

# Bruno Magalhaes

## PhD Neuroscience candidate with Computer Science background

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Av. de France 38, 1004 Lausanne, Switzerland Born the 20<sup>th</sup> August 1984 in Braga, Portugal  
Native in Portuguese, fluent in English and French, fair in Spanish and Slovenian



PhD candidate researching large-scale algorithms for biologically inspired neural networks.  
Interested in the combination of brain sciences, super-computing and machine learning.

## Education

ongoing Mar 2015	<b>PhD Neuroscience, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland</b> <ul style="list-style-type: none"><li>Title : Large-scale Asynchronous Simulation of Neuronal Activity</li><li>Technologies : HPX for Parallax runtime system; global memory addressing; asynchronous communication; remote procedure calls, concurrency and threading; dynamic load-balancing; distributed computation graphs, tree-parallelism and task scheduling; vectorization and cache-optimization;</li><li>Core courses : Neuroscience - cellular mechanisms, Neuroscience - behavior and cognition, Biological modeling of neural networks and Machine learning</li><li>Teaching Assistant (400 hours) for Unsupervised and reinforcement learning in neural networks, Projects in neuroinformatics and <i>In silico</i> neuroscience</li><li>Visiting scholar at Center for Research in Extreme Scale Technologies, Indiana University (US), working with HPX developers on fine-tuning asynchronous processing of neural networks, Summers 2015-17</li></ul> <div>C C++ Python HPX-5 MPI <math>\LaTeX</math> tensorflow google test TCLAP Sundials CVODEs API IBM BlueGene/Q</div>
Sep 2009 Oct 2008	<b>MSc Advanced Computing, Imperial College London, UK</b> <ul style="list-style-type: none"><li>Final thesis on multi-core CPU, GPU and parallel computation of large Markov models in heterogeneous networks, awarded distinction and published at NSMC'10. Finished degree with Merit.</li></ul> <div>C NVIDIA CUDA Message Passing Interface (MPI) Posix threads Java</div>
Jul 2007 Oct 2002	<b>BEng (5 year programme) Systems Engineering and Computer Science, University of Minho, Portugal</b> <ul style="list-style-type: none"><li>Exchange student at the University of Maribor, Slovenia, 2005/2006. Finished degree with final grade A.</li></ul>

## Work Experience

Feb 2015 Mar 2011	<b>Scientific Assistant and HPC Engineer, The Blue Brain Project, EPFL, Lausanne, Switzerland</b> <ul style="list-style-type: none"><li>Parallel algorithms for spatial decomposition of neural networks</li><li>Parallel algorithms for distributed task-stealing programming models on neural networks</li><li>Parallel algorithms for synaptic map reconstruction via efficient distributed sparse matrix transposition</li><li>Algorithms for the distributed spatial indexing of detailed neuron morphologies</li></ul> <div>C C++ Message Passing Interface (MPI) OpenMP CMake IBM BlueGene/P and /Q parallel IO (MPI, HDF5)</div>
Feb 2011 Sep 2009	<b>Junior Architect for IT infra-structures, Noble Group, Worldwide</b> <ul style="list-style-type: none"><li>Network design of a contingency data centre for all EU Power &amp; Gas trading infrastructure, London, UK</li><li>Network and infrastructure design of a port and warehouse for coffee and soy beans, Santos, Brazil</li><li>Implementation of a web-based software for metals and coffee trading, New York, USA</li></ul> <div>Cisco and 3Com network devices ASP.NET</div>
Oct 2008 Mar 2007	<b>Analyst programmer, MSCI (former IPD - Investment Property Databank), London, UK</b> <ul style="list-style-type: none"><li>Development of a web-based geographical system for real estate data search and analytics</li><li>Development of software for data query and warehousing</li></ul> <div>C# Visual Basic F# ASP.NET MS SQL Server SSIS google maps API javascript</div>
Sep 2005 Jan 2005	<b>Software developer (part-time), Department of Physics, University of Minho, Portugal</b> <ul style="list-style-type: none"><li>Development of parallel algorithms for analysis of collisions of particles, in collaboration with CERN</li></ul> <div>Fortran Message Passing Interface (MPI) C</div>

## Publications peer reviewed ; first author unless mentioned otherwise

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- in preparation** Fully Implicit, Fully Asynchronous, Variable Order, Variable Timestep Simulation of Detailed Neural Networks
- submitted** An Efficient Algorithm for The Distributed Transpose Of Large-Scale Graphs And Sparse Matrices With High-Cardinality Cell Structures
- submitted** Distributed Asynchronous Execution Model Speeds and Scales Up Over Hundredfold The Detection Of Contacts Between Detailed Neuron Morphologies
- submitted** Asynchronous SIMD-Enabled Branch-Parallelism of Morphologically-Detailed Neuron Models
- submitted** Fully-Asynchronous Cache-Efficient Simulation of Detailed Neural Networks
- submitted** Exploiting Implicit Flow Graph of System of ODEs to Accelerate the Simulation of Neural Networks
- 2016** An efficient parallel load-balancing strategy for orthogonal decomposition of geometrical data. Proc. International Super Computing 2016, Frankfurt, Germany
- 2015** (*co-author*) Reconstruction and Simulation of Neocortical Microcircuitry, Cell 163, 456–492.
- 2010** (*MSc final project*) GPU-enabled steady-state solution of large Markov models, Proc. 6th International Workshop on the Numerical Solution of Markov Chains (NSMC 2010), Williamsburg, Virginia

## Short Courses

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- 2017** Advanced Topics in Machine Learning, Denmark Technical University
- 2017** Google Machine Learning crash course with tensorflow, Google offices, Zurich, Switzerland
- 2014** Compute Node-level performance engineering, Swiss National Supercomputing Center, Switzerland
- 2012** Advanced Course in Computational Neuroscience, Bedlewo, Poland
- 2011** CERN School of Computing, University of Copenhagen, Denmark
- 2006** Biomedical Engineering Summer University, Katholieke Universiteit Leuven, Belgium
- 2006** Leadership Course, Military Academy , Portugal

## About me

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- Side Projects**
  - Cryptocurrencies and blockchain enthusiast, currently building a trading bot as a hobby
  - Machine Learning enthusiast, currently developing data mining algorithms for a real estate company
- Awards**
  - 3<sup>rd</sup> place at the Regional Olympiads of Mathematics, 1997
  - 1<sup>st</sup> place at the Regional Olympiads of Mathematics, 1996
- Misc**
  - Qualified PADI diver
  - Qualified sailor for coastal waters and low sea
  - Volunteer for the Swiss Red Cross (ongoing)
  - Volunteer at the hospice *Casa de Asilo*, Bocal del Toro, Panama, February 2015
  - Boy scout between 1991 and 2004
  - Currently a player at Lausanne Natation Water-Polo team, on the Swiss National League B
  - Enjoys skiing, snowboarding, travelling and cooking. Trying to learn electric guitar