Lucas Flores

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Particle physics PhD with 6+ years of experience analyzing big data sets from a fundamental physics experiment utilizing Python, C++, distributed computing, data visualization, statistical analysis, and Git. Eager to bring a first principles approach, project ownership experience, and an analytical and mathematical mindset to a challenging Data Scientist/Machine Learning Engineer role.

EXPERIENCE

Research Assistant/Physicist, *University of Pennsylvania, Philadelphia, PA* JUL 2015 – DEC 2021
CERN, Geneva, Switzerland

- Investigated petabytes of proton-proton collision data produced by the Large Hadron Collider in search of theorized subatomic particles, furthering the knowledge of fundamental physics
  - Researched, constructed, optimized and implemented two new features used to form control, validation, and signal regions for robust statistical hypothesis tests
  - Built, maintained and documented Python/YAML based git framework for the preservation, re-usability and reinterpretation of a physics analysis
    * Restructured, simplified, upgraded with git submodules and integrated via Docker the analysis into the preservation framework's CI pipeline
  - Processed big data sets utilizing the LHC Computing Grid (AWS analogue), a powerful distributed computing resource, and distributed computing software HTCondor (TORQUE/SLURM analogue), RUCIO (Hadoop analogue), and PanDA (Airflow analogue)
  - Set exclusion limits at a 95% confidence level over a large parameter space scan for the existence of new fundamental particles via a profile likelihood ratio fit
  - Computed experimental acceptance rates for 42 independent particle decay channels over a large parameter scan and compiled values into striking visualizations
  - Created two Python/BASH based internal tools for automating common procedures for creating visualizations and preserving/collating analysis results
  - Presented technical methods and results to the physics community at two international conferences
- Performed model tuning, software development and new user onboarding/mentorship in an expert level role in a major performance division within the collaboration
  - Maintained, developed and documented the Python/C++ based electron identification analysis framework
  - Instructed, mentored and guided four new technical users and developers of the framework
  - Re-optimized 108 independent multivariate likelihood models designed to identify electrons, AKA "the electron likelihood (LH)." This is integrated in nearly every analysis in the 5000+ member collaboration
    * Trained models on a 20% larger, most current, and most representative data set
    * Tuned 324 selection parameters (3 per model), achieving targeted precision/recall benchmarks
    * Transitioned training models from a 25% simulated 75% real data hybrid to 100% real data
  - Investigated a new metric for tuning the *electron LH* to retain desired signal and background rates for different particle detector environments
  - Re-tuned *electron LH* parameter that created a gain in signal rate in 50% busier detector environments

SELECTED PROJECTS

PermaLost — github.com/lucasflores/PermaLost ↗ JUL 2022
- Engineered predictive permafrost loss tool in application to vulnerable "soft" artifact decay in Greenland using Python, pandas, scikit-learn, and matplotlib

The Large Google Maps Collider — lucasflores.com/blogfolio/LGMC/ ↗ APR 2020
- Animated an educational illustration of the LHC within google maps using JavaScript and Google Maps Platform API

cryptoino — lucasflores.com/blogfolio/cryptoino/ ↗ JAN 2017
- In identifying need for secure IoT devices, Implemented Tree Parity Machine neural nets into a lightweight symmetric key exchange protocol between two Arduinos in Python/C#

eyeHUD — lucasflores.com/blogfolio/eyeHUD/ ↗ SEP 2016
- Built an eye-tracking transparent window 'smart heads-up display' out of a deconstructed monitor, two webcams and Python/OpenCV

EDUCATION

AUG 2015 – DEC 2021	**PhD & MS** – Particle Physics	*University of Pennsylvania, Philadelphia, PA*
SEP 2010 – JUN 2015	**BS** – Physics & Applied Mathematics	*UC Riverside, Riverside. CA*

- Awards: MARC U STAR Scholar Fellowship, Robert T. Poe Memorial Scholarship for Outstanding Bachelor of Science Graduate, Benjamin C. Shen Memorial Undergraduate Scholarship for Outstanding Academic Achievement

SKILLS

LANGUAGES:	Python, C++, BASH, SQL, HTML, CSS, YAML, JavaScript
SOFTWARE/TOOLS:	UNIX, Git, CI, LaTeX, matplotlib, scikit-learn, pandas, Docker, HTCondor, NumPy
OTHER SKILLS:	Hypothesis testing, statistics, machine learning, regression analysis, data visualization, JIRA, Jupyter, web design, scraping