

Tyler James Burch

DATA ANALYSIS, MACHINE LEARNING, BAYESIAN STATISTICS, PERFORMANCE COMPUTING

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Experience

Boston Red Sox

Boston, MA

SENIOR DATA ANALYST

January 2021 - Present

- Member of sports science arm of analytics department, leveraging 300 FPS markerless motion capture data to better understand batting.
- Built simulation to quantify batter timing and swing quality using physics and **XGBoost**. Outputs used in beta regression models fit with **brms** to create key performance indicators by which all batters are measured.
- Modernized several core models integral to day-to-day operations, notably integrating data from new data collection systems into batted ball outcome prediction model, considering the effect of batted ball spin rate on most likely outcome for the first time.

Argonne National Laboratory

Lemont, IL

POSTDOCTORAL APPOINTEE - PARTICLE PHYSICS SIMULATION WITH MACHINE LEARNING ON EXASCALE SUPERCOMPUTERS

May 2020 - Present

- Studied Bayesian uncertainty quantification methods in machine learning models used in particle physics object identification. Proof-of-concept Bayesian neural network and MC Dropout network fit using **PyTorch**.
- Adapting particle physics simulation software (**MadGraph**) to Intel's OneAPI for use on the first US exascale supercomputer.

Northern Illinois University

DeKalb, Illinois

GRADUATE RESEARCH ASSISTANT

May 2015 - March 2020

- Main analyzer on a team searching for a rare physics process in one of the world's largest datasets
 - Generated simulation of previously unstudied particle physics processes and detector effects using Monte Carlo techniques.
 - Employed an XGBoost multiclassifier to identify candidate signal events, ultimately improving projected significance by 10%.
- Studied highly granular detector signatures to classify those coming from photons, ultimately showing up to a 25% improvement in background rejection over previous methods. Primary lift found from adding new variables based the topology of detector response.
- Research mentor of 3 undergraduate physics students, instructor of two undergraduate general physics laboratory courses.

Skills

Programming Languages Python, Julia, R, C++, SQL

Libraries and Frameworks PyData Stack (Numpy, Pandas, Scikit-Learn, etc.), misc. modeling libraries (XGBoost, LightGBM, Torch, Keras, etc.), Probabilistic Programming Languages (PyMC, Stan)

Computing and software Git, SVN, \LaTeX , JIRA, VSCode, Emacs, Microsoft Office, Quarto

Education

Northern Illinois University

DeKalb, IL

DOCTOR OF PHILOSOPHY

August 2014 - March 2020

- **Thesis** - A search for resonant and non-resonant di-Higgs production in the $\gamma\gamma b\bar{b}$ channel using the ATLAS Detector
- **CERN (European Organization for Nuclear Research)**, Geneva, Switzerland — April 2017 - August 2018

Murray State University

Murray, KY

BACHELOR OF SCIENCE, CUM LAUDE - PHYSICS MAJOR, MATH AND MUSIC MINORS

August 2011 - May 2014

Awards

DOE Office of Science Graduate Student Research (SCGSR) Fellowship

Lemont, Illinois

PROPOSAL: UTILIZING MACHINE LEARNING CLASSIFIERS FOR PHOTON IDENTIFICATION

September 2018 - August 2019

Publications & Talks

Phenomenology Symposium (PHENO) 2019

University of Pittsburgh

ATLAS SEARCHES FOR VH/HH RESONANCES

Invited Talk - May 6, 2019

Search for Higgs boson pair production in the $\gamma\gamma b\bar{b}$ final state with 13 TeV pp collision data collected by the ATLAS experiment

J. HIGH ENERG. PHYS. (2018) 2018: 40.

Publication - November 7, 2018

Higgs Boson Pair Production at Colliders: Status and Perspective

REVIEWS IN PHYSICS, P. 100045.DOI:HTTPS://DOI.ORG/10.1016/J.REVIP.2020.100045.

White Paper - September 30, 2019

Sole author of Section 5.6: HH production in the VBF mode

400 publications as a member of the ATLAS Collaboration, January 2017 to February 2022.