Harikrishnan S

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> "Mathematics is not about numbers, equations, computations, or algorithms: it is about understanding." — William Paul Thurston

EDUCATION

- **IISER TVM (Currently Studying)** — Thiruvananthapuram, Kerala
  BSMS Mathematics major with Physics minor; CGPA: 8.36/10 — Dec 2020 -

- **Mahatma Gandhi Government Higher Secondary School** — Kottayam, Kerala
  Higher Secondary; Marks: 97.33% — Jun 2018 - May 2020

- **St Thomas High School Pala** — Kottayam , Kerala
  Higher Secondary; GPA: 10.00/10.00 — Jun 2018 - May 2020

SKILLS SUMMARY

- **Skills**: Problem Solving, Programming skills, Sticks to interesting tasks for very long time periods.
- **Programming Languages**: C++, Python, C, R language, bash scripting
- **Libraries**: Pytorch, Torch-Geometric, Deep graph library, Numpy, Matplotlib, Pandas
- **Languages**: English, Hindi, Malayalam

AREAS OF INTEREST

Geometry and Topology

WORKSHOPS ATTENDED

- **Symplectic Geometry mini-workshop**: Chennai Mathematical Institute

  URL : https : //www.cmi.ac.in/activities/kohli − centre/symplectic − geometry − 2024/

COURSES TAKEN

- **9th Semester**: Fourier Analysis, **Hyperbolic Geometry**, Fluid Dynamics
- **8th Semester**: Functional Analysis, **Differential Geometry**, **Algebraic Topology**, Number Theory
- **7th Semester**: Measure theory, **Analysis on Manifolds**, Partial differential equations, Commutative Algebra, Data structures and algorithms.
- **6th Semester**: **General Topology**, Complex Analysis, Fields Modules and Algebras, Theory of ODE, Probability Theory and Stochastic Processes.
- **5th Semester**: Real Analysis, Linear Algebra, Numerical Analysis, Theory of Groups and Rings, Mathematical Statistics + Lab.
- **Foundation Courses (1,2,3 and 4th Semesters)**: Single Variable Calculus, Introduction to Linear Algebra, Introduction to Ordinary Differential Equations, Multivariable Calculus, Introduction to Probability
- **Courses in Physics**: Mechanics, Electromagnetism, Optics, Thermal and Statistical Physics, Quantum Mechanics I, Statistical Mechanics, Statistical modelling in Physical Sciences.

EXPERIENCES AND INTERNSHIPS

- **Major Project (Master's thesis) : Symplectic Topology** — IISER,TVM

  I'm currently working on my master's thesis under the guidance of Dr. Shrihari Sridharan at IISER Thiruvananthapuram. I began my master's thesis by studying symplectic topology using Dusa McDuff's 'Introduction to **Symplectic Topology**.' In the future, I hope to pursue a Ph.D. and expand the frontiers of symplectic topology.

- **Minor Project : Synchronization in complex dynamical networks** IISER,TVM
  Master Stability function *JAN 2024 - MAY 2024*
  This project utilizes the master stability function (MSF) methodology to analyze the synchronizability of coupled dynamical networks. MSF is the most elegant and powerful tool to characterize the stability of synchronization in coupled dynamical systems on the network. Specifically, in this project, we focused on a star network of N coupled oscillators, namely Lorenz and Rössler oscillators. We investigated their MSFs analytically and numerically under different coupling schemes. We have also observed various patterns in N coupled dynamical systems under the coupling between different variables of the systems.

- **Internship with Dr. Chandrakala Meena** IISER,TVM
  Appearance of Chimera states in various networks *APR 2023 - JUNE 2023*
  My work revolved around the paper **Chimera states in Star Networks**. Mainly, I tried reproduce the results in this paper. This helped me get a glimpse of what is happening in the field **Spatio-temporal pattern formation in complex systems**.

- **Internship with Dr. Santanu Sarkar and Dr. Chandra Chowdhary** IIT,MADRAS
  Topological Descriptors in data analysis *APR 2023 - OCT 2023*
  I worked on a project to predict various properties of 2D materials. The computations of material properties using Density Functional Theory and other methods are computationally expensive. An alternative approach is use machine learning. But traditional GNNs have their theoretical limits. We tried to overcome this limit by using Topological Graph Layer along with Atomistic Line Graph Neural Networks.

  Publication : *https* : *//doi.org/*10.1039/*D4RA07703B*

- **Winter Internship with Dr. Aparna Lakshmanan** CUSAT, KOCHI
  Graph Theory *DEC 2022*

  We used R Balakrishnan and K Ranganathan's book as a reference during the internship. We started from the basics and covered topics such as Directed Graphs, Connectivity, Trees, Independent Sets, Matchings, Eulerian Graphs, Hamiltonian Graphs, Graph Colouring's and Planarity.

  Certificate : *https* : *//bit.ly/HARI − INTERN − CERT*5

- **Summer internship 2022 with Dr. Shrihari Sridharan** IISER, TVM
  Analysis and fractal geometry *JUN 2022 - JUL 2022*

  During the internship, I studied real analysis and fractals geometry. I started by figuring out how to make real numbers from rational numbers using Dedekind cuts and Cauchy sequences. Then I learned about polynomial spaces. After that, I looked at different fractals like the Cantor set, Sierpinski triangle, and Koch curve. I asked whether they were compact, countable, or perfect sets.

EXTRA CURRICULAR ACTIVITIES

Badminton