Cheng-Han Wu

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Summary

With extensive practical experience in big data processing and statistical analysis, particularly through participation in the Large Hadron Collider (LHC) experiment, I have utilized machine learning to improve object identification and the precision of particle reconstruction. Additionally, through international experiments, I have honed my abilities in communication and problem-solving. Thanks to these experiences, I am adept at managing complex big data systems and tackling challenging and technical tasks effectively.

Education

08.2020 - 06.2023 Master's degree in **Physics** at **National Central University**
08.2016 - 06.2020 Bachelor's degree in **Physics** at **National Central University**

Skills

Programming languages	C/C++, Python, Shell scripts
Machine learning	XGBoost, Keras TensorFlow, scikit-learn, TMVA, Optuna
Environment management	Docker, Conda
Resource management	HTCondor, SLURM

Work Experience and Projects

Research assistant - Center for High Energy and High Field Physics (CHiP) 07.2023 - 11.2023

- Performed the statistical analysis on searching the rare Higgs Dalitz decay.
- Gave the estimation of the expected significance deviated from the prediction of the Standard Model under the 95% confidence level.
- Led several analysis groups, including National Central University, Northwestern University, etc. to integrate our findings and synchronize efforts, ensuring the reliability of the results.

Master thesis 08.2020 - 06.2023

- Search for a Higgs boson decaying into $\gamma^*\gamma \to ee\gamma$ with low dilepton mass in pp collisions at $\sqrt{13} = 13$ TeV
- Constructed the statistical analysis framework using C++, adding parallel computing to reduce data processing time significantly. Its user-friendly and easily modifiable features also enable subsequent analysts to utilize the framework more effectively.
- Trained a particle identification model, achieving up to 95% of background rejection while maintaining a 90% signal efficiency.
- Developed a dedicated energy calibration involving energy regression and residual correction, resulting in an enhancement of energy resolution by nearly 40%.

Undergraduate project (High energy physics) 08.2019 - 06.2020

- Efficiency measurements of electron veto in the e photon identification for the CMS detector.
- Established the method to estimate both statistical and systematic uncertainties of efficiency, which was endorsed by CMS statistical experts.
- The measurement was included in CMS EGM-17-001 paper and published in JINST.

Undergraduate project (Statistical physics) 08.2017 - 06.2018

- The fluctuation theorem with pachinko-like setup.
- Constructed a simple mechanical setup with a one-particle, and chaotic system to verify the Fluctuation theorem, which is regarded as a generalization of the second law of thermodynamics.
- Used Python to develop a simulation employing the Runge-Kutta method to validate the experiment.

Extracurricular Activities

Teaching Assistant of the Workshop for NSTCCore & HEP Computing Service 11.2023

- Demonstrated how to leverage the computing resources available at Academia Sinica for distributed data processing.
- Illustrated the integration of HTCondor and the computing tool developed by CERN (European Organization for Nuclear Research Organisation) utilizing both C++ and Python.

Asia-Europe-Pacific School of High-Energy Physics 10.2022

- In the competitive arena of postdoctoral and doctoral students worldwide, my master's research achievements were recognized by reviewers.
- Communicated fluently in English with peers from various countries, effectively presenting my research in the Poster session.

Teaching Assistant of Experimental Methods and Experimental Physics 08.2019 - 08.2022

- Constructed the data analysis procedure and Python scripts for fitting, making histograms, and error propagation used in this course.
- Instructed students on the Linux system using Raspberry Pi, which is used to control various modules through Python scripts to conduct measurements.
- Instructed students in making comprehensive experimental reports and delivering presentations.

Teaching Assistant/Groups curator of One-Day-HEP school

- Provided a concise overview of several fundamental particles within the Standard Model (SM).
- Directed students to calculate momentum and invariant mass of Z boson in the process $Z \to \mu\mu$ with real events collected by CMS detector.
- Cloud chamber DIY

Awards

Postgraduates Student Thesis Award from the Physical Society of Taiwan 2023

110 FOCI Scholarship

2023 Annual Meeting of the Physical Society of Taiwan - selected to give the oral presentation

Publication

Sirunyan, A.M. et al. (May 2021). "Electron and photon reconstruction and identification with the CMS experiment at the CERN LHC". In: *Journal of Instrumentation* 16.05, P05014. ISSN: 1748-0221. DOI: 10.1088/1748-0221/16/05/p05014. URL: http://dx.doi.org/10.1088/1748-0221/16/05/P05014.

Referee

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