Hari Prasad Sreekrishnapurath Variyam

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Education

- **MSc. Physics** — University of Cologne, Cologne, Germany
  Bonn Cologne Graduate School for Physics and Astronomy (BCGS) — *October 2023 - Present*
  Under BCGS stipend program

- **BSc. Physics Honours** — St. Stephen's College, University of Delhi, India
  First division — *November 2020 - June 2023*

Current positions

- **Exploring machine learning techniques in brain imaging data** — Forschungszentrum Jülich,Germany
  Research internship — *Aug 2024 - Present*
  Currently, I am working as a research intern in the Applied Machine Learning (AML) group at the Brain and Behaviour Institute (INM-7) of Forschungszentrum Jülich. My work involves analyzing GMV (Gray Matter Volume) distributions obtained from MRI and fMRI images, as well as performing classification and regression tasks on various labels..

Research Experience - Undergraduate level

- **Studying Synchronisation in coupled systems** — Indian Institute of Technology, Delhi
  Research internship — *Mar 2022 - May 2023*
  Worked under the guidance of Prof. Ramakrishna Ramaswamy (Indian Institute of Technology, Delhi) on studying coupled systems in synchrony. Design and implementation of tabletop experiments that exhibit synchrony.

- **Probing variation in Fermi Coupling Constant Using Supernova Ia data** — St. Stephen's College, Delhi
  Research internship — *Oct 2021 - December 2022*
  Worked under the guidance of Dr. Akshay Rana (St Stephen's College, Delhi), on studying the temporal variation of Fermi Coupling constant using Light curves of Type Ia supernovae.

- **Fast radio bursts (FRB) classification using neuro-evolutionary techniques** — St. Stephen's College, Delhi
  Bachelor thesis — *Nov 2022 - June 2023*
  Worked under the guidance of Dr. Geetanjali Sethi (St Stephen's College, Delhi), on methods of FRB classification using evolutionary neural networks (ENNs) as part of final year dissertation.

- **Analysis of neural data using non linear features and neural networks** — St. Stephen's College, Delhi
  Research — *Nov 2022 - June 2023*
  Worked on the analysis of Electroencephalogram data - Specifically on data obtained from Epileptic and Schizophrenic candidates, analysis and classification using various classifiers like SVMs, KNNs, and CNNs

- **A novel dual polarized Disconne antenna design in the 18 - 40 MHz range** — St. Stephen's College, Delhi
  Research — *Jan 2022*
  Worked on the support structure design of a novel dual polarized disconne antenna design as part of a team (Jovian 42) which was awarded first prize by IUCAA and Fergusson College Pune,India

Publications/Preprints

- **Digital Fireflies : Coupled LEDs in synchrony**
  Resonance — *2024*
  DOI : https://doi.org/10.1007/s12045-024-0765-2

- **A Novel method for Schizophrenia classification using nonlinear features and neural networks**
  Arxiv — *2024*
  DOI : https://doi.org/10.48550/arXiv.2402.14819

- **Examining Temporal Variation of the Fermi Coupling Constant using SNe Ia Light Curves**
  Arxiv — *2023*
  DOI : https://doi.org/10.48550/arXiv.2207.10065

Skills Summary

- **Scientific Programming and computational statistics**: Python, Bash, Fortran, Maxima
- **Frameworks**: Scikit, TensorFlow, PyTorch, PyGAD, Keras, OpenCV
- **Platforms**: Linux, Web, Docker, Arduino, Raspberry PI, GIT
- **Antenna design**: 4NEC2
- **Graphic Design and video Editing**: Adobe premier pro, Inkscpae Vector graphics editor
- **Language proficiency**: English, Hindi, Malayalam, Tamil, Sanskrit
- **Typesetting**: LaTeX, Microsoft office

Projects - Summary

Category	Description
Chaos and Nonlinear Dynamics	Modelling and analysis of chaotic oscillators
Machine Learning	RNNs and LSTMs (Solar flare and sunspot (temporal) prediction)
	Classification using KNNs, SVMs and CNNs (EEG timeseries)
	Reinforcement learning with neuroevolutionary networks
	Bayesian inference (Inference of mutation rates of bacterial species from empirical data.)
	Boltzmann machine learning (Inverse Ising models)
	Reservoir networks in dynamical systems (Lorenz 63', Rossler)
	Age/Sex prediction using gausian/ridge regression models from GMV distributions from brain imaging data
Computer Vision (OpenCV based)	Design and implementation of tracking systems for analysing mechanical oscillators
Astrophysics	Modelling N-body systems
	Modelling Neutron Stars using TOV equations
Miscellaneous	Analysing Cardiac fibrillation using computer models
	Design and implementation of circuits and mechanical systems based on microcontroller (Arduino and Raspberry Pi) platforms
	Synthesis and charecterisation of ZnO, Ag and Au nanoparticles
	Physical vapor deposition techniques

Accomplishments

- **BCGS Scholar**: Selected as a full scholarship student for the BCGS masters program in physics under the Bonn Cologne Graduate School (April 2023)
- 9^{th} **National Student Symposium on Physics (NSSP 2022)**: Presented a paper on *A Novel method for Schizophrenia classification using nonlinear features and neural networks, organised by Indian Association of Physics Teachers (IAPT)* (December 2022)
- **Annual Meera memorial paper presentation competition (First Place)**: Presented on *Diagnosing Neurological/Psychiatric disorders from Electroencephalogram data using features of Non-Linear Analysis and Neural networks.* (April 2022)
- **Guru Dhwani antenna designing competition (First place)** ***Team name : Jovian 42***: A national level online radio antenna designing competition, organised by NRC IUCAA. (April 2022)
- **Hyperion Case study competition** : Case study on **Dark matter acceleration** organised by Indian institute of technology, Kanpur. (Selected as one of the top 3 submissions nationally.) (October 2021)

Honors and Awards

- Recipient of SC Bhargava Excellence award for undergraduate research - May 2023
- Recipient of SC Bhargava Merit Scholarship - June 2022
- Recipient of Tushar Nagia Excellence award for maintaining the highest CGPA aggregate in first year - June 2022

Conferences and workshops

- **Perspectives in Nonlinear dynamics** Complex systems and dynamics group, IITM,India
  Attended a 4 day triannual conference on nonlinear dynamics *2023*
- **'Physics of life' - Annual monsoon school on biophysics** NCBS,India
  Attended a 10 day school on biophysics in National center for biological sciences *2023*