

Pedro Brandimarte

Curriculum Vitae

Background in computational and theoretical physics, and mathematics. I carry extensive experience in software development, with a deep knowledge on algorithms, abstract data structures, hybrid parallel programming and high-performance computing. I am fascinated by the changes of paradigm that machine learning algorithms pose against traditional programming, as well as new forms of computing such as quantum computing. I am always very enthusiastic about tackling problems out of my comfort zone and working in a cooperative environment.

Areas of Expertise

Programming languages

Advanced	PYTHON, C++, C, FORTRAN, SHELL SCRIPT
Intermediate	R, OCTAVE/MATLAB
Basic	JAVA, RUBY, LUA

Operating systems

Linux, Windows and MacOS

Key competencies

- Research, Computational Physics, Mathematical Modeling, Data Analysis
- Probability Theory, Statistics, Linear Algebra
- Algorithms, Abstract Data Structures, Parallel Computing, HPC
- Machine Learning Techniques, Deep Learning, Data Science, Data Analytics
- Communication Skills, Problem-Solving, Teamwork, Teaching/Training Skills, Goal-Oriented

Open source codes

- 1 Contributor of Auto Kernel Generator - **AKG** (gitee.com/mindspore/akg/tree/master), a polyhedral based optimizer and code generator for operators in deep neural networks. Part of the **MindSpore** project (www.mindspore.cn/en), an open source all scenario deep learning computing framework. [PYTHON, C++]
- 2 **MCMCneuro** (github.com/brandimarte/MCMCneuro) data driven graph model for neuronal interactions using Bayesian statistics and Markov Chain Monte Carlo. [C, SHELL, R]
- 3 **KPM** (github.com/brandimarte/kpm) kernel polynomial method implementation using Chebyshev expansion for disordered lattices. [FORTRAN95, MPI]
- 4 **PhOnoS ITeRatIVe VIBRATIONS** (github.com/brandimarte/vibrations) for vibrational and electron-phonon coupling analysis via first-principles. [C, SHELL]
- 5 **Inelastic Disorder** (github.com/brandimarte/idisorder) for transport on devices with random defects and inelastic scattering. [FORTRAN95, C++, MPI, CUDA]
- 6 **Inelastic SMEAGOL** (bitbucket.org/brandimarte/smeagol-2.0 - request access) for *ab initio* inelastic electronic transport of atomic scale devices. [FORTRAN95, MPI, OPENMP]

Work Experience

- 2023–present **Vicomtech, Spain**
Research Engineer at the Connected & Cooperative Automated Systems Department.
- 2021–2023 **Huawei Technologies, France**
Parallel computing / Accelerator programming research engineer at Paris Research Center.
Key accomplishments:
- Headed the full refactoring of the new tiling module (modularization, better integration and clean code techniques) integrated into *MindSpore-AKG*
 - Implemented the intermediate representation IR parsing
 - Implemented the scheduler information extraction
 - Several performance improvements
 - Implemented test automation for exhaustive testing
 - Benchmark evaluation on single fused operators
 - Benchmark on end-to-end deep neural networks model training, such as:
 - Transformer
 - GPT-3
 - Bert
 - Wide and Deep
 - DeepFM
 - ResNet50
 - YOLO-v3 Darknet-53
 - MindSponge Protein Relaxation
- 2020–2021 **Alerion Tec, Spain**
Software engineer on computer vision, parallel imaging processing, autonomous localization and mapping.
Key accomplishments:
- Implemented two modules for parallel image processing, using FastVideo (proprietary library) and NVIDIA NPP libraries (abstraction layer over CUDA):
 - Image processing on NVIDIA Jetson embedded in inspection drones, equipped with a 50mpx full frame camera that takes pictures in raw format at 20 fps
 - Raw images processed on the fly (debayering, white balance, color correction, bad pixel correction, gamma correction, jpeg conversion) using the NVIDIA card's GPU
 - Responsible for the in-flight metadata acquisition.
 - Developed a clustering algorithm to automatically separate the acquired images according to the inspected blades parts, based on geo-localization data.
 - Implemented a blade stitching, that is, a 2D reconstruction of the blades with the acquired images and their metadata, including geo-localization and sensors data (such as LiDAR scan for the distance from the camera to the blade).
- Postdoctoral researcher**
- 2017–2020 **Donostia International Physics Center - DIPC, Spain**
Electronic structure and quantum transport in graphene-based nanostructures and networks.
funding: DIPC Foundation
- 2015–2017 **Centro de Física de Materiales - CFM, Spain**
Development of tools and theoretical models for studying electron transport in nanoscale devices.
funding: European Commission, 7^o Framework Programme, ICT Collaborative project
- Scientific training**
- 2006–2007 **CERN - European Organization for Nuclear Research, Switzerland, ALICE experiment**
Development on the AliRoot framework for simulation at the ALICE Off-line group (950h).
funding: European Commission, programme América Latina - Formación Académica (ALFA)
- 2004–2005 **Universidade de São Paulo, Brazil, Coherent Manipulation of Atoms and Light Laboratory**
Development of a magneto-optical trap experiment.
funding: National Council of Technological and Scientific Development (CNPq/PIBIC)

Supervision

- 2019 **Donostia International Physics Center - DIPC, Spain**, Supervisor
Electronic properties and tight-binding parametrization of twisted bi-layer graphene.
student: Itsaso Blanco, University College London, Faculty of Maths and Physical Sciences.
- 2018 **Donostia International Physics Center - DIPC, Spain**, Supervisor
Code development for evaluating bond order of graphene-based structures via graph theory.
student: Amaia Juaristi Arrizabalaga, Universidad del País Vasco, Departamento de Matemáticas.

