ARTUR BACK DE LUCA

About me

My current work focuses on exploring and improving the reasoning capabilities of neural networks. More specifically, I am interested in the ability of neural networks to simulate algorithms and how such simulations can emerge through training. Understanding these characteristics is crucial for designing models that exhibit a more consistent behavior. Prior to this, I spent more than two years applying machine learning to real-world applications.

Education

Ph.D. in Computer Science — **2022 – Present**
University of Waterloo. Supervised by Kimon Fountoulakis — GPA: 92/100

M.Sc in Artificial Intelligence and Robotics — **2019 – 2022**
Sapienza University of Rome — GPA: 98/100 (108/110)

B.Sc in Mechanical Engineering — **2013 – 2019**
Federal University of Santa Catarina — Overall course ranking: 92nd percentile

Exchange Program — **2017 – 2018**
RWTH Aachen University

Research Experience

Amazon *Applied Science Intern* — **Jun 2025 – Present**
Hosted by Youxin Zhang and Ruijun Ma — *New York, US*

Huawei *Research Intern* — **Feb 2022 – Jan 2023**
Hosted by Guojun Zhang and Yingxue Zhang — *Toronto, Canada*

Micromed/CERTI Foundation *Research Consultant* — **Feb 2021 – Jan 2022**
Florianopolis, Brazil

Publications

[Preprint 2025] **Back de Luca, A.**, Giapitzakis, G., & Fountoulakis, K. "Learning to Add, Multiply, and Execute Algorithmic Instructions Exactly with Neural Networks ."
https://arxiv.org/abs/2502.16763

[HiDL @ ICML 2025] Giapitzakis, G., **Back de Luca, A.**, & Fountoulakis, K. "Exact Learning of Permutations for Nonzero Binary Inputs with Logarithmic Training Size and Quadratic Ensemble Complexity."
https://openreview.net/pdf?id=4RLpgRyJIm

[ICML 2025] **Back de Luca, A.**, Giapitzakis, G., Yang, S., Veličković, P., & Fountoulakis, K. "Positional Attention: Expressivity and Learnability of Algorithmic Computation."
https://arxiv.org/abs/2410.01686

[ICML 2024] **Back de Luca, A.** & Fountoulakis, K. "Simulation of Graph Algorithms with Looped Transformers"
https://arxiv.org/abs/2402.01107

[ICLR 2024] **Back de Luca, A.**, Fountoulakis, K. & Yang, S. "Local Graph Clustering with Noisy Labels"
https://arxiv.org/abs/2310.08031

Awards

PGS President's Graduate Scholarship — **2025**

OGS Ontario Graduate Scholarship — **2025**

DGSA Mathematics Domestic Graduate Student Award — **2023**

M-IMAE Mathematics International Master's Award of Excellence Scholarship — **2022**

Teaching

Teaching Assistant at the University of Waterloo

CS 479/679 – Neural Networks — **2025**

CS 348 – Introduction to Database Systems — **2024**

CS 475/675 – Computational Linear Algebra — **2024**

CS 338 – Computer Applications in Business: Databases — **2024**

CS 245 – Logic and Computation — **2022-2023**

Other Professional Experience

NEO Empresarial *Engineering Intern* **May 2015 – Jul 2018**

CERTI Foundation *Data Analytics Intern* **Summers 2017 and 2018**

Fraunhofer Institute for Production Technology *Research Intern* **Apr 2017 – Jan 2018**

Whirlpool – Embraco *Procurement Intern* **Summer 2016**

Numerical Simulation Lab. in Fluid Mechanics and Heat Transfer *Research Intern* **Feb 2015 – May 2015**