# Miguel Caçador Peixoto

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## WORK EXPERIENCE

18/08/2023 – CURRENT Germany

### **BOOST PROGRAM - MACHINE LEARNING ENGINEER** BOSCH SECURITY SYSTEMS

Selected as one of 8 professionals from over 900 applicants for the Portuguese Junior Managers Program. Rotations included:

1 - Computer Vision Engineer in the Digitalization Team, Ovar, Portugal
Crafting bespoke solutions for factory digitalization through a vision-based Industry 4.0 approach

2 - Multimodal Machine Learning Full Lifecycle on Embedded Devices, Hildesheim, Germany
Data engineering, training, finetuning, distilation, quantization, pruning, compilation and deployment on the edge.

3 - AI Framework Creation & Implementation, Ovar, Portugal
Engaged with multiple stakeholders to identify use cases and deploy AI solutions, optimizing processes while ensuring compliance, data governance, and human factors.

05/2023 – 12/2024 Braga, Portugal

### **RESEARCHER** UNIVERSITY OF MINHO

Collaboration with Bosch Car Multimedia to advance anomaly detection in the industry.

01/10/2021 – CURRENT Braga, Portugal

### **RESEARCHER** INSTRUMENTATION AND EXPERIMENTAL PARTICLE PHYSICS LABORATORY

Led a team of 10 motivated students specializing in anomaly detection and quantum computing applied to high-energy physics. I also facilitated machine learning workshops and seminars to students at our research institute. My role involved both leadership responsibilities and hands-on participation across various domains, including:

**Natural Language Processing & Recommendation Systems:**
- Collaborated with SPAC Lab to pioneer a model capable of diagnosing possible diseases based on patients' historical records from the Portuguese National Health Service. We also explored determining the prevalence of diseases in the population and evaluating the appropriateness of drug prescriptions.
- Used **HuggingFace Sentence-Transformers** and **Facebook Faiss** for similarity search.

**Quantum Machine Learning (QML) - Paper Published:**
- Compared novel Quantum ML architectures with shallow ML.
- Developed a robust library with a parallelization pipeline, comprehensive unit tests, CI/CD pipelines, and thorough documentation.
- Used **Pennylane, Qiskit**, **Scikit-Learn, PyTorch** and **Optuna**.

04/2020 – 10/2021 Braga, Portugal

### **SUMMER INTERN** INSTRUMENTATION AND EXPERIMENTAL PARTICLE PHYSICS LABORATORY

Two summer internships: Advanced data analysis methods for dark matter research (2020) and Anomaly Detection as a Tool for Discovering New Physics at CERN's Large Hadron Collider (2021)

## PUBLICATIONS

2022

### Fitting a Collider in a Quantum Computer: Tackling the Challenges of Quantum Machine Learning for Big Datasets

**Abstract:**

Current quantum systems have significant limitations affecting the processing of large datasets and high dimensionality typical of high energy physics. In this work, feature and data prototype selection techniques were studied to tackle this challenge. A grid search was performed and quantum machine learning models were trained and benchmarked against classical shallow machine learning methods, trained both in the reduced and the complete datasets. The performance of the quantum algorithms was found to be comparable to the classical ones, even when using large datasets.

Frontiers in Artificial Intelligence - DOI: 10.3389/frai.2023.1268852

## EDUCATION AND TRAINING

Braga, Portugal
### MASTER'S DEGREE IN INFORMATION PHYSICS University of Minho

- Created a production-ready, autoencoder-based framework for anomaly detection across *any* industrial part and production line, requiring minimal inicial data. Autonomously selects optimal ML models, validated live at Bosch Braga. Outperformed SOTA on MvTec benchmark.
- Student representative of my master's.

**Final grade** 20/20 | **Thesis** Anomaly Detection as a Quality Control Tool in an Industrial Context

Braga, Portugal
### BACHELOR'S DEGREE IN PHYSICS ENGINEERING University of Minho

Association of Physics Students - NEFUM (2019-2021):
Founded and managed the discord with 200+ members and a website. Part of the team organizing the national physics students meeting where 134 students attended. Ran for president and lost by a margin of ~15% in 2022.

Academic Debate Association:
Developed my debate skills by going to soft skills developing sessions and debating with law students.

**Final grade** Average Score of 16.4 out of 20 | **Type of credits** ECTS | **Number of credits** 180

## HONOURS AND AWARDS

### 15th Fraunhofer Portugal Challenge – Fraunhofer

Recognized for outstanding innovation in technological research. Awarded for my master's thesis.

### UMinho University Award for the Initiation in Scientific Research – University of Minho

Used Variational AutoEncoders to build an anomaly detection system for detecting beyond the standard model events in high-energy physics. [Media Link]

### Meritorious behavior of social and scientific nature – Secondary School of Morgado De Mateus

Awarded 4 distinctions at the end of high school due to my participation in "Project Rocket" and my seminar on the Noble Prize of Physics 2017 promoted by UTAD University.

### Empreende@Villa.Jovem-BILATECH – Vila Real Municipality

Won 1st place and prize money of 5k among 30+ finalists in the contest aimed at young entrepreneurs by developing an innovative business idea - Automating marketing and improving the online presence of companies.

## SOCIAL AND POLITICAL ACTIVITIES

Milan, Italy
### ESA Winter Astronomy Camp

Selected as one of the 40 participants among more than 200 entries worldwide for a 1-week Winter Astronomy Camp at Saint-Barthélemy, Italy. Explored the theme of exoplanets - included lectures, hands-on activities, and nighttime observations with the instruments of the observatory.