

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

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.

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

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 INTERSHIPS

Mila – Quebec AI Institute (Visiting Student), Montreal, Canada Sep’21 – Aug’22

McGill University (Graduate Research Trainee), Montreal, Canada Sep’21 – Aug’22

ARM Research (Research Intern), 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.

Microsoft Research (Research Intern), Cambridge, UK (host: Ryota Tomioka) Aug’18 – Oct’18

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

Huawei (Collaboration), University of Edinburgh Sep’17 – Aug’18

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

York Centre for Complex Systems Analysis (YCCSA) (Research Intern), York, UK

Jul '15 – Sep '15

Hosts: Martin Trefzer, Dimitris Lagos

Sophos (Engineering Intern), 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

Thomson Reuters (News Annotator for NLP research), Remote, UK

Sep '16 – Jun '17

EDF Energy (IT and Digital Summer Intern), Brighton, UK

Jul '12 – Sep '12

Stockholm Environment Institute York (Web Design Intern), York, UK

Feb '12 – Aug '12

M2 Ltd (System Administrator / Software Developer), Riga, Latvia

Jun '09 – Dec '14

TEACHING

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| 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

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| Talk , International Conference on Compiler Construction (CC), remote | Apr'22 |
| Talk , Systems, PL and Compilers Group at McGill University | Oct'21 |
| Poster , Google Compiler and Programming Language Summit, Munich, Germany | Dec'19 |
| Talk , "Renegotiating Accelerator Abstractions" workshop, ARM Research Summit, Austin, TX, USA | Sep'19 |
| Talk , Workshop on Emerging Deep Learning Accelerators, HiPEAC, Valencia, Spain | Jan'19 |
| Tutorial , International Symposium on Performance Analysis of Systems and Software (ISPASS), Belfast | Apr'18 |
| Poster , Google Compiler and Programming Language Summit, Munich, Germany | Dec'17 |
| Invited talk , Glasgow Systems Seminar, University of Glasgow, UK | Oct'17 |
| Poster , The Scottish Informatics and Computer Science Alliance (SISCA), University of Dundee, UK | Jun'17 |

SKILLS

Prog. languages: Scala, Java, C, OpenCL, Python

Frameworks: Caffe, PyTorch, Tensorflow

Hardware: GPU (Mali, NVIDIA), FPGA, HiKey, Arduino

Languages: English, Russian, Latvian