Siddharth Chaini

Website: siddharthchaini.github.io
Email: siddharthc17@iiserb.ac.in
GitHub: github.com/siddharthchaini

Research Interests

- **Time-Domain Astronomy**
- **Transients & Variable Stars**
- **Astroinformatics**
- **Data Science in Astronomy**

Education

Indian Institute of Science Education Research Bhopal — Bhopal, India
Integrated BS-MS in Physics, CPI: 8.94*/10 — 2017–2022 (expected)

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

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

Research Experience

MS Thesis: Comparison of Distances for Light Curve Classification — IUCAA & Caltech
Advisors: Prof. Ashish Mahabal, Prof. Ajit Kembhavi and Prof. Sukanta Panda — Aug. 2021 –Present

- Working on finding the most optimum distance metrics to optimally separate ZTF objects based on their light curves
- Proposal: Click here

Light Curve Feature Extraction — Laboratoire de Physique de Clermont
Advisor: Dr. Johann-Cohen Tanugi — May 2021 –July 2021

- Worked on feature extraction methods for light curves of transients using curve fitting techniques and gaussian process variational autoencoders
- Collaborated as part of the Cosmostatistics Initiative (COIN) on the REcommendation System for SPECTroscopic follow-up (RESSPECT)

Star - Galaxy - QSO Image Classification — IUCAA, Pune
Advisors: Prof. Ajit Kembhavi, Dr. Kaushal Sharma and Dr. Vivek M — Aug. 2020 –Feb. 2021

- Used machine learning for photometric classification of of compact images from the Sloan Digital Sky Survey as galaxies, stars or quasars on the basis of their images in five observational bands

Photometric Classification of Simulated LSST Light Curves — IISER Bhopal
Course Project for DSE 301: Artificial Intelligence and its Scientific Applications — Feb. 2020 –June 2020

- Worked on a solution for the PLAsTiCC Challenge by implementing an ensemble of deep learning models to classify light curves of astronomical object

Thermodynamic Properties of Ice - A Monte Carlo Study — IISER Bhopal
Course Project for PHY 312: Numerical Methods and Programming — May 2020 –June 2020

- Implemented a Monte Carlo algorithm (Metropolis Hastings) to calculate the residual entropy of a two-dimensional lattice model of ice at various temperatures, and identify a phase transition

Publications, Preprints and Theses

[1] **S. Chaini**, A. Bagul, A. Deshpande, R. Gondkar, K. Sharma, M. Vivek, and A. Kembhavi, "Photometric classification of compact galaxies, stars and quasars using multiple neural networks", (*In Preparation* - To be submitted to MNRAS).

[2] **S. Chaini**, A. Mahabal, and A. Kembhavi, "A Comparison of Distance Metrics for Light Curve Classification", M.S. thesis, IISER Bhopal, (*In Preparation*).

[3] T. Bhore, **S. Chaini**, S. Bachoti, V. Khade, and V. Patil, "Thermodynamic Properties of Ice: A Monte Carlo Study", *arXiv:2010.04964 [cond-mat]*, Oct. 2020. arXiv: 2010.04964 [cond-mat].

[4] **S. Chaini** and S. S. Kumar, "Astronomical Classification of Light Curves with an Ensemble of Gated Recurrent Units", *arXiv:2006.12333 [astro-ph]*, Jul. 2020. arXiv: 2006.12333 [astro-ph].

Posters and Talks - Presenting Author

- Oral Presentation - Department of Physics - Presentation/Report — November 2021
  "Distance Metrics for Machine Learning in Time-Domain Astronomy"
- Poster Presentation - 2021 IAP colloquium - Poster/Video — October 2021
  "Photometric classification of compact galaxies, stars and qasars using multiple neural networks"

Teaching Experience

- **Teaching assistant, Lab assistant and Grader** at IISER Bhopal — Jan. 2019 – May 2019
  ECS 102 – Introduction to Programming

Responsibilities

- **Head of the Student Research Group** at IISER Bhopal Astronomy Club — Aug. 2020 – Aug. 2021
  In charge of activities and data analysis - image reduction and CCD photometry
- **Member of the Student Research Group** at IISER Bhopal Astronomy Club — Jan. 2019 – Present
  Lead Data Analyst

Technical Skills

Languages: Python, C, C++, Java, Wolfram Language, HTML, SQL, LaTeX, Assembly Language, Bash
Libraries: Astropy, NumPy, Keras, TensorFlow, pandas, scikit-learn, Selenium, matplotlib, qiskit
Software: Mathematica, SAOImage DS9, Aperture Photometry Tool
Developer Tools: Git, Jupyter, VS Code

Other Projects

- Authorship Identification (HSS 322 Project, Report)
  Identified the author of an unknown text by analyzing n-gram frequencies, similar to K-Nearest Neighbours
- Coupled Harmonic Oscillators and Neutrino Oscillations (PHY 206 Project, Notebook)
  Solved and simulated a coupled harmonic oscillator and modelled neutrino oscillations as a coupled oscillator
- Call Data Record Analysis (Summer Project - 2019, Certificate)
  Worked under Dr. Kushal Kumar Shah and Madhya Pradesh Police to analyse criminal activity through call data

Relevant Courses

Physics and Astronomy
Cosmology, General Relativity, Astronomy & Astrophysics, Quantum Information & Computing, Quantum Mechanics, Classical Mechanics, Statistical Mechanics, Computational Physics, Numerical Methods, Electrodynamics and Special Relativity, etc.

Mathematics
Probability and Statistics, Linear Algebra, Calculus, etc.

Other

Data Science and Machine Learning, Artificial Intelligence, Introduction to Programming, Computational Linguistics, Atmospheric Science, Evolution of the Earth, etc.

Summer/Winter Schools

ZTF Summer School 2021, Summer School in Statistics for Astronomers, ESCAPE Summer School 2021, 2nd Winter School on Observational Astronomy, IUCAA Introductory Summer School in Astronomy and Astrophysics 2020, Qiskit Global Summer School on Quantum Machine Learning

Online Courses

Data Driven Astronomy, TensorFlow Specialisation, Applied Machine Learning, Algorithms I by Stanford , etc.

Note: These are only a subset of all courses. A full list of courses with their certificates and gradesheets can be found here.

Achievements and Awards

- DST Innovation in Science Pursuit for Inspired Research (INSPIRE) Fellow 2017–2022
- Winner, Codeplay - IISER Bhopal's annual hackathon 2019
- Winner, Model Solvay Conference 2018 - Physics at IISER Bhopal 2018
- Governor's Gold Medal recepient, Hiranandani Foundation School 2015

Extracurricular Activities

- Football (Soccer)
  I am passionate and love playing as well as watching football (soccer).
- Computer Programming
  I am a programming enthusiast, and love learning about and implementing new algorithms, "automating the boring stuff" and developing software to speed up daily activities