Laura Pereira Sanchez

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Linkedin | Github | CERN Gitlab | Publication List | Google Scholar

Geneva, Switzerland

About me

PhD in Physics with 6+ years of experience analyzing Big Data from CERN, with expertise in AI, data science, statistics, and software development. Driven to apply my skills to projects that deliver meaningful impact to society.

Techical Skills

- **Programming Languages:** Python, C++, ROOT, Bash/UNIX
- **Machine Learning & Deep Learning Frameworks:** Pytorch, Tensorflow, JAX, Keras, XGBoost, TMVA
- **Data Processing and Visualization:** Pandas, Matplotlib, Seaborn, Numpy etc.
- **Cloud Technologies:** CERN, SLAC
- **DevOps & Version Control:** Gitlab, Github, VSCode, JIRA, CI/CD Pipelines, Unit Testing
- **Database Systems:** Mongo DB
- **Statistics:** Hypothesis Testing, Log-likelihoods, Uncertainty Modeling

Experience

- **Stanford University & SLAC National Laboratory (US)** *Oct 2023 -*
  Postdoctoral Research Fellow - ATLAS Collaboration (CERN) Menlo Park, CA, USA & Geneva, Switzerland

  - **Project 1: AI algorithms to identify key signatures in particle physics collisions**
    Tools: JAX, PyTorch, Tensorflow
    * Developed and benchmarked AI algorithms, utilizing transformers, graph neural networks, deep neural networks, boosted decision trees and generative models such as normalizing flows.
    * Applied state-of-the-art auto-differentiable programming techniques to train physics-aware neural networks.
    * Prepared and optimized datasets for machine learning model training.

  - **Project 2: Building a state of the art silicon tracking detector**
    Tools: MongoDB database, Docker
    * Documented loading and integration stages for the experiment database, specifying component requirements and test parameters for accurate data entry.
    * Coordinated with cross-functional teams to align database functions with project needs, enhancing accessibility and workflow integration.
    * Acted as primary contact for coordination between sites and detector subsystems.
    * Set up the software required for testing during integration using *Docker* containers.
    * Laboratory experience handling sensitive material in the clean room.

- **Stockholm University** *September 2018 - August 2023*
  Doctoral Researcher - ATLAS Collaboration (CERN) Stockholm, Sweden

  - **Project 3: Coordinated analysis of LHC data to search for unknown particles**
    Tools: python, hypothesis testing, Git, XGBoost, Keras [ ]
    * Led a 4-year LHC data analysis project with a team of 15 to search for new particles.
    * Designed and implemented a parametrized neural network strategy, achieving 30% higher detection rates.
    * Built a flexible framework for training neural networks and boosted decision trees on imbalanced datasets, widely adopted across analyses.
    * Oversaw project stages, including meetings, documentation, sample requests, and approvals.
    * Performed statistical analysis and guided the preparation of the final journal paper **[J.1]**.
    * Wrote and presented outreach materials, including a briefing and video script, to publicize the publication.
    * Applied experience with imbalanced datasets to long-range 3D object detection for autonomous driving **[C.1.]**

◦ **Project 4: AI Algorithm Calibration for Simulation-to-Data Shifts**
Tools: Python, C++, Bash, ROOT, Git

∗ Calibrated AI algorithms to correct for simulation-to-data domain shifts over 4 years, adapting to new data and algorithms.
∗ Published a comprehensive statistical analysis of the calibration process in a peer-reviewed journal **[J.2]**.
∗ Automated the calibration workflow with Git pipelines, Bash scripts, and batch processing, reducing required analysis time by over 70%.

Selected Scientifc Publications

C=Conference, J=Journal, S=In Submission, T=Thesis

[J.1] ATLAS Collaboration. (2024). **Search for a resonance decaying into a scalar particle and a Higgs boson in the final state with two bottom quarks and two photons in proton-proton collisions at a center of mass energy of 13 TeV with the ATLAS detector**. Published in *Journal of Hight Energy Physics 11 (2024) 047*. DOI: 10.1007/JHEP11(2024)047

[J.2] ATLAS Collaboration (2023). **Calibration of the light-flavour jet mistagging efficiency of the b-tagging algorithms with Z+jets events using 139 fb^{-1} of ATLAS proton-proton collision data at $\sqrt{s}$ = 13 TeV**. In *Eur. Phys. J. C, 83(8), 728*. DOI: 10.1140/epjc/s10052-023-11736-z

[C.1] A. Khoche, L.Pereira Sanchez et al. (2024). **Towards Long-Range 3D Object Detection for Autonomous Vehicles**. Presented at the *Intelligent Vehicle Symposium (IV) 2024*. arXiv.2310.04800.

Soft Skills

- **Leadership:** Served a project owner in a team of 15 physicist in a novel data analysis project during 4 years, from its start until its publication.
- **Coordination:** Liaison between different international and interdisciplinary teams for 2 different projects
- **Supervision:** Supervised master and PhD students from different universities.
- **Team work** Collaborated in different international and interdisciplinary teams of between 4 and 40 people, resulting in more than 10 scientific publications and two hardware implementations.
- **Languages:** Native Spanish and Catalan, Proficient English (C2), Beginner German (B1) and French (A2).
- **Communication:** Presented research to experts (meetings, conferences and journals) and public (outreach events).

Education

• **PhD in Physics** *September 2018 - May 2023*
Stockholm University Stockholm, Sweden
◦ Thesis title: The Beauty in Broken Symmetries: b-jet identification and searches for Supersymmetry, Dark Matter and multi-Higgs production with the ATLAS experiment

• **Master in Particle Physics, Astrophysics and Cosmology** *September 2017 - July 2018*
Universitat Autonoma de Barcelona Barcelona, Spain

• **Bachelor in Physics** *September 2013 - July 2017*
Universitat Autonoma de Barcelona Barcelona, Spain

Honors and Awards

• **Postdoctoral Fellow at Stanford University** *May 2023*
Knut and Allice Wallenberg Foundation - KAW 2022.0358 [🌐]
◦ My research proposal "Measuring the shape of the Higgs potential in ATLAS" was funded for up to 4 years.

• **Travel Grants** *2023 / 2021*
Kinanders, Lydia and Emil, Foundation / Kobbs, Gustaf and Ellen, Scholarship Foundation [🌐]
◦ Two independent grants to present research at cutting edge international conferences.

• **69th Lindau Nobel Leaureate Meeting in Physics** *2019*
Ragnar Söderberg Foundation [🌐]
◦ Selected to spend one week discussing with Nobel Laureates and other young scientists about Physics.

Certifications

- **Coursera:** Deep Learning Specialization (4/5) *2021*
- **CERN, HSF and SIDIS:** HEP C++ course *2020*
- **University of Michigan:** Proficiency in English *2014*