Jonathan Guiang

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Skills

- **Languages:** Python, C++, Javascript, Matlab
- **Technologies:** PyTorch, Tensorflow, Keras, XGBoost, Pandas, Numpy, Docker, Kubernetes, React, JQuery, Flask, FastAPI, Spark SQL, HTML, CSS, PHP, LaTeX, Mathematica, Git, OpenSCAD, ROOT, Slurm, Hadoop, HTCondor

Education

University of California, San Diego — San Diego, CA
PhD in Physics, MS in Physics — *2019 - Present*

University of California, Santa Barbara — Santa Barbara, CA
BS in Physics — *2015 - 2019*

Professional Development

- SREB Institute on Teaching and Mentoring. Tampa, FL, Oct. 2023
- SLAC Summer Institute: Machine Learning Across the Frontiers. Stanford, CA, Aug. 2023

Experience

Würthwein-Yagil Group — San Diego, CA
Graduate Student Researcher — *2020 - Present*

- **Leadership and communication**
  - Collaborated with colleagues around the world and across disciplines.
  - **Led 6 undergraduates and 3 high school students** on several projects.
  - Presented work at 4 international conferences with published proceedings.
- **VBS Higgs analyses**
  - Performed multiple published statistical analyses searching for anomalous Higgs boson production using **boosted decision trees and deep neural networks.**
  - Created C++ framework to process petabytes of particle collision data.
  - Leveraged Python-based data science tools to turn processed data into insights.
- **Particle tracking machine learning**
  - Designed high-throughput, high-efficiency **deep neural networks and graph neural networks** for resolving particle trajectories (“tracks”) out of massive point clouds.
  - Implemented the entire ML pipeline with PyTorch, showed improved performance, then successfully incorporated ML into a **highly parallelizable C++ algorithm.**
- **US-CMS Tier 2 Data Manager**
  - Managed operations for 3 petabytes of particle collision data stored at the UCSD “Tier 2” computing facility which **services thousands of scientists.**
  - Wrote scripts to orchestrate the bulk migration of this data to a new system.
- **Rucio-SENSE interoperation**
  - Wrote keystone software in Python for incorporating **smart networking** capabilities (SENSE) into the data-management software (Rucio) used at the LHC.
  - Deployed project testbed via Kubernetes.
- **XRootD HTTPS benchmarking**
  - Helped benchmark XRootD file-transfer performance when using HTTPS and showed that it can reach the 500 Gb/s needed for **exascale science.**

Google Summer of Code — San Diego, CA
Student Developer — *Summer 2019*

- **CMS data access**
  - Characterized the access patterns of particle collision data caches in the US.

Campagnari Group Santa Barbara, CA
Undergraduate Student Researcher *2016 - 2019*

- **Rare Higgs decay analysis**
  - Measured the rates of rare Higgs boson decays where anomalous rates would provide evidence for new physics.
- **MIP Timing Detector (MTD)**
  - Developed a tunable OpenSCAD 3D model of the MTD for optimizing its design, cost, and efficiency.
- **AutoDQM**
  - Designed and implemented a Python-based tool that uses **autoencoders alongside traditional statistical tests** to improve data quality management at CMS.
  - Developed an intuitive, React-based frontend used by hundreds of CMS scientists.
- **MilliQan**
  - Characterized the single-photoelectron (SPE) response of photomultiplier tubes used in the "MilliQan" experiment demonstrator.
  - Developed software for simulating SPE responses.

Other Projects

- **RAPIDO** [github]
  - Created a C++ framework for performing LHC data analysis.
- **NBC 7 Investigates** [article]
  - Analyzed police employment data for the entire state of California for an *NBC 7 Investigates* article reporting on the outflux of San Diego police officers.
- **Radiology ML** [github]
  - Completed preliminary work towards developing 3D convolutional neural networks for analyzing CT scans of Covid-19 pneumonia and lung cancer towards clinical utility in collaboration with UCSD radiologists.
- **Integratable** [github][website]
  - Implemented an interactive integral table that evaluates known definite integrals and plots solutions all on a custom React-based frontend.
- **Personal website** [github][website]
  - Built a simple website built using React and deployed on github pages.
  - Used Font Awesome/Bootstrap assets and react-pose animations.
- **ChompChap** [github][website]
  - Designed an application that provides intelligent, individualized restaurant suggestions.
  - Developed during SB Hacks V, where it was selected as one of the top six projects.

