Heitor Baldo, PhD

Applied Mathematician / Researcher

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heitorbaldo

Academic Appointments

2024 – 2026 **Postdoctoral Research Fellow**, *University of São Paulo*, Brazil.

2024 – 2025 **Visiting Postdoctoral Research Fellow**, *Leipzig University*, Germany.

2019 – **Affiliate Researcher**, *IGDORE Institute*, Sweden.

Education

2019 – 2024 **Ph.D. in Bioinformatics (Mathematical Neuroscience)** , *University of São Paulo*, Brazil.
Thesis: *Towards a Quantitative Theory of Digraph-Based Complexes and its Applications in Brain Network Analysis*, advised by Koichi Sameshima and co-advised by André Fujita.

2014 – 2016 **M.S. in Applied and Computational Mathematics**, *University of Campinas*, Brazil.
Thesis: *Álgebras de Clifford e de Cayley-Dickson*, advised by Jayme Vaz Jr.

2009 – 2013 **B.S. in Mathematics**, *University of Campinas*, Brazil.

Selected Publications

Preprint Manuscripts

2026 **Baldo, H., Baccalá, L., Fujita, A., & Sameshima, K.**, *Directed Q-Analysis and Directed Higher-Order Connectivity on Digraphs: A Quantitative Approach*, arXiv:2605.14178, https://doi.org/10.48550/arXiv.2605.14178
(preprint - submitted to a peer-reviewed journal)

Open-Source Software

Since 2022 **Research Packages: DigplexQ, TemporalHypermotifs, GeometrySpectralEvo, PyTropical, Pytroids**, https://github.com/heitorbaldo?tab=repositories

- Open-source Python packages providing computational tools for research in directed higher-order network analysis and directed Q-analysis, temporal graphs and hypergraphs, tropical mathematics, and graphic matroid theory. Tools: Python, Sphinx, PyPi, NumPy, SciPy, Pandas, NetworkX, HyperNetX, XGI, Gudhi, Giotto-TDA, Numba.

Talks

2025 "Spectral Density of Multilayer Hypergraphs and Applications" in *6th Central German Meeting on Bioinformatics*, Leipzig University.

2022 "Graph Cellular Automata and Beyond: Applications in Network Neuroscience." Institute of Mathematics and Statistics - USP. (slides)

2022 "Path Homology Theory of Digraphs and Its Applications to Brain Network Analysis" in *Universitä Leipzig - USP Workshop 2022* at the Institute of Mathematics and Statistics - USP. (slides)

Teaching Experiences

Spring 2021 **Teaching Assistant**, *University of São Paulo*, Brazil.
Course: *Multivariate Data Analysis* (MAE0330).

Winter 2017 **Lecturer**, *University of Campinas*, Brazil.
Course: *Complex-Valued Neural Networks* (Minicourse).

Winter 2016 **Lecturer**, *University of Campinas*, Brazil.
Course: *Bio-Inspired Algorithms: An Introduction* (Minicourse).

Fall 2016 **Teaching Assistant**, *University of Campinas*, Brazil.
Course: *Linear Algebra* (MA327).

Technical Skills

Programming	Python • Julia • R • C/C++ • Rust • SQL • TypeScript • HTML/CSS
ML/DL	PyTorch • TensorFlow • scikit-learn • XGBoost • PyTorch Geometric • DGL • JAX
Backend & APIs	FastAPI • Pydantic • Uvicorn • PostgreSQL • Redis • SQLAlchemy • REST
Frontend	Streamlit • Gradio • React • Next.js • TypeScript
MLOps & Infra	Docker • MLflow • Weights & Biases • DVC • Evidently AI • Prometheus • Grafana
HPC & Parallel	CUDA • CuPy • Numba • Dask • Ray
Others	Git • Linux • pytest • TDD • CI/CD • Sphinx • Agile • LaTeX

Languages

- **Portuguese:** Mother Tongue.
- **English:** Advanced Level (C1*).
- **German:** Pre-intermediate Level (A2*)

(*) *Common European Framework of Reference (CEFR) level.*

Last updated August 18, 2026.