

JOÃO PAULO FONTOURA NOGUEIRA

Autonomous Intelligent Machines and Systems (EPSRC CDT) Applicant

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EDUCATION

Institut Polytechnique de Paris

MSc in Computer Science for Networks

Mention Très Bien (Highest Honors)

Sep. 2023 – Jul. 2025

Paris, France

- **Coursework:** Machine Learning; Formal Verification, IoT & Data; Graph Theory; Distributed Systems.

Polytechnic Institute of Porto

BSc in Electrical and Computer Engineering

ECTS Grading: A, Top 10%, Highest Honors

Sep. 2020 – Jul. 2023

Porto, Portugal

- **Coursework:** Computer Logic, AI; Signals and Systems; Electrical Circuits; Control Systems; Advanced Mathematics and Physics.

PUBLICATIONS

- **João Paulo Fontoura Nogueira**, Wentao Sun, Alonso Silva, Laith Zumot. “Certainty-Guided Reasoning in Large Language Models: A Dynamic Thinking Budget Approach.” *Under review at ICML 2026*. arXiv:2509.07820, 2025.
- Wentao Sun, **João Paulo Fontoura Nogueira**, Alonso Silva. “Structured Thinking Matters: Improving LLMs Generalization in Causal Inference Tasks.” *Under review at ICML 2026*. arXiv:2505.18034, 2025.

RESEARCH & PROFESSIONAL EXPERIENCE

Nokia Bell Labs

Machine Learning Research Intern

Apr 2025 – Sep 2025

Paris, France

- Proposed Certainty-Guided Reasoning (CGR), an inference-time method for adaptive thinking budgets in reasoning LLMs, preserving accuracy while saving millions of tokens on AIME2024/2025.
- Co-authored Structured Thinking Matters, achieving +47.5% relative F1 on Corr2Cause.
- Received the Outstanding Innovation Award from the Nokia Bell Labs Global Student Program; first France-based intern to receive this award.
- Accepted for oral presentation, LINC'S Annual Workshop, Palaiseau, France, June 2025.

Institut Polytechnique de Paris

Industrial Research Project – Networks

Nov 2023 – Jun 2024

Paris, France

- Implemented Cognitive Radio over LoRa networks enabling dynamic frequency switching on unlicensed spectrum.
- Developed MATLAB simulations and validated spectrum sensing and channel switching on SDR hardware.
- Cassiopée Award – Best Student Project 2024 (top among 60+ projects).

INESC TEC – Robotics and IoT Laboratory, University of Porto

Robotics R&D Intern

Feb 2023 – Jun 2023

Porto, Portugal

- Developed a C driver on RP2040 to interface with an LD19 LiDAR, parsing raw packets into usable point-cloud measurements.
- Built a reliable LiDAR data pipeline to stream scans to host devices, now used to support navigation in agricultural-field robots.
- Enhanced an Android (Java) application to generate a 360° 2D map from incoming LiDAR data.

SELECTED PROJECTS

SMT(LRA) Constraint Learning from Labelled Examples

2025

- Reimplemented (from Kolb et al., IJCAI 2018) an SMT(LRA) encoding to learn k -clause CNF formulas combining Boolean literals and linear real arithmetic halfspaces from feasible/infeasible examples.
- Programmed the solver-backed formulation in Python using PySMT, and extracted interpretable learned constraints from the satisfying model.

Middleware & Digital Twin for Collision Avoidance

2024

- Created a digital twin simulation in C++ of cars on a road to predict and prevent vehicle collisions.
- Used MQTT to connect clients (cars) and server via a pub-sub architecture.

Real-Time Train Crowding Forecasting (SNCF-Transilien)

2024

- Built and compared ML models (Random Forest, Neural Networks, Polynomial Regression) to forecast real-time train occupancy using sensor-derived and lag features, handling missing and noisy data.
- Achieved RMSE 0.0229 with Random Forest vs 0.158 baseline (84.6% improvement) through feature engineering from existing variables.

UWB Radar Sensing: Movement Tracking & Breath Monitoring

2023

- Implemented IR-UWB radar movement tracking in MATLAB.
- Performed non-contact breath monitoring using envelope extraction (Hilbert transform) and variance-based feature selection, with Python analysis (NumPy/SciPy/Matplotlib) and time-/frequency-domain validation.

Machine Learning for Mutation Testing Reduction

2024

- Extracted structural code features from mutants and applied clustering (K-Means, DBSCAN, HDBSCAN) to group structurally similar mutants for pruning.
- Used an FSM-based system model and DS test-suite generation methods to check equivalence within clusters and assess when ML-only grouping fails.

Sampling-Based Motion Planning (RRT/RRT*)

2024

- Evaluated RRT vs RRT* across iteration budgets, quantifying the trade-off between path quality and computation time.

ICP-based SLAM (Incremental SLAM & GraphSLAM)

2024

- Implemented ICP scan registration and a simplified GraphSLAM back-end for 2D LiDAR mapping (U2IS/FR079 datasets), comparing against an incremental ICP-SLAM baseline.

Embedded Tetris Table

2022

- Recreated Tetris game logic in C on an ATmega328P under tight memory constraints (2 KB RAM), including collision detection and piece rotation.
- Controlled 300+ WS2812 RGB LEDs for real-time display output.
- Developed a separate Android app to control the custom-built board via Bluetooth.

Real-time Facial Recognition

2023

- Fine-tuned YOLOv8m (Ultralytics/PyTorch) via transfer learning on a custom-labelled webcam dataset for closed-set identification of two individuals, rejecting others.
- Ran live webcam inference with a high-confidence threshold; evaluated using confusion matrices and precision/recall/F1 curves.

- Autonomous Dragster Robot**

2023

 - Built an autonomous dragster to complete a 10 m sprint at max speed and stop precisely at the finish line.
 - Used IR sensing and a PID-based controller for line/target detection and braking control.

- IP Paris Racing Team – Formula Student (Electronics)**

2023

 - Member of the Electronics division for the Formula Student competition.
 - Integrated our custom CAN bus with the EV motor controller and contributed to the team website.

AWARDS & DISTINCTIONS

- Offered a CIFRE PhD position with Nokia Bell Labs and Institut Polytechnique de Paris (2025)
- Outstanding Innovation Award, Nokia Bell Labs Global Student Program (2025)
- Mention Très Bien (Highest Honors) – MSc in Computer Science for Networks (2025)
- Cassiopée Award, Best Student Research Project – Institut Polytechnique de Paris (2024)
- Highest Honors, top 10% – BSc Electrical and Computer Engineering (2023)

SKILLS

Languages	Portuguese (native); English (native); French (B2); Spanish (B1); Italian (A1)
Programming	Python; C/C++; Assembly; Java; JavaScript; MATLAB
Libraries	PyTorch; Keras; scikit-learn; OpenCV; vLLM; SimPy; NumPy; Pandas; Polars
Tools	Git; Docker; Linux; Google Cloud; Wireshark; MongoDB; SQLite; MQTT; PSPICE; Ollama