Community

- **EXPAND Co-founder/Coordinator** [website]
  - Co-founded a novel fusion of a mentorship program and undergrad research experience targeted specifically at students with little-to-no prior experience.
  - Grew program from inception to being one of the UCSD Student Success Center's main programs that has since helped dozens of students start successful careers.
- **ENLACE Mentor** [website]
  - Mentored two high school students (2022) and two undergrads (2023) from Mexico.
  - Program aims to encourage greater participation in science/engineering research.
- **Physics Graduate Council Representative**
  - Served as a 2020-21 volunteer representative.
  - Worked with PGC chairpersons to better organize an ongoing graduate student diversity initiative, and sat on the Physics Department Climate Committee.

Mentorship

- **Alejandro Dennis Hernandez:** ML for particle tracking (ENLACE 2023-24)
- **Abraham Flores Azcona:** ML for particle tracking (ENLACE 2023-24)
- **Yuntong (Joy) Zhou:** VBS VVH analysis (2022-23) → *now at Carnegie Mellon*
- **Diego Tristan Flores King:** Rucio-SENSE simulation (ENLACE 2021-22)
- **Victor Vázquez Espinoza:** Rucio-SENSE simulation (ENLACE 2021-22) → *now at UPenn*
- **Henry Timmerman:** Rucio-SENSE simulation (Summer, 2021-22) → *now at UChicago*
- **Daniela Garcia:** Characterizing NanoAOD read latency (EXPAND 2020-21)
- **David Rovira:** Characterizing NanoAOD read latency (EXPAND 2020-21)
- **Aashay Arora:** VBS VVH analysis (2020-21) → *now at UCSD*

Teaching

- **PHYS 12:** TA for non-major course on energy and the environment. (Winter, 2019-20)
- **PHYS 1AL:** TA for introductory mechanics laboratory. (Fall, 2019-20)

Honors and Awards

- Alfred P. Sloan Minority Ph.D. Scholar (2019)
- UCSB Research Excellence Award (2019)
- UCSB Distinction in the Major (2019)
- UCSB Highest Academic Honors (2019)

Publications

- Aashay Arora, Jonathan Guiang, Diego Davila, Frank Würthwein, Justas Balcas, & Harvey Newman (2023). 400Gbps benchmark of XRootD HTTP-TPC. In *26th International Conference on Computing in High Energy & Nuclear Physics*. arXiv:2312.1258.
- Würthwein, F., Guiang, J. et al. (2022). Managed Network Services for Exascale Data Movement Across Large Global Scientific Collaborations. In *2022 4th Annual Workshop on Extreme-scale Experiment-in-the-Loop Computing* (pp. 16-19). IEEE Computer Society.
- Guiang, J. et al. (2022). Integrating End-to-End Exascale SDN into the LHC Data Distribution Cyberinfrastructure. In *Practice and Experience in Advanced Research Computing*. Association for Computing Machinery.
- Fajardo, E., …, J. Guiang et al. (2020). Moving the California distributed CMS XCache from bare metal into containers using Kubernetes*. EPJ Web Conf., 245, 04042.*
- Ball, A., …, J. Guiang et al. (2020). Search for millicharged particles in proton-proton collisions at $\sqrt{s}$ = 13 TeV*. Physical Review D, 102(3).*

Presentations

- *Improving tracking algorithms with ML: a case for Line Segment Tracking*, Connecting the Dots. Toulouse, FR, October 2023.
- *Search for Anomalous Higgs Boson Couplings in the Production of WH via Vector Boson Scattering*, APS April Meeting. Minneapolis, MN, April 2023.
- *Managed Network Services for Exascale Data Movement across Large Global Scientific Collaborations*, The 4th Annual XLOOP Workshop (Supercomputing 2022). Dallas, TX, November 2022.
- *Integrating End-to-End Exascale SDN into the LHC Data Distribution Cyberinfrastructure*, Practice and Experience in Advanced Research Computing. Boston, MA, July 2022.
- *Testing the Standard Model at the LHC and Pioneering Cyberinfrastructure at the Exascale*, UCSD Lab Expo. UC San Diego, La Jolla, CA, January 2022.