

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 **PhOnonS 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**
Researcher

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, 7o 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

Understand well, speak well, read well, write well

Spanish Advanced

Understand well, speak well, read well, write reasonably

French Intermediate

Understand well, speak reasonably, read well, write reasonably