Siddharth Chaini

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Research Interests

Astroinformatics, Data Science in Astronomy, Time-Domain Astronomy, Machine Learning in Physics

Education

Indian Institute of Science Education Research, Bhopal — Bhopal, India
Integrated Bachelor and Master of Science in Physics, CPI - 8.68/10 — *2017 – 2022 (expected)*

HSC Maharashtra Board - 12th — Thane, India
Overall: 86.0%, Computer Science - 99% — *2017*

ICSE Board - 10th — Thane, India
Overall: 95.83%, Computer Applications - 100% — *2015*

Projects

Star - Galaxy - QSO Image Classification

Advisor: Prof. Ajit Kembhavi, IUCAA — *August 2020 – Present*

- Exploring the use of auto-encoders and deep convnets for the photometric classification of stars, galaxies and quasars across 5 channels
- Using regression as an intermediate step to predict photometric redshift of the sources to use as a parameter during training
- Working with galaxies having small angular sizes (as based on their half light radius and point spread function)
- Working on integrating deep networks with traditional machine learning algorithms
- Developed a program for automated FITS retrieval, stacking, centering and cropping of SDSS objects across 5 passbands

Time-Series Classification of LSST Photometric Data

Course Project for DSE 301: Artificial Intelligence and its Scientific Applications — *Feb. 2020 – June 2020*

- Worked on a solution for the PLAsTiCC Challenge
- Implemented an ensemble of deep learning models to classify the time series data of the astronomical object
- Stacked ensemble of GRU and Dense networks was trained on 7878 samples, and achieved an accuracy of 76.2% on a test set consisting of over 2.5 million samples
- Report: https://arxiv.org/abs/2006.12333
  Code Repository: https://github.com/siddharthchaini/Astronomical-Classification-PLASTICC

Thermodynamic Properties of Ice - A Monte Carlo Study

Course Project for PHY 312: Numerical Methods and Programming — *May 2020 – June 2020*

- Implemented a Monte Carlo algorithm to study thermodynamic properties of ice
- Computed the residual entropy of a two-dimensional lattice model of ice at various temperatures, and identified the phase transition
- Created a visualisation tool for the two-dimensional lattice
- Report: Click here
  Code Repository: https://github.com/siddharthchaini/ColdAsIce

Authorship Identification

Course Project for HSS 322: Computational Linguistics — *Nov. 2019*

- Implemented an algorithm to identify the author of an unknown text
- Analyzed the characteristic n-gram frequencies of the author works in the training set and then matched to the data in the test set, similar to K-nearest neigbours
- Report: Click here
  Code Repository: https://github.com/siddharthchaini/AuthID

Coupled Harmonic Oscillators and Neutrino Oscillations

Course Project for PHY 206: Physics through Computational Thinking — *April 2019*

- Solved and simulated the Coupled Harmonic Oscillator on Mathematica
- Modelled neutrino oscillations by treating them as a coupled oscillator
- Mathematica nb file: Click here

Madhya Pradesh Police Project

Summer Project — *June 2018 – Dec. 2018*

- Worked with the police of Madhya Pradesh on a computer program to help catch local criminals based on their call records
- Handled large phone datasheets using pandas on Python

Teaching Experience

Teaching Assistant

Indian Institute of Science Education Research, Bhopal *Jan. 2019 – May 2019*

Teaching Assistant, Lab Assistant and Grader for the freshman course ECS 102 – Introduction to Programming.

Courses Undertaken

Astronomy & Physics:
Astronomy & Astrophysics*, Quantum Information & Computing*, Quantum Mechanics, Classical Mechanics, Statistical Mechanics, Computational Physics, Numerical Methods and five lab courses.
Maths:
Probability and Statistics, Calculus, Mathematical Methods.
Other:
Artificial Intelligence, Introduction to Programming, Computational Linguistics, Atmospheric Science and Evolution of the Earth.
Summer School:
IUCAA's Introductory Summer School in Astronomy and Astrophysics, 2020
Online Courses:
Data Driven Astronomy, TensorFlow Specialisation, Applied Machine Learning, Algorithms by Stanford

Note: Courses marked with * will be completed by December 2020. A full list of courses can be found here.

Technical Skills

Languages: Python, C, C++, Java, Wolfram Language, HTML, SQL, LaTeX, Assembly Language, Linux scripting
Software: Mathematica, SAOImage DS9
Developer Tools: Git, Docker, VS Code
Libraries: Astropy, NumPy, Keras, TensorFlow, pandas, scikit-learn, Selenium, matplotlib

Achievements

Academic:
- DST Inspire Fellow
- Governor's Gold Medal awardee, Hiranadani Foundation School, Thane
- Topper in Computer Applications, ICSE Board, 2015

Sports:
- Runner-up in football at Sangharsh 2019, IISER Bhopal's Annual Sports Fest
- Runner-up in Hiranandani Estate Rotary Tournament for football in 2012 and 2013

Other:
- Winner of Codeplay 2019, IISER Bhopal's annual hackathon
- Winner of Model Solvay Conference 2018 at IISER Bhopal - Physics