

I am a PhD candidate in programming languages and deep learning at the University of Edinburgh. My project focuses on **optimizing compilation techniques** that benefit from functional intermediate representation (IR) with **deep neural networks** (DL) and **GPUs** as a case study. I also worked on this topic as a research intern at *Microsoft Research Cambridge*.

My other interests include **software/hardware codesign** for DL: while interning at *ARM Research Cambridge*, I worked on a compiler that generates **FPGA** designs in the Spatial HLS language for LSTM networks.

EDUCATION

PhD in Compilers and Programming Languages, University of Edinburgh 2017–2022

Supervisor: CHRISTOPHE DUBACH. Co-supervisors: MICHEL STEUWER, MICHAEL O'BOYLE, KENNETH HEAFIELD.

Project title: *Optimising Compilation of Machine Learning Models for Heterogeneous Hardware*

I am extending the Scala-based compiler Lift to achieve performance portability for DL across GPU architectures. The functional IR adds a universal level of abstraction between the applications and the hardware; the optimal implementation is found by exploring the design space created by rewrite rules.

MSc(R) in Computer Science, University of Edinburgh (sup.: CHRISTOPHE DUBACH) 2016–2017

Thesis title: *Optimisation of CNNs Using A Functional Data-Parallel Language*

MSc in Artificial Intelligence, University of Edinburgh (sup.: CHRISTOPHE DUBACH) 2015–2016

Thesis title: *Expressing Artificial Neural Networks In A Functional Data-Parallel Language For GPU Acceleration*

BEng in Computer Science (with a year in industry), University of York (sup.: SIMON O'KEEFE) 2011–2015

Thesis title: *Memory in Simulated Swarms*

RESEARCH VISITS AND INTERNSHIPS

Visiting Student at **Mila – Quebec AI Institute**, Montreal, Canada Sep'21 – Aug'22

Graduate Research Trainee at **McGill University**, Montreal, Canada Sep'21 – Aug'22

Research Intern, **ARM Research**, Cambridge, UK (hosts: GIACOMO GABRIELLI, ALI ZAIDI) Sep'19 – Dec'19

Worked on a software/hardware codesign project focused on extending the Scala-based Lift compiler to generate HDL designs in Spatial targeting LSTMs and FPGAs.

Research Intern at **Microsoft Research**, Cambridge, UK (host: RYOTA TOMIOKA) Aug'18 – Oct'18

Worked on optimizing compilation of ML workloads for the Microsoft Brainwave ML accelerator.

Collaboration with **Huawei**, University of Edinburgh Sep'17 – Aug'18

Worked on accelerating VGG, ResNet and GoogleNet on Mali GPUs using automatic rewriting techniques.

Research Intern at **York Centre for Complex Systems Analysis (YCCSA)** Jul'15 – Sep'15

Hosts: MARTIN TREFZER, DIMITRIS LAGOS

Engineering Intern at **Sophos**, Abingdon, UK Jul'13 – Jul'14

PUBLICATIONS

Mapping Parallelism in a Functional IR through Constraint Satisfaction: A Case Study on Convolution for Mobile GPUs

Naums Mogers, Lu Li, Valentin Radu, Christophe Dubach

Proceedings of the 31st ACM SIGPLAN International Conference on Compiler Construction (CC'22)

Automatic Generation of Specialized Direct Convolutions for Mobile GPUs

Naums Mogers, Valentin Radu, Lu Li, Jack Turner, Michael O'Boyle, Christophe Dubach

Proceedings of the 13th Annual Workshop on General Purpose Processing using Graphics Processing Unit 2020

Towards Mapping Lift to Deep Neural Network Accelerators

Naums Mogers, Aaron Smith, Dimitrios Vytiniotis, Michel Steuwer, Christophe Dubach, Ryota Tomioka

Workshop on Emerging Deep Learning Accelerators (EDLA) @ HiPEAC

Sensor Organism

Naums Mogers, Martin Trefzer, Dimitris Lagos

C. Paterson (Ed.), Proceedings of the Eighth York Doctoral Symposium on Computer Science & Electronics. (2015)

AWARDS

PhD scholarship , University of Edinburgh, EPSRC UK	2016–2020
1st Prize for the IBM and Swiss Re Hackathon Challenge , HackZurich hackathon	2016
Best Poster Award , National Student Research Conference, University of Edinburgh	2016
Best Poster Award , York Doctoral Symposium	2015
York Award , University of York	2015
Accepted to Google Compiler and Programming Language Summit , Google Munich	2019, 2017
Accepted to Facebook PhD London Tech Talk , Facebook London	2018
Accepted to Google Inside Look Program (31 selected out of thousands of applicants), Google London	2017
Public Engagement: Raspberry Pi Project Funding , University of York	2014

WORK EXPERIENCE

News Annotator (for NLP research) at Thomson Reuters , UK	Sep'16 – Jun'17
IT and Digital Summer Intern at EDF Energy , Brighton, UK	Jul'12 – Sep'12
Web Design Intern at Stockholm Environment Institute York	Feb'12 – Aug'12
System Administrator / Software Developer at M2 Ltd , Riga, Latvia	Jun'09 – Dec'14

TEACHING

Object-Oriented Programming , TA, University of Edinburgh	2017–2019
Algorithms, Data Structures and Learning , TA / Marker, University of Edinburgh	2016–2018
Introductory Applied Machine Learning , Marker, University of Edinburgh	2017–2018
Machine Learning; Algorithms; Microcontrollers , Tutor, ABFS School, Riga, Latvia	2016–2019
Software Testing , Tutor, University of Edinburgh	2017
Compiling Techniques , Demonstrator, University of Edinburgh	2016
Processing Formal and Natural Languages , Marker, University of Edinburgh	2016
Raspberry Pi / Raspbian / Windows 10 IoT , Tutor, Microsoft Student Partners	2016

PRESENTATIONS

Talk , <i>International Conference on Compiler Construction (CC)</i> , remote	Oct'21
Talk , <i>Systems, PL and Compilers Group</i> at McGill University	Oct'21
Poster , <i>Google Compiler and Programming Language Summit</i> , Munich, Germany	Dec'19
Talk , <i>"Renegotiating Accelerator Abstractions" workshop</i> , ARM Research Summit, Austin, TX, USA	Sep'19
Talk , <i>Workshop on Emerging Deep Learning Accelerators</i> , HiPEAC, Valencia, Spain	Jan'19
Tutorial , <i>International Symposium on Performance Analysis of Systems and Software (ISPASS)</i> , Belfast	Apr'18
Poster , <i>Google Compiler and Programming Language Summit</i> , Munich, Germany	Dec'17
Invited talk , <i>Glasgow Systems Seminar</i> , University of Glasgow, UK	Oct'17
Poster , <i>The Scottish Informatics and Computer Science Alliance (SISCA)</i> , University of Dundee, UK	Jun'17

SKILLS

Prog. languages: Scala, Java, C, OpenCL, Python, MATLAB	Hardware: GPU (Mali, NVIDIA), FPGA, HiKey, Arduino
Frameworks: Caffe, PyTorch, Tensorflow	Languages: English, Russian, Latvian