Daniel Gaytan-Villarreal

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Education

Carnegie Mellon University 2023 – Present
Doctor of Philosophy, Physics *Pittsburgh, PA*

- **Relevant Coursework:** 10-701 Introduction to Machine Learning, 33-765 Statistical Mechanics
- **Activities:** STEM Teaching Assistant, Mentoring Undergrads for Research Projects

University of Sonora 2017-2021
Bachelor of Science, Physics *Hermosillo, Mexico*

- **Relevant Coursework:** Machine Learning, Probability and Statistics, Computational Physics

Research & Professional Experience

CMU Experimental Particle Physics Group August 2023 – Present
Graduate Research Assistant *Pittsburgh, PA*

- Development of Graph Neural Networks (GNN) for the reconstruction of particles in the Compact Muon Solenoid (CMS) experiment High Granularity Calorimeter (HGCal) at CERN.
- Design and training of Machine Learning (ML) models for Dark Matter (DM) searches at CERN's Large Hadron Collider (LHC).

CERN July 2024
Research Assistant *Geneva, Switzerland*

- Collaborated with an international research team on a physics analysis to measure the top quark mass using the latest data from CERN's LHC, resulting in a **field-leading** precision result.
- Awarded **1st place** out of 12 teams for the Best Physics Analysis Project.

Fermi National Laboratory May 2024 – August 2024
Research Assistant *Batavia, IL*

- Directed the development of physical metrics through data analysis & data science applied with Python & C++ to measure the effectiveness of a GNN to simulate a particle detector.
- Led training efforts of a GNN that resulted in an energy resolution performance increase of **25%.**

Deloitte April 2022 - July 2023
Artificial Intelligence & Data Consultant *Mexico City, Mexico*

- Provided insights to stakeholders through data analysis and data science that led to an improvement in understanding of consumer behavior.
- Migrated SQL queries from Google Cloud to Azure that led to an improvement of **31%** in performance.
- Designed & trained ML models for classification problems that resulted in better understanding of consumer patterns.

Selected Projects & Publications

Search for DM Particles through ML — *CERN* In Process of Publication

- Applied ML and statistical methods for DM signal detection.

GNN for Particle Reconstruction — *Fermi National Laboratory* In Process of Publication

- Design and training of a GNN for particle reconstruction at CERN's HGCal.
- Developed physics metrics for algorithm performance evaluation and benchmarking.

Scholarships, Grants & Awards

Summer 2024 LHC Physics Center Guests & Visitors Program May - August 2024
Fermi National Laboratory *Batavia, IL*

- Monetary research grant for CMS scientists that collaborate with other LHC Physics Center users on projects that advance, enrich, & impact the interests of the CMS experiment from a hardware and/or software perspective.

XVII Read Science for All 2020/2021 May 2022
Economic Culture Fund *Mexico City, Mexico*

- Honorable Mention granted in the essay category for the work titled *The ambivalent ignorance in the arts and sciences*; national writing competition to promote the vocation for science and technology among Mexico's youth.

CONACyT Research Grant July - December 2021
National Commission for Science and Technology *Mexico City, Mexico*

- Monetary research grant for collaborating in the research project *Study of heavy quark production in high multiplicity pp and pPb collisions in the CMS experiment at the LHC*, led by Phd Lizardo Valencia at the University of Sonora.

Telmex-Telcel Foundation Scholarship August 2017 – December 2021
Telmex-Telcel Foundation *Mexico City, Mexico*

- Financial and equipment aid for outstanding Mexican undergraduate students

Schools, Workshops & Certifications

CMS Machine Learning Hackathon July 2024
Fermi National Laboratory *Batavia, IL*

- Machine Learning Hackathon held by Compact Muon Solenoid (CMS) experiment scientists aimed to design robust and interpretable machine learning algorithms for anomaly detection, as well as provide fast, resource efficient & highly automated tools for data monitoring and validation.

CMS Data Analysis Schoool June 2024
European Organization for Nuclear Research (CERN) *Geneva, Switzerland*

- Data Analysis School held by Compact Muon Solenoid (CMS) scientists designed to help CMS physicists from across the collaboration to learn about CMS data analysis and enable them to participate in significant ways in any physics analysis, including cutting-edge measurements and future discoveries; awarded Best Analysis for Best Student-led Analysis

Leadership & Scientific Outreach

Scientific Childhood Day 2022 October 2022
Department of Physics, University of Sonora *Hermosillo, Mexico*

- Scientific outreach event aimed to promote and inspire scientific curiosity on children; presented and explained a variety of physics experiments to elementary school children

Data Science Applications in Particle Physics May 2022
IX Sonora State Congress of Natural and Exact Sciences *Hermosillo, Mexico*

- Scientific outreach presentation about the various data science applications in experimental HEP to undergrads of the University of Sonora and the general public

Skills & Interests

Programming Languages: Python, R, SQL, C++, Apache Spark, Octave, Mathematica, FORTRAN90
Frameworks: Pandas, NumPy, PyTorch, Scikit-learn, TensorFlow, Git, Bash, Apptainer, Singularity
Data Visualization: Jupyter Notebooks, Google Colab, Microsoft Power BI, Tableau
Cloud Platforms: AWS, Databricks, Snowflake, Google Cloud
Spoken Languages: Spanish, French
Interests: Literature, creative writing, boxing, weight lifting