Lucas Flores

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SKILLS

	(*Proficient*)	(*Good*)	(*Basic*)
LANGUAGES:	C++, Python, Bash	SQL, HTML, CSS	YAML, JavaScript
SOFTWARE/TOOLS:	UNIX, Git, CI, LaTeX	matplotlib, scikit-learn, pandas, Docker	scipy, NumPy
OTHER:	Hypothesis testing, statistics, machine learning, regression analysis, data visualization, scraping, JIRA, GitHub, HTCondor, Google Colab, Jupyter, Web design		

EXPERIENCE

JULY 2015 – DEC. 2021   **Research Assistant**   *University of Pennsylvania,*   *Philadelphia, PA*
CERN,   *Geneva, Switzerland*

Responsible for designing and implementing control and validation regions in a particle physics analysis using $7\times$ the data as the previous most analogous analysis iteration. Developed a framework for the preservation, re-usability, and reinterpretation of this analysis using git, Continuous Integration (CI), Docker images, and workflows. Gave weekly reports to audiences of varying expertise within the ATLAS collaboration.

- Investigated petabytes of proton-proton collision data ($\approx$13.9 million billion collisions) produced by the Large Hadron Collider (LHC) with the ATLAS detector in a search for theorized subatomic particles, furthering our knowledge of fundamental physics.
- Utilized the Worldwide LHC Computing Grid, a powerful distributed computing resource, and HTCondor (distributed parallelization software) enabled dedicated computing clusters to process big data sets.
- Developed C++/Python framework to clean, analyze, transform, and visualize data.
- Engineered new features to optimize selections for control, validation, and signal regions.
- Set exclusion limits at a 95% confidence level (exclude for $p<0.05$) for the existence of new fundamental particles via a profile likelihood ratio fit.
- Presented results to the broader physics community at two international conferences.

Served as a software expert for the "electron-photon" performance group, a major working group within the ATLAS collaboration tasked with measuring the properties of electrons/photons that emerge from the proton collisions. Responsible for maintaining and developing the electron identification analysis framework (Python/C++). Responsible for re-optimization of a data-driven multivariate likelihood based electron identification algorithm, the *electron likelihood*, used in nearly all analyses on ATLAS (over 5000 members).

- Transitioned the electron likelihood from being trained on a hybrid of simulated and real data to a fully real data driven algorithm.
- Re-optimized the electron likelihood by utilizing all newly available *high-energy* data that was collected.
- Investigated a new metric for tuning the algorithm to retain desired signal and background rates for different detector environments, i.e. the detector can see anywhere from 1 to 80 "simultaneous" collisions.
- Validated the electron likelihood after a major upgrade of software that produces its lower level inputs (i.e. an "electron reconstruction" object that gets fed into the electron identification).
- Ported framework from RootCore (deprecated physicist built package build manager) to CMake and migrated framework from longstanding version control software SVN, to gitlab.
- Mentored new framework users/developers. Hands on help and served as expert contact.

PROJECTS

2022   [Project] – ***"PermaLost"*** – Predictive permafrost loss tool in application to the vulnerability of "soft" artifacts to rot and decay in Greenland due to climate change induced warming. Built with pandas, geopandas, matplotlib, scikit-learn, and skforecast. Identifying list of localities with greatest rate in permafrost reduction. github.com/lucasflores/PermaLost

2017   [Project] – ***"cryptoino"*** @ PennApps XV Hackathon – Lightweight symmetric key exchange via Tree Parity Machine (TPM) neural nets. Targeted small insecure Internet of Things devices. Semi-final qualifier. Contributed to arduino/C# code development and sole creator of the TPM synchronization visualization, blog post: lucasflores.com/blogfolio/cryptoino/

2016   [Project] – ***"eyeHUD"*** @ PennApps XIV Hackathon – Smart eye-tracking transparent window 'heads-up' display. Responsible for developing the calibration/training method for transform factors for the 3 different 'pixel' spaces (2 webcams and LCD). **Third place overall** and *"Best Public Safety or Video Processing App."*, blog post: lucasflores.com/blogfolio/eyeHUD/

EDUCATION

AUG. 2015 – DEC. 2021	**PhD/MS** – Particle Physics	*University of Pennsylvania, Philadelphia, PA*
SEPT. 2010 – JUNE 2015	**BS** – Physics & Applied Math.	*UC Riverside, Riverside. CA*