Arun Ravishankar

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About me

I am a Theoretical Physicist with programming experience in Python and Mathematica for numerical simulations, statistics and machine learning. I am looking forward to working on purposeful, interesting and challenging problems that have a widespread impact in our global community.

Education

PhD in Physics — Expected Fall. 2020

MS. in Physics — May 2019
University of Arizona, Tucson, AZ, USA

MSc (hons.). in Physics — May 2014
(with thesis at LMU, Munich, Germany)

B.Pharmacy (hons.)
Birla Institute of Technology & Science Pilani, India

Skills

Programming Languages & OS

Python, Wolfram Mathematica, R, LaTeX
Linux, MacOS, Windows

Packages and Platforms

Numpy, Scipy, Matplotlib, Scikit-Learn, Pandas, Keras, Tensorflow, Seaborn
Git, Jupyter

Data Science

Data Visualization, Machine Learning & Deep Learning, High Performance Computing

Awards & Achievements

- Identified and corrected an error in a long-standing result in the Digital Library of Mathematical Functions maintained by the National Institute of Standards and Technology.
- Invited as a guest speaker at Chennai Mathematical Institute and the Institute of Mathematical Sciences, Chennai, India, July 2019.
- Awarded scholarship to continue higher education in Physics for being placed 1st in nationwide Physics Talent Test, India, 2009.
- Awarded 3rd place in a nationwide Science quiz at university level at IISER Pune, India, 2012

Work Experience

University of Arizona, Physics Department

Tucson, AZ, USA
August '15 - Current

Graduate Research Associate

- Discovered an instability of a maximally charged black hole and investigated its connections to phase transitions at zero temperature. doi.org/10.1007/JHEP12(2018)087
- Identified the only known physical cause of the instability to be a class of null geodesics which has paved way for a deeper understanding of extremal black holes. doi.org/10.1007/JHEP05(2020)094
- Designed and ran simulations to compute Green functions to prove the above in Mathematica and Python on a supercomputer (El Gato) by parallel job scheduling with PBS scripts to investigate the instability.

Graduate Teaching Associate

- Created and taught a new online course for Freshman Engineering Mathematics and Physics.
- Led lab (~25 students/section) and discussion sessions (~150 students/section) for introductory physics courses and received overwhelmingly positive reviews from my students.

Fascination Based Learning

Munich, Germany
September '13 - July '14

Content Producer (Co-Founding Team)

- Was a part of the co-founding team of a startup to create a platform to aid fascination based learning by supplementing traditional online lectures (linear pedagogy) with subject-expert curated wiki (non-linear pedagogy) to keep the learner engaged.
- Produced pedagogical content on a host of wikis for various target audiences for the preliminary product based on lectures in cosmology by Prof. Roger Penrose.
- Coordinated with an interdisciplinary team of entrepreneurs, educationalists, researchers and philosophers to create the Minimal Viable Product (MVP).

Projects

arunravishankar.github.io

Simulating an Epidemic

May '20

- Built a mechanistic model (in Python) of people moving like gas molecules in a box and transmitting a disease to people in their proximity to simulate the spread of an epidemic.
- Expanded on the SIR model by introducing more categories to realistically model the phenomenon - Quarantined, Hospitalized, Hospitals full and Dead.
- Studied the effect of changing hospital capacity, the possibility of reinfection, adopting social distancing measures and the usage of personal protective equipment (PPE).
- Highlighted the importance of social distancing and the usage of PPEs in 'flattening the curve' using visualizations with Matplotlib and observed features like the occurrence of multiple waves of the outbreak, unseen by simpler models like the SIR model in a blog post.

Cancer Prediction

February '20 - March '20

- Cleaned and processed histology tiles (using Pandas) of Colorectal cancer patients where 8 different tissues were labelled.
- Used K-Means Clustering (using ScikitLearn) on the percentile intensity data to classify the different tissues. The clustering algorithm was only able to classify accurately 3 types of tissues.
- Used a multi-layer Convoluted Neural Network model (using Keras) with Convolution, Pooling and Fully-Connected layers to classify the histology tiles into the 8 different types of tissues and got an accuracy score of 86% and an ROC curve area of over 0.96 for all the classes.
- Cleaned and processed health records, and compared the performance of various classification algorithms to predict a patient's risk to cervical cancer - Naive Bayes, K-Nearest Neighbours, Decision Tree, Support Vector Machines and Random Forest.

Quantum Foundations and Computing

May '12 - July '14

- For my Master's thesis, I analyzed the problem of describing arrival time distributions in quantum physics in the context of POVMs and Bohmian mechanics.
- Worked on understanding the Peres-Horodecki separability criterion as a part of a reading project for a course on Quantum Information & Quantum Computing where I was also introduced to quantum algorithms and quantum error correction.