# ANDREW CARNES

andrew.carnes(at)protonmail.com

EDUCATION

**PhD in Particle Physics - University of Florida** (May 2018)
- Cumulative GPA: 3.7/4.0

**Bachelor of Science in Physics - University of Florida** (Fall 2010)
- Physics GPA: 4.0/4.0
- Computer Science GPA: 4.0/4.0
- Cumulative GPA: 3.8/4.0
- Graduation with Honors (Cum Laude)

INDUSTRY
EXPERIENCE

**Senior Data Scientist at HCA HealthONE** (August 2018 to Present)
*Denver, CO*

- Built and implemented various Machine Learning [ML], NLP [NLP], and Classical [C] algorithms in Python to improve care and reduce cost

  - [ML] **AMISS**: detects present on admission septic shock in the emergency department in real time – reduced mean time to treatment by 100 minutes and reduced mortality by 15%

  - [C] **COVID-FORECAST**: models the spread of COVID-19 for continental division hospitals to determine required staff, beds, and ventilators for our hospitals – peak predictions accurate to within 25 COVID ICU patients for a 7 hospital system

  - [ML] **OSPRI**: flags patients at high risk for pressure injuries (bed sores) – reduced pressure injuries by 75%

  - [ML] **XRAI**: a Convolutional Neural Network (CNN) that identifies collapsed lungs in chest xrays as accurately as human radiologists

  - [C] **HAPI**: collaborative work that predicts in real time which patients will deteriorate and transfer to the ICU – reduced unplanned transfers by 20% and mortality by 10%

  - [C] **IO**: overturns insurance company denials to save over $5 million dollars every year

  - [NLP] **SCUBA**: reconciles supply chain spend data against written contracts to find unclaimed rebates – saves over $1.5 million per year

  - [NLP] **COVID-NLP**: identified over 1000 COVID positive patients who would have been misplaced in our hospitals

- Developed AI computing infrastructure with fast GPUs and solid state storage to facilitate imaging, NLP, and AI on large datasets
- Managed and upskilled a team of analysts to use Ubuntu and Python, learn NLP and machine learning, and automate their reports enabling them to improve hospice use by 35%, catch an extra 400 MRSA infections per year, recoup over $4 million per year in missed charges, and win and maintain the award for best large healthcare system according to IBM Watson Health
- Performed a variety of statistical analyses to determine the efficacy of different machine learning algorithms and medical strategies

RESEARCH
EXPERIENCE

**Particle Physics Research at the Large Hadron Collider (LHC) at CERN** (2012 - 2018)
*under Professors Paul Avery and Darin Acosta for the CMS Detector*

- Developed big data software performing state of the art statistical analyses on terabytes of distributed data to search for a unique decay of the Higgs boson (C++)
- Invented a machine learning algorithm to minimize the expected p-value of a scientific experiment (C++)

- Implemented the algorithm above to improve the search for the Higgs boson decaying to two muons by a factor of 1.3
- Developed the first machine learning based hardware trigger at CERN, reducing the rate of false positives in muon data by 3x
- Developed a Boosted Decision Tree (BDT) package from scratch and implemented it in hardware to run evaluations within 25ns, yielding the 3x improved trigger above (C++ → FPGA)
- Advanced CERN's machine learning software by parallelizing the BDTs and adding a variety of Loss Functions (C++)
- Invited speaker for the LHC's Inter-experimental Machine Learning Forum
- Speaker at the artificial intelligence and computing methods conference, ACAT, in Seattle, Washington (August 2017)

Papers

**Particle Physics Research at the Large Hadron Collider** (2012-2018)
*CMS Experiment*

- Boosted Decision Trees in the Level-1 Muon Endcap Trigger at CMS – https://cds.cern.ch/record/2290188
- Search for the standard model Higgs boson decaying into two muons in pp collisions at sqrt(s)=13TeV – https://cds.cern.ch/record/2292159

Teaching Experience

**Adjunct Professor at Denver University** (2020 and 2021)
*Health Informatics at Unversity College*

- Developed two courses for DU's Health Informatics curriculum
- HINF4230: Statistical Dynamics of Machine Learning
- HINF4210: Data Platforms in Healthcare

**Teaching Assistant at the Univeristy of Florida** (2011 - 2016)
*under Dr. Robert Deserio, Professor Pradeep Kumar, and Professor Darin Acosta*

- Physics 1 Lab: Led the experiments and graded lab assignments
- Physics 1 Discussion: Made lesson plans and quizzes, graded quizzes, lectured, and held office hours
- Physics 2 Discussion: Made lesson plans and quizzes, graded quizzes, lectured, and held office hours

Technical Skills

**Programming Languages:** C++, Python, Java, MATLAB

**Miscellaneous:** Quantum Field Theory, Statistical Mechanics, Differential Equations, Statistics, Calculus, Linear Algebra, Numpy, Sci-kit Learn, Pandas, Tensorflow and Pytorch (Neural Nets), Spark, ROOT, UNIX, Object Oriented Programming, git, Docker, Flask, nginx

Testimonials

"Andrew really knew what he was talking about and knew exactly how to relay the information. Even as a TA, he is one of the best teachers I have had."

"Always had huge supply of tricks and creative ways to approach seemingly difficult problems. Entertaining guy."

"He is EXCELLENT at explaining physics concepts. He's extremely smart and very funny and nice so he is my favourite TA in my science classes in three years at UF. He also listens to and asks us what we want him to change or improve on, so he's very open to suggestion from his students."

"His understanding of the course material and his ability to approach the material as a student helped me succeed in physics. Also, his selfless interest in physics helped. He would exemplify every concept with all types of crazy examples that he would explain very confidently and in a very step-wise manner. He is the smartest and most understanding physics teacher I've had. He taught better than the actual professors."