Christodoulos Stylianou

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About

A PhD student, researching methods to maximize performance of iterative solvers both at single node and at scale. Interests are based around High Performance Computing and more specifically GPU Programming, performance portability across architectures, sparse matrix storage formats and novel methods for communication.

Education

University of Edinburgh, School of Informatics, EPCC **Edinburgh, UK**
PhD in HPC, Computational & Data Science, Software Engineering *2019–today*

- Optimizing sparse linear algebra through automatic sparse matrix storage format selection and dynamic switching on heterogeneous hardware.
- Developer and maintainer of Morpheus, a library for efficient runtime sparse matrix format format switching and selection.
- Funded as part of the ASiMoV, a project jointly led by EPCC and Rolls-Royce, and includes the Universities of Bristol, Cambridge, Oxford and Warwick.

University of Edinburgh, School of Informatics, EPCC **Edinburgh, UK**
MSc High Performance Computing with Data Science, Distinction *2018–2019*

- Obtained an all-around knowledge in HPC and Data Science.
- Extensively used MPI and OpenMP for Distributed and Shared Memory parallelism.
- Performed optimisations using compiler directives/flags and code refactoring in C.
- Experimented with non-deterministic messaging, through active messages and callbacks.

Imperial College London **London, UK**
MEng Electrical & Electronic Engineering w/ Management, 2:1 *2014–2018*

- **Relevant Courses:** Digital System Design ▪ Embedded Systems ▪ Real-Time DSP ▪ Optimisation
- **Relevant Coursework:**
  - Thread safe firmware for precision control of brush-less motor using C.
  - Real-time speech enhancement based on spectral estimation using C.
  - Accelerating computationally intensive mathematical expressions using FPGAs.

Kykkos A' Lyceum **Nicosia, Cyprus**
Secondary Education, GPA: 19.75/20 *2009–2012*

Work Experience

Cyl **Nicosia, Cyprus**
HPC Intern *July 2022 – Aug 2022*

- Researched the feasibility of launching CUDA kernels and change their behaviour using generic device function pointers.
- Familiarized with PTX ISA and CUDA's JIT functionality.
- Explored how the above functionality could be packaged and deployed as a Python library.

CyI **Nicosia, Cyprus**
HPC Intern *Mar 2021 – Sep 2021*

- Worked as part of the Lattice QCD group in Computation-based Science and Technology Research Center (CaSToRC).
- Implemented parallel IO functionality for an open-source project (Lyncs-API).
- The implementation supports multiple backends under the hood (MPI-IO, Dask, HDF5) and was written in Python.

EPCC **Edinburgh, UK**
Teaching Assistant - Demonstrator *Oct 2019 – Sep 2022*

- Acting as lab demonstrator for Postgraduate courses in High Performance Computing and Data Science offered by EPCC.
- Examples of courses are Numerical Algorithms for HPC, Advanced Message-passing Programming, Advanced Parallel Techniques, Data Analytics with HPC.

Felcana **London, UK**
Software Developer Intern *Oct 2017 – Dec 2017*

- Learned software engineering process improvements and best practices.
- Responsible for researching and implementing various algorithms, such as moving averages and compression, to be used in the IoT devices designed by the start-up.

National Guard Of Cyprus **Nicosia, Cyprus**
Second Lieutenant *2012–2014*

Projects

Accelerating MCMC on multiple GPUs MSc Thesis
Supervisor: Dr Kevin Stratford

- Continuation of the MEng Thesis, extending support for multiple GPUs.
- The main goal of the project was to extend the Metropolis-Hastings algorithm to target multiple GPUs at a distributed environment whilst at the same time maintaining a single source code.
- The end result was a performance portable three-level hierarchical model of MPI-OpenMP-OpenACC written in C, to target multiple GPUs across multiple compute nodes.

Student Cluster Competition

- Annual competition between teams of students from different universities, part of the International Supercomputing Conference(ISC)
- Each team was responsible to design and build their supercomputing cluster and optimise certain applications based on their choice of hardware.
- Was responsible for optimising CP2K and SWIFT codes as well as assisting in the software configuration and installation on the cluster.

Accelerating MCMC on GPU MEng Thesis
Supervisor: Dr Christos-Savvas Bouganis

- The project tackles the modern issues of Markov Chain Monte Carlo implementations occurring by the adoption of Big Data and complex Bayesian models by investigating ways to accelerate them using modern GPUs.
- Metropolis-Hastings algorithm was mapped on GPU to perform a binary classification problem using logistic regression on large datasets unable to fit on the available memory.

Skills

Programming Languages: C, C++ , Python, Bash
Programming Models: MPI+X ▪ OpenMP ▪ CUDA/HIP ▪ OpenACC ▪ Kokkos
Tools/Methods: Make, CMake ▪ git ▪ Unit Testing (CUnit, gTest) ▪ CI (GitHub Actions)
Languages: English (fluent) ▪ Greek (native)

Participations

1. The International High-Performance Computing Summer School, Athens, Greece, June, 2022.
2. Student Cluster Competition at ISC19, Frankfurt, Germany, June, 2019.

Achievements

1. Programming challenge winner for the Fastest CPU code – The International High Performance Computing Summer School, Athens, June 2022.
2. 1st Pan-Cyprian Prize, Research by Students competition, Nicosia, Cyprus, May 2012
3. 1st Pan-European Prize, Energy Scouts Competition, Nicosia, Cyprus, May 2009

Publications

1. Stylianou, C., and Weiland, M., "Optimizing Sparse Linear Algebra Through Automatic Format Selection and Machine Learning", in *Eighteenth International Workshop on Automatic Performance Tuning (iWAPT2023)*, St. Petersburg, FL, USA, 2023 (accepted)
2. Stylianou, C., and Weiland, M., "Morpheus: a library for efficient runtime switching of sparse matrix storage formats", in *SoftwareX*, 2023 (under review)
3. Klaisoongnoen, M. et al., "Morpheus unleashed: Fast cross-platform SpMV on emerging architectures", in *2023 Cray User Group conference*, Helsinki, Finland, 2023 (accepted)
4. Stylianou, C., and Weiland, M., "Exploiting dynamic sparse matrices for performance portable linear algebra operations," in *2022 IEEE/ACM International Workshop on Performance, Portability and Productivity in HPC (P3HPC)*, Dallas, TX, USA, 2022 pp. 47-57.
5. Bacchio, S., Finkenrath, J., and Stylianou, C., "Lyncs-API: a Python API for Lattice QCD applications", in *The 38th International Symposium on Lattice Field Theory*, 2022.

Scholarships & Awards

2020: A.G. Leventis Foundation Educational Grant
2020: Scholarship for Doctoral Studies - State Scholarships Foundation of Cyprus
2019: PhD Stipend as part of the EPSRC project ASiMoV (EP/S005072/1).
2012: Scholarship for Undergraduate Studies - State Scholarships Foundation of Cyprus

Other Interests

Running: Discovering and expanding physical boundaries through long-distance running.
Cooking: Fuelling imagination and creativity through culinary art and cooking.