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(Relocation Flexible)

Yi Fei Han

Physicist / Data Scientist

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SKILLS

Tools and Languages	C++, Python, Git, \LaTeX , Valgrind
Distributed Computing	HTCondor, Linux, Rucio, AWS, Docker
Quantitative Research	Probability Modelling, ROOT, ROOFIT
Communication	English (native), Chinese (native), Japanese (fluent)

TECHNICAL EXPERIENCE

Researcher - Data Analysis

Sept 2017 —

ATLAS Experiment | CERN

Toronto, Canada

ATLAS is a general-purpose particle physics experiment at the Large Hadron Collider at CERN designed to answer questions about the fundamental forces of nature. As of 2022, it has over 5000 collaborating members from 181 institutions in 42 countries.

- Analysis goal was to reject the background only likelihood model at 99.99994% confidence level, and to set limits on the strength of alternative signal likelihood models.
- Calibrate data objects to correct for biases and errors introduced in the data-taking process,
- Applied cuts to datasets according to the underlying physics to define phase spaces where the desired signal is enhanced, and
- Corrected for mis-modelling in physics simulation with data-driven methods.
Software used include C++, python, Git, and ROOT (similar to R).
- Skimmed data sets for final analysis use over distributed computing resources, from 1000+ TB to less than 10 GB.
Software used include the LHC computing grid (similar to AWS) and rucio (a scientific data management tool).
- Trained and used recursive neural networks as the final discriminant for signal separation, and
- Optimized NNs with feature engineering by constructing high-level variables and removing poorly modelled low-level variables.
- Performed likelihood maximization on a probability model with 3 observed data sets and 100+ nuisance parameters.
- Personally developed the software framework to apply cuts to datasets, took over dataset production over distributed computing tools, and lead the development of the statistical tools,
- Lead efforts to improve data uncertainties which improved the expected statistical significance from 99.4% to over 99.9999999% (4σ to 6.5σ), a factor of over 1,000,000.
- Resolved a conflict in the probability model by identifying mis-modelling in NN inputs due to data calibration, and moved the team towards publication.
- Documented and edited over 500 pages of notes for internal use.

Developer - Detector Simulation

Aug 2017 – Sept 2021

ATLAS Experiment | CERN

Toronto, Canada

- Used multi-thread physics engines to simulate detector response to charged particles,
- Built interface between in-house software framework and third-party physics libraries, and
- Optimized physics simulation time with a library of pre-processed detector responses as a function of input parameters.
Software used include C++, python, Docker, and Git CI/CD.
- Validated physics simulation accuracy for each detector component by comparing a high- and low-level output variables.
- Improved simulation time by a factor of 10, from 28.1s/event to 2.82s/event.

Teaching Assistant

Sept 2016 — Sept 2021

University of Toronto

Toronto, Canada

- Ran weekly tutorials and host office hours for undergraduate physics courses
- Graded lab reports, essays, assignments and exams, for classes of up to 150 students
- Topics taught include mechanics, electromagnetism, quantum mechanics, and relativity

EDUCATION

PhD in Physics, University of Toronto

2022

Bachelor of Science in Physics and Mathematics, University of California, Los Angeles

June 2016

SELECT PUBLICATIONS

As an ATLAS author, I have my name on every published ATLAS paper. I contributed significantly to these following publications:

ATLAS Collaboration, Measurement of fiducial and differential W^+W^- production cross-sections at $\sqrt{s} = 13$ TeV with the ATLAS detector. The European Physical Journal C, 79(10), Oct 2019. [arXiv:1905.04242\[hep-ex\]](https://arxiv.org/abs/1905.04242)

ATLAS Collaboration, Search for electroweak diboson production in association with a high-mass dijet system in semileptonic final states in pp collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector. Phys. Rev. D 100, 032007. [arXiv:1905.04242 \[hep-ex\]](https://arxiv.org/abs/1905.04242)

ATLAS Collaboration, The Fast Simulation Chain in the ATLAS experiment. EPJ Web Conf. 251 03012 (2021). DOI:

[10.1051/epjconf/202125103012](https://doi.org/10.1051/epjconf/202125103012)