Teaching

- 2004–2005 **Universidade de São Paulo, Brazil**, Instructor
Experimental Physics III and IV.

Volunteer

- 2008 **Educafro - Cohab de Taipas and Cohab Brasilândia, Brazil**
Teacher of physics and mathematics.
- 2001 **A. A. Criança - Associação de Apoio às Meninas e Meninos da Região Sé, Brazil**
Assistance to children and young people living on the streets.

Technical works

- 2019 **Universidade Federal do ABC - UFABC, Brazil**
Setup and installation of environment for scientific computing on the cluster *mildred*.
- 2016 **ESPEEM, Luxembourg**
Configuration and installation of environment for scientific computing on Google Cloud Platform.
- 2016 **INSPIRE - Johannes Gutenberg-Universität Mainz, Germany**
Scientific computing environment setup/installation on the workstations *iph-bigbang* and *quasar*.
- 2015 **Centro de Física de Materiales - CFM, Spain**
Setup and installation of environment for scientific computing on the cluster *oberon*.
- 2015 **Donostia International Physics Center - DIPC, Spain**
Scientific computing environment setup and installation on the clusters *atlas*, *brontes* and *hemera*.

Education

- 2008–2014 **Ph.D. in Physics, Universidade de São Paulo, USP, Brazil**
Study of the influence of localized vibrational modes in charge transport properties at nanoscale systems.
- 2002–2007 **Bachelor in Physics, Universidade de São Paulo, USP, Brazil**

Complementary education

- 2009–2014 **Bachelor in Applied and Computational Mathematics, Universidade de São Paulo, USP, Brazil**
Concluded 65% of the courses (1350h).

Certifications

- 1 **IBM, 2022, IBM Quantum Challenge Fall 2022 Achievement - Advanced**
- 2 **deeplearning.ai, 2019, Deep Learning Specialization**
- 3 **deeplearning.ai, 2019, Neural Networks and Deep Learning**
- 4 **deeplearning.ai, 2019, Structuring Machine Learning Projects**
- 5 **deeplearning.ai, 2019, Improving DNNs: Hyperparameter tuning, Regularization and Optimization**
- 6 **deeplearning.ai, 2019, Convolutional Neural Networks**
- 7 **deeplearning.ai, 2019, Sequence Models**
- 8 **Stanford University, 2018, Machine-Learning**

Scientific Production

Publications

Author of **17** publications in high-quality peer-reviewed journals, **11 as first theory author**, with average impact factor **8.64** and all in **Q1** (citation metrics at scholar.google.com/citations?hl=en&user=P-rSYmoAAAAJ).

Commission of trust

Reviewer of scientific journals:

- ChemistrySelect
- Nature Scientific Reports
- Physica Status Solidi (b)
- The Journal of Physical Chemistry
- Journal of Physics. Condensed Matter
- The European Physical Journal

Conferences, Scientific Meetings and Workshops

Attended and presented work in scientific conferences/workshops worldwide (Germany, Hong Kong, USA, Spain, Denmark, Austria and Brazil), whose complete list can be found at lattes.cnpq.br/8885012919924529.

Organization of International Congresses

- 2016 **Towards reality in modelling of molecular electronics (TRMME)**, *Spain*, June 13-17
<http://trmme.dipc.org>

Research projects and grants

- 2018–2020 **A Novel Platform for Electronics and Quantum Electron Optics Based on Graphene Nanostructures (GRANAS)**
grant: Spanish Ministry of Economy, Industry and Competitiveness
- 2010–2014 **Study of the Influence of Localized Vibrational Modes in Charge Transport Properties at Nanoscale Systems**
grant: National Council of Technological and Scientific Development - CNPq
- 2006–2007 **CERN (European Organization for Nuclear Research) at ALICE (A Large Ion Collider Experiment)**
grant: HELEN program (High Energy Latin American Network)
- 2004–2005 **Vacuum Quantum Noise Squeezing by Polarization Self-rotation**
grant: National Council of Technological and Scientific Development - CNPq

Languages

Portuguese	Mother Tongue	
English	Fluent	<i>Understand well, speak well, read well, write well</i>
Spanish	Advanced	<i>Understand well, speak well, read well, write reasonably</i>
French	Intermediate	<i>Understand well, speak reasonably, read well, write reasonably</i>