variety of projects

Linux & shell scripting: Good knowledge, used since 2005. Extensive use on AWS.

23 January 2019

To ACT 2019 School organisers,

Letter in support of Paul Wilson's application for ACT 2019 School

It is a pleasure to write in support of Paul's application.

Paul is a brilliant PhD student who has significant previous experience in the private sector, working as a developer and data scientist. He is an excellent programmer with a good mathematical intuition.

He has recently come back to academia and is in the early stages of his PhD. He is fascinated by category theory and diagrammatic methods – in fact, he applied for the PhD with me and Fabio Zanasi through the Graphical Linear Algebra blog.

Paul is currently working on tool support for visualisation, manipulation and rewriting of string diagrams for symmetric monoidal categories. He is also spending a lot of his time on studying category theory.

I think that the School would be an extremely valuable experience for Paul at a formative stage in his research development. I am sure that he will be inspired by the research projects at the school and he will be able to better appreciate the kinds of tools that our community has a need for. It will also be great for him to be able to meet other young researchers working in our community.

Yours sincerely

Dr Pawel Sobocinski
Associate Professor
Cyber Physical Systems Group
Electronics and Computer Science
University of Southampton
Direct tel: +44 (0)23 8059 9220
Mobile: +44 (0)7919 695 967
email: ps@ecs.soton.ac.uk

My Ph.D research - building tools for applied category theory - has two main aspects: the editing and graphical manipulation of string diagrams, and the interpretation of those terms into domain-specific "backends".

I'm applying to ACT2019 because I need concrete problems to help guide the development of the domain-specific backends. Essentially, I want to get a deeper understanding of a particular, concrete problem so I can make sure the tool is useful for researchers' actual day-to-day work.

With that in mind, I'm particularly interested in the "Autopoiesis" and "Partial evaluations" tracks (of Spivak and Fritz, respectively).

The former because of my interest in alternative models and settings of computation. For example, in distributed computing there is the (similar) concept of self-stabilization, which describes how distributed systems try to preserve invariants ("legitimacy" of states) during their operation - similar to the idea of autopoietic systems "preserving" themselves. I also think the idea for a "language" of autopoietic systems is exciting in general, so this is my preferred topic.

I'm also keen on the latter topic (Fritz) because of my interest in probability theory (and in particular, probabilistic programming). I would like to have a more categorical view of probability theory, and I hope the application to stochastic dominance will be an instructive starting point. I'm also interested to see how the concept of dominance might apply to probabilistic programs. For example, if some stochastic agent behaves according to a probabilistic program, the concept of dominance could tell it which behaviour is more appropriate: in the second order case, which behaviour minimises risk in a given scenario.