Pedro Lustosa Rege Botelho

plrbotelho.ai@gmail.com +55 62 99833 - 5533 linkedin.com/in/pedro-lustosa/
Google Scholar

EDUCATION

Aeronautics Institute of Technology Bachelor of Science (BSc) in Electronic Engineering
(Instituto Tecnológico de Aeronáutica - ITA - http://www.ita.br/) *March 2018 - December 2023*

- Brazil's **top 1** engineering school: acceptance rate of 0.98%;
- Capstone Thesis: "ASAGYM: A Python Library for Reinforcement Learning in Aerospace Operational Scenarios" [Online] Available: http://www.bdita.bibl.ita.br/TGsDigitais/lista_resumo.php?num_tg=79374
  Deep Reinforcement Learning aircraft combat simulation - Third scenario

WORK EXPERIENCE

Northwestern University
Evanston, IL, USA
May 2024 - Present

Research Scientist (Visiting Student)* | *Advisor: Prof. Igor Kadota

- **Best Student Paper Award – WiOpt 2025** (ECE Team Wins Best Student Paper Award at 2025 WiOpt)
  "Fair Dynamic Spectrum Access via Fully Decentralized Multi-Agent Reinforcement Learning"
- Designed and implemented fully decentralized **multi-agent reinforcement learning (MARL)** for dynamic spectrum access, achieving network throughput of up to 86% across **52 diverse wireless network settings** (M = 2–10 agents, N = 1–10 bands).
- Developed **Distributional Recurrent Dueling DQN models**, reducing collision rates to near zero and minimizing idle slots, optimizing spectrum utilization for up to 10 source-destination pairs.
- Enhanced network **fairness by up to 89%** compared to **baseline RL algorithms**, achieving a Jain fairness index of 1.0 in balanced settings (M = N) and >0.89 in most scenarios.
- Demonstrated **adaptability to dynamic conditions**, maintaining **throughput and fairness** during **jamming** episodes and in ad-hoc network models, leveraging localized interference patterns.

Center of Excellence in Artificial Intelligence
Goiânia, GO, Brazil
July 2020 - Present

(Centro de Excelência em Inteligência Artificial)
Research Scientist

- CEIA is a leading LatAM AI research group that contributes to important research, such as DeepMind's project GAIA
- **Offline-to-Online RL for Robotics:** Developing methods to enable safe pre-deployment training for humanoid robots. Currently establishing a comprehensive offline RL benchmark based on these findings.
- **AI for Speech & Generative Models:** Developed a diffusion model for singing-voice conversion for Moises (Music.AI), recognized as Apple's iPad App of the Year (2024).
- **Kolmogorov–Arnold Networks (KAN):** Investigating the application of KANs to predict Mean Opinion Score (MOS) for human-robot interaction. Preliminary results demonstrate that KANs generalize better across multi-distribution datasets compared to traditional MLPs.
- **Computer Vision:** Engineered a real-time visual odometry algorithm for autonomous vehicles, applying mathematical modeling to ensure navigation and localization.

Aeronautical Materials Park of Lagoa Santa - the Brazilian Air Force
Lagoa Santa, MG, Brazil
February 2024 - January 2026

(Parque de Materiais Aeronáuticos de Lagoa Santa - PAMALS)
Electronic Engineer

- My main attributions are the modernization and maintenance of the Brazilian Air Force's aircraft.
- I worked on the navigation system update for the EMB-314 and the modernization of the Neiva T-25 and military Cessna 208 fleets.

Institute for Advanced Studies - the Brazilian Air Force
São José dos Campos, SP, Brazil
March 2023 - December 2023

(Instituto de Estudos Avançados - IEAv)
AI Research Engineer

- Multi-Agent Reinforcement Learning (MARL): Developed a MARL framework within ASA (FAB's C++ strategic simulator) for my senior thesis, deploying agents to support High Command decision-making.
- **Algorithm Design:** Engineered a Deep Q-Network (DQN) strategy using relative polar coordinates for state abstraction and a delayed-reward scheme, enabling retrospective learning from simulation outcomes.
- **Performance:** Achieved a 91% successful engagement rate, effectively neutralizing or repelling adversarial agents in the vast majority of combat scenarios.
- **Strategic Impact:** The framework is being integrated into FAB's training pipeline to train 720 pilots alongside and against RL agents, directly enhancing the safety and operational capabilities of Brazil's air defense.

