BRUNO MAGALHAES

Curriculum Vitae. 15/05/2023

PERSONAL INFORMATION

Emails: brunomaga@gmail.com, brmagalhaes@microsoft.com
Mobile Phone: +41 77 487 8992
Citizenships: Portuguese and Swiss
Current address: 251 Newmarket Road, Cambridge CB5 8JE, UK
Personal webpage: https://brunomaga.github.io/
Professional webpage: https://www.microsoft.com/en-us/research/people/t-bmagalhaes/
Linkedin: https://www.linkedin.com/in/brunomaga/
Github: https://github.com/brunomaga
Google scholar: https://scholar.google.com/citations?user=pirWLLgAAAAJ
Languages: fluent in Portuguese, French, English and Spanish

SUMMARY

I am a research engineer at Microsoft Research, with 10+ years of experience on end-to-end research, design and development of scientific applications, using methods from High Performance Computing, Simulation and Machine Learning. I consider myself an active learner and I enjoy multicultural and diverse work environments with the possibility of personal and intellectual growth.

EDUCATION

PhD Computational Neuroscience   2015 - 2019
École polytechnique fédérale de Lausanne (EPFL), Switerland

· thesis *Asynchronous Simulation of Neuronal Activity* underlies the first simulated mouse-scale brain model and was nominated for the EPFL doctoral school excellency award (TOP 8% PhD students) and for the IBM research award for the best thesis in computational sciences in Switzerland;
· during the Summers of 2015, 2016 and 2017, I was a visiting researcher at the Center for Research in Extreme Scale Technologies (CREST) at Indiana University, US;
· Trained on cellular neuroscience, behavior and cognitive neuroscience, biological modeling of neural networks, machine learning, Natural Language Processing and Statistics for Data Science;
· advised by Prof. Felix Schuermann (EPFL, co-director of the Blue Brain Project), and Prof. Thomas Sterling (Indiana University, inventor of the Beowulf cluster and winner of the Gordon Bell prize).
· thesis jury composed by Jesus Labarta (director of Barcelona Supercomputing Center), Markus Diesmann (Director of Jullich Research Center) and Simone Deparis (Professor at the dept. of Mathematics at EPFL);
· thesis jury composed by Jesus Labarta (director of Barcelona Supercomputing Center), Markus Diesmann (Director of Jullich Research Center) and Simone Deparis (Professor at the dept. of Mathematics at EPFL);

MSc Advanced Computing   2008 - 2009
Imperial College London, UK

· thesis *GPU-enabled steady-state solution of large Markov models* based on distributed, multi-core CPU and GPU (CUDA) computation of large Markov models awarded distinction and published at NSMC'10;
· advised by Dr. Nicholas J. Dingle and Prof. William Knottenbelt (both at Imperial College London);
· Finished with Merit.

BSc (5-year programme) Computer Science and Systems Engineering 2002 - 2007
University of Minho, Portugal *final grade: A (Top 10%)*
· Exchange student at the University of Maribor (Slovenia) in the academic year of 2005/2006;
· Internships at IBM Slovenia, and the European Center for Nuclear Research (CERN);
· Finished with A, equivalent to top 10% of graduates.

EMPLOYMENT HISTORY

Microsoft Research September 2019 - Present
Postdoctoral researcher, then Senior researcher *Cambridge, UK*
· (ongoing) porting Transformer-based models to confidential optics hardware;
· Likelihood estimators and Gaussian Processes for parameter fine-tuning of experimental systems;
· Convolutional Neural Nets for data extraction and classification on 3D glass at Project Silica;
· Information encoding (Gray, Huffman), and error recovery/correction to maximize channel capacity;
· Scaling large DNNs via data/model parallelism techniques such as sharding, pipelining, gradient accumulation, checkpointing, IO offloading, mixed precision, model compression and distillation;
· ML models for time-series (RNNs, GRUs, Encoder-Decoders, and Bayesian Optimization), to improve load balancing of Exchange email servers with logs on distributed exabyte-scale COSMOS databases;
· development of a recommendation system using Graph Neural Nets and DNNs on a trillion-edge graph of meetings, documents, emails and users, stored on a distributed spark databases;
· full-stack DevOps, CI/CD, development and finetuning of ML systems, pipelines and models for local, cluster and cloud (AzureML) compute environments, taking into account business and hardware requirements (limited memory, low network bandwidth, cost vs accuracy vs runtime trade-offs);
· Presenter of talks on *single-node CPU optimization*, *distributed computing* and *AI SuperComputing*;

École polytechnique fédérale de Lausanne (EPFL), Switerland March 2015 - August 2019
PhD candidate, then postdoctoral researcher *Lausanne, CH*
· Research, development and publication of better and faster methods for asynchronous variable-step simulation of spiking neural networks on Cray and SGI supercomputers with 10K+ compute nodes;
· Technologies used: C, C++; asynchronous runtime systems (HPX-5), computation and InfiniBand communication; global memory addressing; distributed task scheduling, concurrency and threading; dynamic load-balancing; vectorization and cache optimization; CVODE numerical library;
· Performed 400h+ of teaching assistant duties for Unsupervised and reinforcement learning, Project in neuroinformatics and *In silico* neuroscience;
· scientific reviewer for the IPDPS (International Parallel and Distributed Processing Symposium), SC (SuperComputing) and ISC (International Supercomputing) conferences and proceedings;
· during postdoc, performed supervision of PhD students and engineers;

