

VIRAJ KARAMBELKAR

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PROFESSIONAL SUMMARY

Astrophysics Ph.D. candidate specializing in designing and implementing data-driven methods to study cosmic explosions in our universe. Experienced in leading software development projects to analyze complex datasets and discover rare astrophysical phenomena. Graduating in 2025, seeking to transition into an industry research role post-graduation. Proficient in Python programming, and passionate about applying data science expertise to solve real-world problems.

EDUCATION

California Institute of Technology (Caltech)

Pasadena, CA

PhD in Astrophysics (Expected June 2025), MS in Astrophysics (2021), GPA: 4.1/4.0

Indian Institute of Technology (IIT), Bombay

Mumbai, India

Bachelor of Technology in Engineering Physics with Honors, Minor in Mathematics (2019), CPI: 9.75/10

TECHNICAL SKILLS

Languages: Python, C++, SQL, HTML, Bash, Fortran,

Developer Tools: Git/GitHub, Docker, MongoDB, dask, Apache Kafka, PyCharm, Jupyter

Libraries: PyTorch, Scikit-Learn, TensorFlow, pandas, NumPy, SciPy, Matplotlib, Flask,

Coursework: Machine Learning, Bayesian Statistics and Inference, Data Analysis and Interpretation, Astrophysics

PROJECTS

Data processing pipeline software lead *Thesis Project*

- Led the development of an **open-source Python pipeline** available at [Github/mirar](#) for real-time, automated and parallelized processing of images taken with the new infrared WINTER telescope.
- Implemented **automated image differencing algorithms** in python to detect new sources in astronomical images.
- Designed and implemented **SQL databases** for efficient storage and retrieval of images, and filtering of over a hundred thousand sources to discovered rare, unusual gems associated with cosmic explosions.
- Established a collaborative community** comprising three international teams utilizing the “mirar” codebase.

Machine Learning to characterize Stellar Variability *Thesis Project*

- Led an initiative to characterize brightness variability of stars using **time-series data** from the Gattini telescope.
- Built an ML classifier** to sift through an **extensive dataset of 60 million stars** to identified ≈ 50 rare erratically variable stars, facilitating their in-depth study producing a series of five [research papers](#)
- Mentored two undergraduate student** on building a machine-learning classifier that **achieved 95% accuracy** to identify stars that show periodic brightness variations, publishing one of the largest catalog of such stars.

Data-Driven Discoveries of Merging Stars and their statistics *Thesis Project*

- Leading an effort to find rare cosmic explosions linked to merging stars using the Zwicky Transient Facility survey.
- Devised and implemented Python-based filters** specifically tailored to sift through an **extensive dataset of 100,000 candidate explosions every night**. This process efficiently pinpoints **2 to 3 rare stellar merger explosions annually**, and has produced the first statistical [study](#) of merging stars.

Scheduling software for India's First Robotic Telescope *UG Project*

- Developed the scheduling software for India's first robotic telescope, the [GROWTH-India telescope](#). Written in Python and C++, this software facilitated efficient communication and coordination between the telescope, camera, filter-wheel, and observatory dome, enabling robotic operations of the observatory.

ACHIEVEMENTS AND AWARDS

- Authored **50** peer-reviewed [publications](#) garnering over **1500 citations**, notably featuring **3 papers in the esteemed journal Nature**. Delivered research presentations at more than 10 international conferences.
- Secured highly coveted observations with the **Hubble Space Telescope** and the **James Webb Space Telescope**, succeeding in highly competitive selection processes with oversubscription factor of 8.
- Awarded the prestigious Neugebauer Scholarship at **Caltech**, the Institute Academic Prize at **IIT Bombay** and the INSPIRE, KVPY and NTSE fellowships by the **Govt. of India**.
- Ranked **196th** out of a million students in the highly competitive Joint Entrance Exam for admission to IITs.