

Naums Mogers

www.naumsmogers.me
naums.mogers@gmail.com

My interests are **compilers** (optimising compilation for deep learning), **programming languages** (expressive type systems are great) and **deep learning**. My PhD (2023) at the *University of Edinburgh* focused on **optimising compilation techniques** that benefit from functional intermediate representation with **deep learning** 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 deep learning: while interning at *ARM Research Cambridge*, I worked on a compiler that generates **FPGA** designs in the Spatial HLS language for LSTM networks.

WORK EXPERIENCE

Software Engineer at **Google**, Sunnyvale, California, US

Dec '22 – Now

I work on compilers for Google TPUs. Specifically, I contribute to the MLIR-based Mosaic custom kernel language, leveraging the block-centric programming model for sparse computations.

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.

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

IT and Digital Summer Intern at **EDF Energy**, Brighton, UK

Jul '12 – Sep '12

Web Design Intern at **Stockholm Environment Institute York**, York, UK

Feb '12 – Aug '12

System Administrator / Software Developer at **M2 Ltd**, Riga, Latvia

Jun '09 – Dec '14

EDUCATION

PhD in Compilers and Programming Languages, University of Edinburgh

2017–2022

Supervisor: Christophe Dubach. Co-supervisors: Michel Steuwer, Michael O'Boyle, Kenneth Heafield.

Thesis: Guided Rewriting and Constraint Satisfaction for Parallel GPU Code Generation

MSc(R) in Computer Science, University of Edinburgh (supervisor: Christophe Dubach)

2016–2017

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

MSc in Artificial Intelligence, University of Edinburgh (supervisor: Christophe Dubach)

2015–2016

Thesis: 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: Memory in Simulated Swarms

PUBLICATIONS

Guided Rewriting and Constraint Satisfaction for Parallel GPU Code Generation

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Doctoral Thesis, University of Edinburgh, 2023

Mapping Parallelism in a Functional IR through Constraint Satisfaction

Naums Mogers, Lu Li, Valentin Radu, Christophe Dubach

ACM SIGPLAN 2022 International Conference On Compiler Construction (CC), 2022

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

RESEARCH VISITS AND COLLABORATIONS

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

Collaboration with **Huawei**, University of Edinburgh

Sep'17 – Aug'18

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

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

Public Engagement: Raspberry Pi Project Funding, University of York

2014

PRESENTATIONS

PhD Viva , University of Edinburgh	May '23
Talk , <i>International Conference on Compiler Construction (CC)</i> , remotely	Apr '22
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: C++, Python, C, Scala, Java, OpenCL, MATLAB **Hardware:** TPU, GPU, FPGA, HiKey, Arduino
Frameworks: XLA, Caffe, PyTorch, Tensorflow **Languages:** English, Russian, Latvian