CHRIS CUMMINS

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PROFESSIONAL EXPERIENCE

2019-current **University of Edinburgh**, UK
Postdoctoral Researcher

Developed industry-grade differential testing for IBM, integrated into their OpenJ9 and Eclipse JVM testing services. Currently investigating program representations and machine learning models for analysis and optimization. Funded by IBM and Tetramax.

2018 **DeepMind**, London, UK
Software Engineer Intern

Applied Genetic Algorithms to tuning XLA's instruction fusion pass, achieving 36% reduction in memory consumption of WaveNet models on TPUs. Designed a reinforcement learning environment to expose the optimization space.

2018 **Google**, Mountain View, California, USA
Software Engineer Intern

Developed a benchmark generator for protocol buffers that is more representative of fleet performance and API usage than Google's benchmarks, and SPEC. Enabled by company-wide performance counter and source code statistic aggregation.

2016–2018 **Codeplay Software**, Edinburgh, UK
Software Engineer, Part Time

Implemented GPU memory management for Eigen. Contributed to OpenCL port of Tensorflow. Extensive C++ meta-programming with compile-time expression trees. Designed and maintained the Python interface for VisionCpp.

2012–2013 **Intel Corporation**, London, UK
Open Source Developer Intern

Patched vulnerabilities and bugs in open source software with millions of users: Linux kernel, GTK+, Wayland, GNOME. Developed particle effects engine for a 3D rendering program, and SIMD register visualisation tool for Intel GPUs.

EDUCATION

2020 **Ph.D, Informatics**
University of Edinburgh, School of Informatics

Deep learning over programs. Developing novel machine learning methods for random program generation, compiler optimisations, and representative benchmarking. Applications for heterogeneous parallelism, compiler testing, and adaptive performance tuning. Awarded 3 grants, 3 best papers, 9 invited talks, and 7 posters.

2015 **MSc by Research, Pervasive Parallelism *(Distinction)***
University of Edinburgh, School of Informatics
Thesis: *Autotuning Stencil Codes with Algorithmic Skeletons* (grade: 85%)

Runtime adaptive tuning for heterogeneous parallel systems, targeting a high level DSL for multi-GPU stencil programs. Machine learning over distributed training sets.

2014 **MEng Electronic Engineering & Computer Science *(First Class Honours)***
Aston University, School of Engineering & Applied Science
Thesis: *Protein Isoelectric Point Database* (grade: 90%)

Created a search engine and API for a novel molecular biochemistry dataset. Targeting bioinformatics research and released open source, with $\approx 1k$ monthly active users.

PUBLICATIONS

2020 C. Cummins, Z. Fisches, T. Ben-Nun, P. Petoumenos, T. Hoefler, H. Leather. Program Analysis through Graph-based Machine Learning *(in preparation)*.

2019 A. Goens, A. Brauckmann, S. Ertel, C. Cummins, H. Leather, J. Castrillon. A Case Study on Machine Learning for Synthesizing Benchmarks. MAPL'19, Phoenix, Arizona.

2018 C. Cummins, P. Petoumenos, A. Murray, H. Leather. Compiler Fuzzing through Deep Learning. **Distinguished Paper Award ISSTA'18** (28% acceptance rate), Amsterdam.

2018 C. Cummins, P. Petoumenos, A. Murray, H. Leather. DeepSmith: Compiler Fuzzing through Deep Learning. ACACES'18 (extended abstract), Fiuggi, Italy.

2017 C. Cummins, P. Petoumenos, Z. Wang, H. Leather. End-to-end Deep Learning of Compiler Heuristics. **Best Paper PACT'17** (23% acceptance rate), Portland, Oregon.

2017 C. Cummins, P. Petoumenos, Z. Wang, H. Leather. Synthesizing Benchmarks for Predictive Modeling. **Best Paper CGO'17** (22% acceptance rate), Austin, Texas.

2016 C. Cummins, P. Petoumenos, M. Steuwer, H. Leather. Autotuning OpenCL Workgroup Sizes. ACACES'16 (extended abstract), Fiuggi, Italy.

2016 C. Cummins, P. Petoumenos, M. Steuwer, H. Leather. Towards Collaborative Performance Tuning of Algorithmic Skeletons. HLPGPU'16, HiPEAC, Prague.

2016 C. Cummins, P. Petoumenos, M. Steuwer, H. Leather. Autotuning OpenCL Workgroup Size for Stencil Patterns. ADAPT'16, HiPEAC, Prague.

2015 E. Bunkute, C. Cummins, F. Crofts, G. Bunce, I. T. Nabney, D. R. Flower. PIP-DB: The Protein Isoelectric Point Database. Bioinformatics, 31(2), 295-296. Chicago.

AWARDS

2019 **HiPEAC Collaboration Grant**
€5k cash grant awarded to 20 junior post-doctoral researchers worldwide.

2018 **Distinguished Paper Award Winner, ISSTA'18**
Top tier conference with 112 submissions, 28% acceptance rate.

2017 **Best Paper Winner, PACT'17**
Top tier conference with 109 submissions, 23% acceptance rate.

2017 **Best Paper Winner, CGO'17**
Top tier conference with 116 submissions, 22% acceptance rate.

2014 **Institute of Engineering & Technology Prize**
Annual prize for top engineering student at Aston University.

2009 **Arkwright Scholarship, Rolls Royce Holdings plc**
Funded scholarship awarded to less than 250 students nationwide.

2009 **Engineering Education Scheme of England**
R&D for a (now patented) supermarket trolley mounted shopping aid.

2008 **AESSEAL Design Innovation Award**
Cash prize for first place in a national 3D CAD competition.

TECHNICAL SKILLS

Languages Python, C++, SQL, Bash, JavaScript, C, OpenCL, Java, Go.

Tools Bazel, Git, GNU/Linux, LaTeX, TensorFlow, Jupyter, gdb, Linux perf.