

JOÃO EDUARDO BATISTA

HPC/LLM/AI Researcher | Data Scientist | Machine Learning Engineer

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Scholar: Scholar

João Batista received his Ph.D. degree from the University of Lisbon, Portugal, in 2024. From 2016 to 2024, his research was focused on automatic feature engineering using methods based on genetic programming, which were applied to remote sensing data for his Ph.D. research. In 2024, he joined RIKEN Center for Computational Science (RIKEN-CCS), where his research became focused on attribution in large language models (LLMs), LLM token-per-second throughput optimization, and code optimization using machine learning. Currently, he is also integrated into the FugakuNEXT team, a project that deals with the development of the successor to the Fugaku supercomputer.

RESEARCH & TECHNICAL EXPERIENCE

High-Performance Computing (HPC)

- Using machine learning to optimize high-performance C code, with 2.1x g-mean speedups;
- LLMs optimization for long-context tasks, with 1.2x speedups in tokens-per-second throughput;
- Worked with HPC hardware: servers containing several A100/H100 GPUs, and the Fugaku supercomputer.

Machine Learning

- Development of evolutionary computation and feature engineering algorithms;
- Creation of models robust to out-of-distribution samples;
- Explainable and interpretable artificial intelligence and attribution in LLMs.

EDUCATION AND EMPLOYMENT

- Post-doctoral researcher, RIKEN Center for Computational Science (2024-ongoing);
- Ph.D. in Computer Science, Faculty of Sciences of the University of Lisbon (2024);
- Teacher Assistant, Faculty of Sciences of the University of Lisbon (2023-2024);
- Intern, IBA Laboratory, Graduate School of Information Science and Technology, The University of Tokyo (2022-2023);
- Software Developer, University of Lisbon (2018-2019);
- M.Sc in Computer Science Engineering, Faculty of Sciences of the University of Lisbon (2018);
- Teacher Assistant, Faculty of Sciences of the University of Lisbon (2017-2018);
- Part-time researcher, BioISI, Faculty of Sciences of the University of Lisbon (2017-2017);
- B.Sc in Computer Science Engineering, Faculty of Sciences of the University of Lisbon (2016);

LANGUAGES

Portuguese: Native

English: Fluent

Japanese: Intermediate (B1 CEFR level)

Research group:

Keywords:

- High-Performance Computing (HPC)
- Artificial Intelligence (AI)
- AI Systems Optimization
- Large-Scale Machine Learning
- GPU/CPU Acceleration

Outline of the Laboratory:

The RIKEN Center for Computational Science (R-CCS) is a leading international center dedicated to advancing computational science through the development and application of cutting-edge computing technologies. It drives innovation by combining hardware, software, and scientific research, and operates flagship systems such as the Fugaku supercomputer.

The High Performance Artificial Intelligence Systems Research Team focuses on the integration of AI and HPC. Its work spans both HPC for AI—accelerating large-scale AI applications on massively parallel systems—and AI for HPC, where machine learning techniques are used to optimize system-level functions such as scheduling, power management, and execution. The team aims to advance both fields simultaneously by developing high-performance systems, software, and algorithms in collaboration with leading research institutions.

Research Topics:

- Acceleration of HPC algorithms using machine learning
- Auto-generation of code for HPC algorithms using empirical models based on machine learning.
- Extreme speedup and scalability of deep learning: Achieve extreme scalability of deep learning in large-scale supercomputing environments, including Fugaku, extending the latest algorithms and frameworks for deep learning.
- Performance analysis of deep learning: Accelerate computational kernels for AI over the state-of-the-art hardware architectures by analyzing algorithms for deep learning and other machine learning/AI, measuring their performance, and constructing their performance models.
- Acceleration of modern AI algorithms: Accelerate advanced AI algorithms, such as ultra-deep neural networks and high-resolution GAN over images, that require massive computational resources, using extreme-scale deep learning systems.

Website: https://www.riken.jp/en/research/labs/r-ccs/high_perf_ai_sys/index.html

Project Description

This project studies hierarchical neuroevolution, an approach to the co-evolution of neural network components across multiple abstraction levels simultaneously, using evolutionary computation (EC) as its primary search engine. Rather than focusing this project description to a single level, the candidate will design and evaluate an EC-drive search strategy targeted at the levels they are most interested in, out of the following options:

- Fine-grained components: individual operations and their parameterisation, including weight initialisation strategies (e.g., Xavier, Kaiming), activation functions, and normalisation schemes;
- Intermediate building blocks: attention mechanisms, transformer encoder/decoder blocks, convolutional modules;
- Global network topology: inter-cell connectivity patterns, stage composition, and depth/width trade-offs.

The search will employ bio-inspired optimisation methods including Genetic Algorithms (GAs), Evolutionary Strategies (ES), and Genetic Programming (GP), building on the group's current work on neural architecture search (NAS) and post-NAS. As well as its established expertise in surrogate-assisted NAS [Jiang24], multi-objective evolutionary NAS [Xue26a], performance-clustering surrogates [Xue26b], and neuroevolution for specialised architectures such as Spiking Neural Networks [Wang25].

Candidate profile. The ideal candidate holds a strong background in deep learning and has hands-on experience with GPU-accelerated frameworks (PyTorch, JAX, or TensorFlow). Familiarity with evolutionary computation methods, whether through coursework, research, or personal projects, is expected. Prior exposure to NAS, neuroevolution, or automated machine learning is an advantage but not required.

References:

- [Jiang24] L. Jiang, Y. Xue, F. Neri, X. Zhao and M. Wahib, "Progressive Neural Predictor with Score-Based Sampling," 2024 International Joint Conference on Neural Networks (IJCNN), Yokohama, Japan, 2024, pp. 1-8, doi: 10.1109/IJCNN60899.2024.10651529.
- [Xue26a] Y. Xue, P. Jiang, C. Zhu, M. Zhou, M. Wahib and M. Gabbouj, "A Pairwise Comparison Relation-Assisted Multiobjective Evolutionary Neural Architecture Search Method With Multipopulation Mechanism," in *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, vol. 56, no. 2, pp. 1274-1287, Feb. 2026, doi: 10.1109/TSMC.2025.3647894.
- [Xue26b] Y. Xue, W. Fang, P. Chen, M. Wahib and Y. Tan, "Surrogate-Assisted Neural Architecture Search with Performance Clustering," in *IEEE Transactions on Cognitive and Developmental Systems*, doi: 10.1109/TCDS.2026.3672588.
- [Wang25] Yuting Wang, Yu Xue, Wei Ding, Yiyu Tan, Peng Chen, Mohamed Wahib, Predictor-assisted evolutionary neural architecture search for spiking neural networks, *Neurocomputing*, Volume 654, 2025, <https://doi.org/10.1016/j.neucom.2025.131244>.

Additional Information:

1. Unfortunately, there is a limited possibility of additional funding for the selected candidate; therefore, candidates should be prepared to cover their own expenses.
2. Depending on the duration of the stay and the candidate's country of origin, a visa may be required. While the RIKEN Center for Computational Science will assist with obtaining the Certificate of Eligibility for the visa application, the candidate should take into consideration that the overall process typically takes around four months.
3. If selected, the candidate is expected to work on-site in the Nihombashi office (Tokyo).
4. It is possible to continue the collaboration remotely after the visit.
5. Japanese language proficiency is not required. This is an international team, and all supervisors and direct collaborators are fluent in English.
6. For those interested, there is a possibility that RIKEN will provide online Japanese classes.