

# Naums Mogers

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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 <b>Google</b> , Toronto, Canada	Dec '22 – Now
Research Intern, <b>ARM Research</b> , 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 <b>Microsoft Research</b> , 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 <b>York Centre for Complex Systems Analysis (YCCSA)</b> Hosts: Martin Trefzer, Dimitris Lagos	Jul '15 – Sep '15
Engineering Intern at <b>Sophos</b> , Abingdon, UK	Jul '13 – Jul '14
IT and Digital Summer Intern at <b>EDF Energy</b> , Brighton, UK	Jul '12 – Sep '12
Web Design Intern at <b>Stockholm Environment Institute York</b> , York, UK	Feb '12 – Aug '12
System Administrator / Software Developer at <b>M2 Ltd</b> , Riga, Latvia	Jun '09 – Dec '14

## EDUCATION

<b>PhD in Compilers and Programming Languages</b> , University of Edinburgh Supervisor: Christophe Dubach. Co-supervisors: Michel Steuwer, Michael O'Boyle, Kenneth Heafield. Thesis: <i>Guided Rewriting and Constraint Satisfaction for Parallel GPU Code Generation</i>	2017–2022
<b>MSc(R) in Computer Science</b> , University of Edinburgh (supervisor: Christophe Dubach) Thesis: <i>Optimisation of CNNs Using A Functional Data-Parallel Language</i>	2016–2017
<b>MSc in Artificial Intelligence</b> , University of Edinburgh (supervisor: Christophe Dubach) Thesis: <i>Expressing Artificial Neural Networks In A Functional Data-Parallel Language For GPU Acceleration</i>	2015–2016
<b>BEng in Computer Science (with a year in industry)</b> , University of York (sup.: Simon O'Keefe) Thesis: <i>Memory in Simulated Swarms</i>	2011–2015

## PUBLICATIONS

### **Guided Rewriting and Constraint Satisfaction for Parallel GPU Code Generation**

**Naums Mogers**

*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*

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## 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

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## 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

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## 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

<b>PhD Viva</b> , University of Edinburgh	May '23
<b>Talk</b> , <i>International Conference on Compiler Construction (CC)</i> , remotely	Apr '22
<b>Talk</b> , <i>Systems, PL and Compilers Group</i> at McGill University	Oct '21
<b>Poster</b> , <i>Google Compiler and Programming Language Summit</i> , Munich, Germany	Dec '19
<b>Talk</b> , <i>"Renegotiating Accelerator Abstractions" workshop</i> , ARM Research Summit, Austin, TX, USA	Sep '19
<b>Talk</b> , <i>Workshop on Emerging Deep Learning Accelerators</i> , HiPEAC, Valencia, Spain	Jan '19
<b>Tutorial</b> , <i>International Symposium on Performance Analysis of Systems and Software (ISPASS)</i> , Belfast	Apr '18
<b>Poster</b> , <i>Google Compiler and Programming Language Summit</i> , Munich, Germany	Dec '17
<b>Invited talk</b> , <i>Glasgow Systems Seminar</i> , University of Glasgow, UK	Oct '17
<b>Poster</b> , <i>The Scottish Informatics and Computer Science Alliance (SISCA)</i> , University of Dundee, UK	Jun '17

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## SKILLS

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

**Hardware:** GPU, FPGA, HiKey, Arduino

**Frameworks:** Caffe, PyTorch, Tensorflow

**Languages:** English, Russian, Latvian