Juan C. Cardenas, Ph.D.

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Lomita, CA

Doctor of Physics and Applied Physics

Education

The University of Texas Arlington (UTA)

Doctor of Philosophy (PhD), Physics and Applied Physics — *July '19 - May '24*
Master of Science in Physics, Experimental High Energy Physics — *July '16 - July '19*

California State University Dominguez Hills (CSUDH)

Bachelors of Science, Physics, Minor in Mathematics — *Aug '11 - May '16*

Professional Skills

Programming Languages: Python, C++, Bash
Programming Tools : TensorFlow, HTCondor, Linux, Git, VSCode, Pandas, Seaborn, Matplotlib, SQL, Jupyter Notebook
Technical Skills: Statistical Analysis, Machine Learning, Data Visualization, Data Pipeline Development, Binary Classification, Public Speaking, Analog and digital electronics, Circuit building and prototyping

Work Experience

Post Doctoral Researcher in High Energy Physics, UTA — *May '24 - Present*

- Conducted statistical analysis for a charged Higgs search in the ATLAS experiment, including hypothesis testing, maximum likelihood fitting, and systematic uncertainty analysis. Parallelized data processing workflows, reducing computation time by 11x.
- Led a team of graduate and undergraduate researchers in the search for hypothetical heavy Higgs bosons, by using effective communication to coordinate software development and research methodologies.
- Made major contributions to the charged Higgs analysis paper and internal note by collaborating with a global team, responding to reviewer comments, and writing sections describing results and analysis methods.

Graduate Research Assistant, UTA / Software Developer, ATLAS TauWG CERN — *Aug '19 - May '24*

- Developed and deployed an array of Recurrent and Deepset-based binary classifiers to the ATLAS collaboration.
- Developed a Deepset-based deep neural network for tau particle identification, reducing training time by 3x on average.
- Developed an RNN for jet classification which performed with up to 2.5 times better background rejection than the previous network.
- Regularly collaborated with team members at CERN, and presented results at weekly meetings and workshops within ATLAS.
- Developed feature ranking software used by my team and other ATLAS members to remove extraneous training variables.
- Trained neural networks using SLURM and HTCondor at large-scale GPU clusters at CERN and UT Austin.
- Developed data conversion pipelines for training databases to ensure compatibility with algorithms.
- Brought Multi-GPU training methods to the TauID code base, decreasing training time from days to hours.

Classical Mechanics Lab Instructor, UTA — *Jun '16 - Aug '19*

- Taught various topics in classical mechanics (centripetal force etc.) in a lab setting to classes of 30 undergraduate students.
- Rewrote the classical mechanics signature assignments to improve students' understanding of topics.

Undergraduate Research Assistant in Nuclear Physics, CSUDH — *Aug '14 - Jun '16*

- Discovered the existence of a Lambda Hyperon Beam in the CLAS detector, located at Jefferson National Accelerator Facility.
- Constructed and maintained a 44-node computer cluster from recycled university computers using the ROCKS monitoring software.

Projects

Anomaly Detection for Credit Card Fraud Estimation [link]

- Performed a statistical analysis of open-source credit card transactions using Pandas and Seaborn to detect cases of fraud.
- Created an auto-encoder network in Pytorch to detect anomalous credit card activity and flag it as fraudulent.

Understanding infectious diseases in the state of California [link]

- Performed an analysis of open-source infectious disease data to understand infectious disease rates in California and draw actionable insights.

Creation of a 6-Node Computing Cluster

- Constructed a 6-node computing cluster managed with the SLURM batch system, using an NVIDIA Jetson-Nano as a head node.
- This cluster was used for parallel job submissions, Blender simulations, and to manage GPIO projects and video hardware remotely.

Monte Carlo Simulation of the solid and liquid argon [link]

- Modeled the electromagnetic forces between Argon atoms to create simulations of solid and liquid argon using Visual Python.

Awards & Collaborative Achievements

Maverick Science Graduate Research Fellowship, UTA *Fall '22 - Fall '23*

- This fellowship acknowledges the recipient's outstanding accomplishments as a Ph.D. candidate and their potential for a successful research career.

President of the Physics Graduate Student Association (PGSA), UTA *Aug '20 - Aug '21*

- Collaborated with UTA administration and the physics department leadership to increase the Graduate Teaching (GTA) and Research Assistant (GRA) monthly stipend, bring writing tablets to GTAs allowing them to teach more effectively throughout the COVID-19 pandemic, and to create written guidance on how graduate students should best prepare for their comprehensive examination.

Department of Energy INFN Summer Fellowship, The University of Bologna *Summer of '19*

This is a fellowship awarded by the US Department of Energy (DOE) and the Istituto Nazionale di Fisica Nucleare of Italy (INFN) to 11 young research scientists to conduct research in Particle Physics at one of the 21 INFN sites in Italy.

Publications

Search for charged Higgs bosons produced in top-quark decays or in association with top quarks and decaying via $H^{\pm} \to \tau\nu$ in 13 TeV pp collisions with the ATLAS detector
Physical Review D (Expected), https://arxiv.org/abs/2412.17584

Tau Leptons In The Search For Charged Higgs Bosons *May '24*
MavMatrix, Ph.D. Dissertation, https://mavmatrix.uta.edu/physics_dissertations/3/

Reconstruction, Identification, and Calibration of hadronically decaying tau leptons with the ATLAS detector for the LHC Run 3 and reprocessed Run 2 data *May '22*
ATL-COM-PHYS-2022-370, CERN Document Server, https://cds.cern.ch/record/2827111?ln=en

Additional Skills

Languages: English (Native), Spanish (Intermediate), French (Elementary), Italian (Elementary)
Interests: Language learning, Computer Networking, Computer Cluster Building, Network Security, Bash Scripting, 3D rendering, Parallel Computing, Raspberry Pi software projects