Siddharth Chaini

Website: siddharthchaini.github.io
Email: siddharthc17@iiserb.ac.in
GitHub: github.com/siddharthchaini
Mobile: (+91) 98671 69984

Research Interests

- **Time-Domain Astronomy**
- **Transients**
- **Astroinformatics**
- **Data-intensive Astronomy**

Education

Indian Institute of Science Education Research Bhopal — Bhopal, India
Integrated BS-MS in Physics (CGPA: 9.04/10) — 2017–2022 (expected)

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

- Researching new methods for separating ZTF light curves - by distance matrix analysis
- Classification: Creating median-based template for each class and comparing each test object's distance to this template. Prediction is based on minimum distance
- Outlier detection: Calculating the pair-wise distance between all light curves for a class. Light curves consistently having a large distance are marked as outliers
- Semester Report: Click here

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

- Reorganized the curve fitting pipeline to make feature extraction quicker and more robust
- Worked on improving the feature extraction methods for REcommendation System for SPECTroscopic follow-up (RESSPECT) as part of the Cosmostatistics Initiative (COIN)
- Investigated the use of gaussian process variational autoencoders for feature extraction
- Report: github.com/siddharthchaini/Improving-Feature-Extraction-RESSPECT

Classification of Faint and Compact Galaxies, Stars and QSOs — IUCAA, Pune
Advisors: Prof. Ajit Kembhavi, Prof. Vivek M and Dr. Kaushal Sharma — Aug. 2020 –Feb. 2021

- Used machine learning for photometric classification of faint and compact sources from SDSS as galaxies, stars or quasars
- Developed a new neural network architecture which uses images as well as photometric parameters
- Created a custom compactness parameter to select training set
- Presented a poster on this work. Manuscript is in prep.

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
- Preprint: arXiv: 2006.12333
  Code: github.com/siddharthchaini/Astronomical-Classification-PLASTICC

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

– Preprint: arXiv: 2010.04964
Code: github.com/siddharthchaini/ColdAsIce

Image Reduction and Photometry IISER Bhopal
IISER Bhopal Astronomy Club: Student Research Group Feb. 2019 –Present

– As the lead data analyst, worked on codes for image visualisation, image reduction and photometry
– Involved in setting up a Charged Coupled Device (CCD) at IISER Bhopal's observatory housing CGE Pro 1400 HD telescope

Publications, Preprints and Theses

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

[2] **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).

[3] **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].

[4] 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].

Posters and Talks - Presenting Author

- Oral Thesis Presentation - IISER Bhopal - 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

Additional Responsibilities

- **Head of the Student Research Group** at IISER Bhopal Astronomy Club Aug. 2020 – Aug. 2021
  In charge of group activities and data analysis - image reduction and CCD photometry. Also helped organise telescope viewing nights and computational astronomy tutorials.

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, threading, qiskit
Software: Mathematica, SAOImage DS9, Aperture Photometry Tool
Developer Tools: Git, Jupyter, VS Code

Achievements and Awards

- INSPIRE Scholarship for Higher Education (SHE), DST, Government of India 2017–2022
  (Amount: ₹300,000)
- Winner, Codeplay - IISER Bhopal's annual hackathon 2019
- Winner, Model Solvay Conference 2018 - Physics at IISER Bhopal 2018
- Governor's Gold Medal recipient, Hiranandani Foundation School 2015