Blue Brain Project, EPFL, Switerland March 2011 - February 2015
Research Engineer *Lausanne, CH*
· Research, development (C, C++, MPI, OpenMP) and publication of methods for parallel/distributed volumetric spatial decomposition, load balancing, spatial indexing, sorting, I/O, sparse matrix transpose, and graph navigation, that underlie an efficient storage and processing of neural networks on SGI and IBM BlueGene supercomputers with 16K compute nodes;

Noble Group September 2009 - February 2011
Junior IT Infrastructures Architect *New York, São Paulo and London*
· Network design and configuration of master-slave data replication system for a data centre for EU Power & Gas trading infrastructure, based in London, UK;

· 3-month placement: IT infrastructure design and configuration (servers, storage, network routers) for a port and warehouse for trading of coffee and soy beans, Sao Paulo, Brazil;

· 3-month placement: implementation of a web-based software for metals and coffee trading, New York

MSCi real estate   March 2007 - September 2008
Analyst Programmer   *London, UK*

· Development of a search engine and C# app for efficient storage and analytics of financial data

SCIENTIFIC PRODUCTION

Patrick Anderson, **Bruno Magalhaes**, et al. Multi-dimensional optical data writing techniques for cloud-scale archival storage, Laser Applications in Microelectronic and Optoelectronic Manufacturing (LAMOM) XXVIII, Volume 12408, Pages 32-35, Publisher SPIE. link: https://www.spiedigitallibrary.org/conference-proceedings-of-spie/12408/1240807/Multi-dimensional-optical-data-writing-techniques-for-cloud-scale-archival/10.1117/12.2649177.full .

Ariel G Diaz, **Bruno Magalhaes**, et al. Cloud-Scale Archival Storage Using Ultrafast Laser Nanostructuring, CLEO: Applications and Technology, Pages AM3I. 1, Publisher Optica Publishing Group. link: https://opg.optica.org/abstract.cfm?uri=CLEO_AT-2022-AM3I.1

Henry Markram, Eilif Muller, Srikanth Ramaswamy, Sean L. Hill, Idan Segev, Felix Schürmann, **Bruno Magalhaes** et al. Reconstruction and Simulation of Neocortical Microcircuitry. Cell, volume 163, issue 2, pages 456-492, October 08, 2015. link: https://doi.org/10.1016/j.cell.2015.09.029.

Bruno R. C. Magalhães, Thomas Sterling, Michael Hines and Felix Schürmann, Asynchronous Branch-Parallel Simulation of Detailed Neuron Models, Frontiers in NeuroInformatics (impact factor 3.566), volume 13, pages 54, year 29019.
link: https://www.frontiersin.org/articles/10.3389/fninf.2019.00054.

Bruno R. C. Magalhães. Asynchronous Simulation of Neuronal Activity (doctoral thesis). In EPFL InfoScience – Scientific Publications. link: https://infoscience.epfl.ch/record/268035

Bruno R. C. Magalhães, Thomas Sterling, Michael Hines and Felix Schürmann. Fully-Asynchronous Fully-Implicit Variable-Order Variable-Timestep Simulation of Neural Networks. In Computational Science - ICCS 2020. Lecture Notes in Computer Science, vol 12141. Springer, Cham.
link: https://doi.org/10.1007/978-3-030-50426-7_8.

Bruno R. C. Magalhães, Thomas Sterling, Michael Hines and Felix Schürmann. Fully-Asynchronous Cache-Efficient Simulation of Detailed Neural Networks. In Computational Science - ICCS 2019 (rated A). Lecture Notes in Computer Science, vol 11538. Springer, Cham. link: https://doi.org/10.1007/978-3-030-22744-9_33.

Bruno R. C. Magalhães, Thomas Sterling, Michael Hines and Felix Schürmann. Exploiting Flow Graph of System of ODEs to Accelerate the Simulation of Biologically-Detailed Neural Networks. In 2019 IEEE International Parallel and Distributed Processing Symposium (IPDPS), 2019, pp. 176-187. link: https://ieeexplore.ieee.org/abstract/document/8821008.

Bruno R. C. Magalhães, Farhan Tauheed, Thomas Heinis, Anastasia Ailamaki and Felix Schürmann. An Efficient Parallel Load-Balancing Framework for Orthogonal Decomposition of Geometrical Data. In ISC High Performance 2016. Lecture Notes in Computer Science, vol 9697. Springer, Cham. link: https://doi.org/10.1007/978-3-319-41321-1_5.

Bruno R. C. Magalhães, Nicholas J. Dingle and William J. Knottenbelt. GPU-enabled steady-state solution of large Markov models. In 6th International Workshop on the Numerical Solution of Markov

Chains (NSMC'10), 16-17 Sep 2010, Williamsburg, Virginia.
link: http://eprints.ma.man.ac.uk/1533/.

Bruno Magalhaes and Felix Schürmann. Efficient Distributed Transposition Of Large-Scale Multigraphs And High-Cardinality Sparse Matrices. ArXiv CS. link: https://arxiv.org/abs/2012.06012

(ongoing) **Bruno Magalhaes** and Felix Schürmann. Distributed Asynchronous Execution Speeds and Scales Up Over 100x The Detection Of Contacts Between Detailed Neuron Morphologies;

(patent, ongoing) Jannes Gladrow, **Bruno Magalhaes**, Erika Aranas, Ioan Stefanovici, for Microsoft Research: "High-bandwidth QR-Movie Data Transmission", based on machine learning to retrieve media from high-frequency QR codes;

(publication and patent, ongoing) **Bruno Magalhaes et al.**, Towards finetuning and error quantification of non-linear physical experimental systems via Machine Learning;