Conta Zap São Paulo, SP, Brazil

AI Engineer, Backend Developer & DevOps March 2020 - August 2020

- Conta Zap is a Fintech that offers bank services through a banking bot assistant on WhatsApp.
- Backend Development: Engineered the core communication infrastructure for a WhatsApp-based banking bot, integrating legacy banking systems with IBM Watson AI and microservices using Python and Node.js.
- Cloud Migration & DevOps: Orchestrated the complete system migration from IBM Cloud to AWS, designing a scalable architecture using Kubernetes, Docker, and automation scripts.

PUBLICATIONS

(*) indicates equal contribution.

- Ferreira, R. P.; **Botelho, P. L. R.**; Zhang, Y.; Kadota, I. "**Neuro-Cognitive Radios for Dynamic Spectrum Access.**" Submitted to **International Conference on Learning Representations (ICLR)** 2026.
- Ferreira, A. I. S.; **Botelho, P. L. R.**; Faustino, R. R.; Lustosa, F.; Casanova, D.; Oliveira, F. S.; Galvão, A. "**CAL-MOS: Cross-layer Aggregation and Layer-wise Importance Analysis for Mean Opinion Score Prediction.**" Submitted to the **51st IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)**, 2026.
- Ferreira, R. P.; **Botelho, P. L. R.**; Zhang, Y.; Kadota, I. "**Neuro-Cognitive Radios for Dynamic Spectrum Access.**" In Proceedings of the Workshop on AI and ML for Next-Generation Wireless Communications and Networking (AI4NextG) at **NeurIPS 2025**. (Accepted) Available: https://openreview.net/pdf?id=MHR8oSkxZU
- J. P. A. Dantas, F. L. L. Medeiros, A. R. Samersla, **P. L. R. Botelho**, V. C. F. Gomes, S. R. Silva, Y. D. Ferreira, A. O. Arantes, M. R. C. Aquino, and M. R. O. A. Maximo, "**Deep Reinforcement Learning Agents With Collective Situational Awareness for Beyond Visual Range Air Combat**," in **IEEE Access**, vol. 13, pp. 143052-143069, 2025, doi: 10.1109/ACCESS.2025.3597199.
- Y. Zhang*, **P. Botelho***, T. Gordon*, G. Zussman, and I. Kadota, "**Fair Dynamic Spectrum Access via Fully Decentralized Multi-Agent Reinforcement Learning**," **2025 23rd International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt)**, Linköping, Sweden, 2025, pp. 1-8, doi: 10.23919/WiOpt66569.2025.11123372.
- **P. Botelho** and G. H. Gobi, "**ASAGYM: A Python library for reinforcement learning in aerospace operational scenarios**," Senior thesis, Instituto Tecnológico de Aeronáutica (ITA), Dec. 2023. [Online]. Available: http://www.bdita.bibl.ita.br/TGsDigitais/lista_resumo.php?num_tg=79374

AWARDS AND HONORS

- **Best Student Paper Award – WiOpt 2025**
  "Fair Dynamic Spectrum Access via Fully Decentralized Multi-Agent Reinforcement Learning", 23rd International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt), Linköping, Sweden, 2025

- **1st Place Award in the General Mechanics Course of the T-27M Aircraft (Embraer EMB-312) - 2024**
  The Brazilian Air Force

- **Silver medal at the Brazilian Astronomy and Astronautics Olympiad (OBA) - 2011**

EXTRACURRICULAR PROJECTS AND ACTIVITIES

LXAI NeurIPS 2024 Mentoring Program October 2024 - January 2025

LatinX in AI Mentoring Program

- A four-month mentoring program with senior academics that debuts at LXAI workshops co-located with prestigious AI and ML conferences;
- Mentored by Felipe Leno da Silva (2023), a Staff Reinforcement Learning Researcher at the Lawrence Livermore National Lab, and mentored by Shagun Sodhani (2024), a Staff Research Scientist at Google DeepMind;

ROBIO - Bionic Prosthesis March 2019 - March 2022

***Leader** and **idealizer** of a bioengineering project*

- Successful development of an electronic hand prosthesis able to interpret the nerve impulse to control itself.
- Research and development of electronics, from signal capture to command execution, applying AI to classify signals.
- ROBIO is currently developing solutions for the National Healthcare System.

CasdVest - Teacher and staff member March 2018 - December 2018

- CasdVest provides tuition-free college preparatory education for students from low-income backgrounds.
- **Teaching:** Tutored Mathematics and Physics, conducting study sessions to bridge knowledge gaps for vulnerable students.
- **Marketing & Fundraising:** Served as a marketing team member, organizing donation campaigns and product sales to secure financial sustainability for the NGO.