Pablo Martín Ramiro

Instituto de Física Teórica IFT-UAM/CSIC
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Artificial intelligence researcher. Develop AI models for anomaly detection in particle physics experiments.

EDUCATION

Instituto de Física Teórica IFT-UAM/CSIC — Madrid, ES
PhD in Theoretical Particle Physics — Oct. 2017 - Oct. 2021
Thesis: Machine learning techniques for new physics searches at the LHC.

Durham University — Durham, UK
MSc in Particles, Strings and Cosmology — Oct. 2015 - Oct. 2016
Graduated with Distinction

Universidad Complutense de Madrid — Madrid, ES
B.S. Physics, specialization in Fundamental Physics — Sept. 2010 - June 2014

RESEARCH EXPERIENCE

Instituto de Física Teórica IFT-UAM/CSIC — Madrid, ES
Graduate Researcher — Mar. 2017 - Oct. 2021
Improve the search for new physics with machine learning and investigate the nature of Dark Matter.

- Developed unsupervised deep learning techniques for anomaly detection of new physics signals at the LHC, with focus on identifying the key features of the anomalous signal in high-dimensional spaces.
- Examined high-dimensional spaces to identify and prepare the key features for anomaly detection.
- Explored different model architectures, defined custom metrics and performed hyperparameter optimization for less-than-supervised models.
- Construction of mathematical models to explain the potential effects of Dark Matter in B-physics observables, focusing on the distinctive experimental signatures they would produce.

Lawrence Berkeley National Laboratory (LBNL) — Berkeley, US
Research Affiliate — Aug. 2019 - Oct. 2019

- Studied and further developed label-free learning methods to deploy less-than-supervised machine techniques directly on unlabeled data.

Institute for Particle Physics Phenomenology (IPPP) — Durham, UK
Research Affiliate — Jan. - Oct. 2016

- Investigated the properties of Dark Matter in the NMSSM, performing complex simulations to connect fundamental theories to observable experimental quantities.

Neumann Institute for Computing (NIC), DESY — Zeuthen, DE
Graduate Research Assistant — Sept. 2014 - July 2015

- Worked on Monte Carlo simulations and data analysis techniques for the numerical computation of meson masses in lattice QCD.

RESEARCH ACTIVITY

Publications

J. Collins, P. Martín-Ramiro, B. Nachman, and D. Shih, "*Comparing Weak- and Unsupervised Methods for Resonant Anomaly Detection*", article manuscript submitted for publication, [arXiv:2104.02092]

G. Kasieczka, B. Nachman, D. Shih, P. Martín-Ramiro et al., "*The LHC Olympics 2020: A Community Challenge for Anomaly Detection in High Energy Physics*", article manuscript submitted for publication, [arXiv: 2101.08320]

P. Martín-Ramiro and J. M. Moreno, "*Improving top quark pair reconstruction in the dilepton channel at future lepton colliders*", article manuscript submitted for publication, [arXiv: 2003.12320]

D. G. Cerdeno, A. Cheek, P. Martín-Ramiro, and J. M. Moreno, "*B anomalies and dark matter: a complex connection*", Eur. Phys. J. C, [arXiv: 1902.01789]

F. Domingo, J. S. Kim, V. Martín-Lozano, P. Martín-Ramiro, and R. Ruiz de Austri, "*Confronting the neutralino and chargino sector of the NMSSM to the multi-lepton searches at the LHC*", Phys. Rev. D, [arXiv:1812.05186]

Conference presentations

"*Comparing weak and unsupervised anomaly detection*". ML4Jets 2020 Workshop, United States, Jan. 2020.

"*Testing B physics anomalies at ATLAS and CMS*". X CPAN Days Workshop, Spain, Oct. 2018.

"*Constraining the electroweak sector of the NMSSM at the LHC*". IX CPAN Days Workshop, Spain, Oct. 2017.

Invited Talks

"*Comparing weak and unsupervised anomaly detection at the LHC*". Machine Learning Group Seminar, Universidad Autónoma de Madrid, Feb. 2020.

Referee

Reviewer at the 2020 NeurIPS workshop on Machine Learning and the Physical Sciences.

Schools

MCnet Summer School on Monte Carlo Event Generators for the Large Hadron Collider. Italy, July 2018.

Taller de Altas Energías (TAE). Spain, Sept. 2017.

SKILLS AND TECHNIQUES

Languages: native in Spanish and proficient in English.

Computing: Python, C, Bash, AWK.

Libraries: Keras, Scikit-learn, NumPy, SciPy, Matplotlib.

Interpersonal Skills: project management, leadership, effective communication, knowledge sharing.

Competences:

- Strive for quality in everything I do.
- A critical thinker with strong analytical skills.
- Enterprising, hardworking and eager to learn.
- Get on well with people at all levels, easily making good working relationships.

REFEREES

Dr. Benjamin Nachman
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