Matthew Drnevich

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Education

PH.D. IN PHYSICS | ESTIMATED 2024 | NEW YORK UNIVERSITY, NEW YORK, NY

- Advisor: Kyle Cranmer
- Focus on machine learning applications in physics

BACHELOR OF SCIENCE | MAY 2019 | UNIVERSITY OF NOTRE DAME, NOTRE DAME, IN

- Majors: Honors Mathematics ● Physics with Honors
- Concentration: Advanced Physics
- Cum Laude
- GPA: 3.859
- Senior Thesis in Physics: "Identifying Top Quarks Decaying Hadronically with a Deep Neural Network"
- Senior Thesis in Mathematics: "Morse Theory and the Arnold Conjecture"

Honors

- Phi Beta Kappa Early Inductee (one of 12 from over 1000 candidates)
  - http://sites.nd.edu/pbk/2018/09/19/induction-ceremony-for-early-inductees-fall-2018/
- Sigma Pi Sigma Inductee
  - https://physics.nd.edu/news-events/news/2019-society-of-physics-students-induction/
- University of Notre Dame Sorin Scholar
  - http://cuse.nd.edu/sorin-scholars/
- University of Notre Dame SUMR alumnus
  - https://math.nd.edu/undergraduate/honors-math-sumr/
- University of Notre Dame, Department of Physics, Outstanding Undergraduate Research Award
  - https://physics.nd.edu/news-events/news/2019-undergraduate-student-awards-in-physics-announced/
- Dean's List Spring 2016, Spring 2017, Fall 2017, Spring 2018, and Fall 2018
- Awarded grant to attend "TRIPODS Summer Bootcamp: Topology and Machine Learning" (details below)

Experience

CERN (CMS) RESEARCHER | CERN, GENÈVE, CH | **JANUARY, 2018 – MAY, 2019**

- Utilized modern neural networks (stacked denoising autoencoders, multilayer perceptrons, convolutional networks, etc.) to better identify particles from top quarks decaying into triplets of hadrons in a proton-proton collision.
- Primary work is available here: https://github.com/mdkdrnevich/DeepHadTopTagger
- Developed code in Python using PyTorch, numpy, pandas, matplotlib, Jupyter, and others.

DATA SCIENCE AND MODERN VISUALIZATION INTERN | NASA GLENN RESEARCH CENTER, CLEVELAND, OH | **JUNE – AUGUST, 2017**

- My primary project was to work with two other interns on developing an extensible website that allows researchers to perform complex data analyses quickly and efficiently without the need to write their own code. This included the ability to process arbitrary data files, view graphs, perform statistical tests, fit machine learning models, and perform persistent homology analyses. My work involved developing all of the frontend and a few backend functions. To accomplish this, I primarily made use of Pandas, Numpy, Flask, Vue.js, Chart.js, and D3.js.
- Additionally, I worked in a collaboratively-minded lab with other machine learning engineers and data scientists. This allowed me to participate in and contribute to decisions regarding unsupervised clustering model building and hierarchical clustering algorithm design.

ALGORITHM CONSULTANT | LOOP SOFTWARE | MARCH, 2017 – DECEMBER, 2017

- Solved various algorithmic problems (~ 7) by finding efficient solutions that could be implemented in production code.
- I work on these problems in my spare time.

DATA INTENSIVE SCIENTIFIC COMPUTING REU | UNIVERSITY OF NOTRE DAME, NOTRE DAME, IN | **MAY – JULY, 2016**

- Explored using deep learning methods to improve physics data analysis on large computing clusters.
- Attended introductory classes to many aspects of computing with big data, such as Hadoop.
- Presented the final results in a poster and video viewable here: https://disc.crc.nd.edu/index.php/2016-disc-summer-reu.

UNDERGRADUATE RESEARCH | UNIVERSITY OF NOTRE DAME, NOTRE DAME, IN **| OCTOBER, 2015 – PRESENT**

- Collaborated with Prof. Lannon as well as the Computer Vision Research Lab on research associated with the CMS experiment at CERN.
- Utilized deep learning techniques for complex data analysis in Python with the keras, theano, and numpy libraries.
- Extended novel ideas using modern neural networks for high-energy particle physics research.
- Developed code on GitHub, see: https://github.com/mdkdrnevich

RESEARCH ENGINEER INTERN | NASA/LOCKHEED MARTIN, HOUSTON, TX **| JANUARY, 2014 – MAY, 2014**

- Studied solar physics and data analysis with the Space Radiation Analysis Group (SRAG) at NASA.
- Learned basic solar dynamics and its relation to the health of our astronauts aboard the International Space Station (ISS) and future missions.
- Calculated complex health analytics based upon radiation shielding distributions in the Destiny module of the ISS using a Computer Aided Design for the model and Perl, C, and Python with PyROOT for the data analysis.
- Programmed a Graphical User Interface as well as command-line interface using Python with PyROOT that facilitates radiation data analysis and presented the final product and analysis to the department.

Workshops/Seminars

ML4JETS | UNIVERSITY OF HEIDELBERG, HEIDELBERG, GERMANY | JULY, 2021

- Presented work on tuning parton shower model parameters using the marginal likelihood
- Showed that we can compute the exact marginal likelihood given a probabilistic parton shower model
- https://indico.cern.ch/event/980214/contributions/4413534/

ML4JETS | NEW YORK UNIVERSITY, NEW YORK, NY | JANUARY, 2020

- Presented work on a simplified normalizing flow inspired model for boosted jets
- https://indico.cern.ch/event/809820/contributions/3632661/

TRIPODS SUMMER BOOTCAMP: TOPOLOGY AND MACHINE LEARNING | ICERM, PROVIDENCE, RI | AUGUST 6-10, 2018

- Worked on generating vectorized topological data analysis methods for use in machine learning
- Attended a conference discussing some current research and applications at the intersection of topology and machine learning
- Further information, talks, and exercises available here: https://icerm.brown.edu/tripods/tri18-2-tml/

Skills & Abilities

COMPUTER

- Advanced in Python and various scientific libraries including PyTorch, keras, theano, numpy, PyROOT, Pandas, matplotlib, etc.
- Intermediate in Javascript and experience with Vue.js and D3.js
- Proficient in HTML and LaTeX
- Previous proficiency in Perl and Java
- Basic proficiency in C++
- Intermediate experience with UNIX based operating systems.
- Some experience with SQL and MongoDB databases.