ANDREW CARNES

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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

- Created and implemented a machine learning algorithm called OSPRI to flag patients at high risk for pressure injuries (bed sores) – reduced pressure injuries at Swedish hospital by 75%
- Created and implemented a real-time machine learning algorithm called AMISS to detect present on admission septic shock – reduced the mean time to treatment by 100 minutes item Modeled the spread of COVID-19 for continental division hospitals to determine required staff, beds, and ventilators for our division hospitals – accurate to within 25 COVID ICU patients for a 7 hospital system
- Worked on and implemented a real-time algorithm called HAPI that predicts which patients will likely deteriorate and have an unexpected transfer to the ICU – reduced unplanned transfers by 20% and mortality by 10%
- Developed and implemented an NLP algorithm called SCUBA to reconcile supply chain spend data against written contracts to find unclaimed rebates – saves over $1.5 million per year for continental division
- Trained a convolutional neural network to identify pneumothorax (collapsed lungs) in chest xrays as accurately as human radiologists
- Developed COVID NLP to identify over 1000 COVID positive patients in real-time 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

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

- Invented a machine learning algorithm to minimize the expected p-value of a scientific experiment
- 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
- 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)

Quantum Turbulence Research at the Univeristy of Florida (Summer 2012)
under Professor Gary Ihas

- Measured the density of quantum vortices in liquid helium
- Coded analysis tools in Python to process the data collected from temperature and sound waves in liquid helium
- Created 3D models of the experimental apparatus and its parts in Solidworks, machined parts, and soldered circuits

Semiconductor Research at the University of Florida (2010)
under Professor Kevin Jones

- Programmed Boltzmann Theory of Electron Transport simulations in Java to predict the conductivity of different semiconductors
- Used various chemical techniques to create silicon nanowires to prototype the design of lithium batteries with longer lifetimes
- Performed Hall Effect experiments to determine the charge carriers in semiconductors
- Cut out transistor cross-sections with the Focused Ion Beam for Transmission Electron Microscope analysis in order to diagnose their failure

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 HINF4230: Statistical Dynamics of Machine Learning
- Developed 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 (2011). Led the experiments and graded lab assignments
- Physics 2 Discussion (2012). Made lesson plans and quizzes, graded quizzes, lectured, and held office hours
- Physics 1 Discussion (2016). Made lesson plans and quizzes, graded quizzes, lectured, and held office hours

Tutor at the University of Florida's Tutoring Center (2010)

- Tutored students three times a week in Physics, Calculus, and Differential Equations
- Gave televised lectures on Physics twice a week

Technical Skills

Programming Languages: C++ and Python,
some MATLAB and Java back in 2010

Miscellaneous: Machine Learning Development in C++ and Python, Web Development in Python, Quantum Field Theory, Statistical Mechanics, Differential Equations, Statistics, Linear Algebra, Numpy, Sci-kit Learn, Pandas, Keras (Neural Nets), Apache Spark, ROOT, UNIX, Object Oriented Programming, git, Docker, Flask, nginx

Honors and Awards

Graduated with honors (Cum Laude), DIANA Fellowship, Grinter Fellowship, IHEPA Fellowship, Presidential Scholar, Florida Opportunity Scholar, Florida Medallion Scholar, Dean's List

Relevant Coursework

Machine Learning, Data Structures and Algorithms, Quantum Field Theory, Linear Algebra, Differential Equations, Calculus, Statistical Mechanics

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."

"He brought humor into the class which definitely helps a lot. He explains questions well. He brought up new ways of looking at problems that can apply elsewhere other than just physics"

"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."

"Andrew was by far the best TA I've had in any subject at UF and am very thankful to him for helping me succeed in PHY 2048"