

Shanmugha Balan

Research Student in Astrophysical Applications of Machine Learning

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EXPERIENCE

ASTROPHYSICS RESEARCH GROUP, BITS PILANI | RESEARCH STUDENT

Dec 2020 – Current | Pilani, India

- Working on data about the star clusters in our galaxy from the Gaia Mission by the European Space Agency, queried through VizieR, a database maintained by the University of Strasbourg
- Studying the structural properties and dynamical stability of clusters using K-means clustering and Gaussian Mixture Models to identify member stars and determined the presence of tidal tails

SPACE TECHNOLOGY CELL, ISRO | RESEARCH INTERN

Oct 2021 – Jan 2022 | Pune, India

- Theorized a model predictive controller model to determine a safe and optimal landing trajectory for a lunar spacecraft
- Implemented a simulation of the controller in Python

COMPUTATIONAL SYSTEMS BIOLOGY LAB, IIT MADRAS | RESEARCH STUDENT

Apr 2018 – Jun 2018 | Chennai, India

- Analysed protein networks for the bacterium E. coli using data from the STRING database and made a network graph with NetworkX
- Used the interactions to identify potential target proteins for novel drugs to act upon using graph centrality measures

PROJECTS

PROPERTIES OF OPEN CLUSTERS USING GAIA DATA | WITH DR. KAUSHAR VAIDYA

- The cluster membership information on the Gaia DR2 data of open clusters was used to study the effect of dynamical evolution on the observed properties of star clusters with a clear binary track
- The morphology of star clusters is examined to look for the presence of any tidal tails in the star clusters

SEU DETECTION FOR CASSIOPE

- Trained a random forest model with sklearn for predicting single event upsets for the CASSIOPE satellite as a part of the NASA SpaceApps challenge
- Achieved an F-score of 0.78 despite having a heavily imbalanced dataset for classification

RESPONSIBILITIES

- **TEACHING ASSISTANT** - Nonlinear Dynamics and Chaos at BITS Pilani
- **TEAM LEAD** - Microsoft Learn Student Ambassadors, Pilani Chapter
- **PROJECT LEAD** - 3D Research Team, Computer Vision Research Society, Pilani
- **CHIEF EDITOR** - Physics Association, BITS Pilani
- **JOINT COORDINATOR** - The Radio Astronomy Club, BITS Pilani

SKILLS

PROGRAMMING

Proficient:

Python • C/C++ • MATLAB • L^AT_EX

Experienced:

Julia • Shell • HTML • JS • CSS

LIBRARIES/Frameworks

Numpy • Scipy • Scikit-Learn
Astropy • OpenCV • Matplotlib
PyTorch • TensorFlow

EDUCATION

BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI

M Sc PHYSICS + BE ELECTRICAL AND ELECTRONICS ENGINEERING
Jul 2019 - Present | Pilani, India
Cum. GPA: 8.15 / 10.0

COURSEWORK

MATHEMATICS

Multivariable Calculus
Linear Algebra
Complex Analysis
Probability and Statistics
Differential Equations

PHYSICS

Classical Mechanics • Optics
Electromagnetic Theory
Quantum Mechanics
Statistical Mechanics
Nonlinear Dynamics and Chaos
Theory of Relativity
Computational Physics
Nuclear and Particle Physics

ELECTRONICS

Digital Design • Signals and Systems • Control Systems

MOOCS

Deep Learning Spec.
Applied Data Science Spec.
Data Driven Astronomy