

ANANTHA KRISHNAN

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Portfolio

Hi I am Anantha

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ananthakrishnan

Integrated BS-MS dual degree Physics graduate Indian Institute of Science Education and Research Thiruvananthapuram

EXPERIENCE

Quantum Network Nonlocality without inputs using Neural Network Oracle

Ongoing

IISER TVM, Kerala, India

- Working with Prof. Anil Shaji and Dr. Debashis Saha on **Quantum Information Theory** and **Quantum Foundations** from a **Machine learning** standpoint & was awarded the Chanakya Fellowship (I-HUB QTF) under the **National Mission on Interdisciplinary Cyber Physical Systems**, of the Department of Science and Technology, Govt. of India
- I have found the best measurement setting for maximal nonlocality for X states & a convenient model in complex multipartite domains. I am in the process of publishing my results.

Superadditivity of Coherent Information in Noisy Quantum Channels

Jan 2022 – Apr 2022

IISER TVM, Kerala, India

- Worked with Dr. Nagaiagh Chamakuri on the application of Meta-heuristic algorithms for finding quantum states (**RBM Architecture**) that showed **Superadditivity of coherent information**.
- Meta-heuristic algorithms such as genetic algorithms were significantly better conventional gradient descent because it bypassed the issue of optimization getting stuck in local optimas

Variational principles for finding quantum bound states

Aug 2019 – Dec 2019

IISER TVM, Kerala, India

- Did a project on **Variational principles** for finding quantum bound states using Mathematica and Matlab under Prof. Anil Shaji,
- Made use of various shooting and relaxation algorithms, including the **Gauss-Seidel iterative algorithm** on electron wave function and energy

Exploring dynamics of Chua's circuit

Jan 2022 – Apr 2022

IISER TVM, Kerala, India

- This was a group project where we set up **Chua's circuit** to study the evolution of its **classic chaotic behavior**.
- I learned how important project management skills are when it comes to research.

Signal locality, Unpredictability and Random number certification

Aug 2020 – Dec 2020

IISER TVM, Kerala, India

- Did a presentation on **Bell's theorem** and the whole Bohr, Einstein debate, and its importance in random number generation.

Quantum Simulation using Qiskit

2022

IISER TVM, Kerala, India

- Experienced in using Qiskit software Quantum Simulation problems using Quantum Algorithms - Qiskit Global Summer School

Intent recognition Chatbot Platform for Mental Health applications

Ongoing

Cloud Cuckoo Land, India.

- Working on a **intent-recognizing chatbot** for mental health applications, by making use of a statistical system of emotion parameters making it possible for the platform to predict the user's emotional compulsiveness.

RESEARCH INTERESTS

I am interested in Quantum Information Science of importance to its foundation nature to emerging quantum technology, using theoretical and machine learning approaches.

I am also interested in Science communication, Interdisciplinary biology, and the Philosophy of science

COURSEWORK

- Courses on Classical, Statistical, and Quantum Mechanics, courses on Condensed matter physics, Electrodynamics with Special and General theories of relativity, Atomic and molecular physics, and High energy physics.
- Advanced courses on Quantum Information Theory, Quantum Foundations, Quantum Field Theory, and Quantum Many-Body Theories.
- Courses on Computational Techniques and Programming languages, Introduction to Machine Learning, Probability and Statistics, Advanced Mathematical methods, and Data and Statistical Models in Astronomy.

MASTERY

Python

MatLab

Mathematica

Java

R

C

MPI

Parallel Computing

Qiskit

QuTip

tensorflow and keras

CuPy and SymPy

Conda

EDUCATION & AWARDS

Integrated BS-MS Dual Degree in Physics with Data Science Minor

IISER Thiruvananthapuram

July 2018 – July 2023

CGPA - 8.34/10

Research fellowship student

July 2023 – present (IISER Thiruvananthapuram)

Chanakya PG Fellowship I-HUB QTF

July 2023

NMICPS, Govt of India

Qiskit Quantum Excellence Award

2023

IISER TVM, Kerala, India

ANVESHA Science Fest Prize winner

2018

IISER TVM, Kerala, India

SKILLS & EXPERTISE

Data Science & Programming

- Machine Learning Algorithms - Neural Networks, SVMs, KNN, Random Forest.
- Languages - Python, JS, C.
- Statistical analysis - Regression Models, ANOVA, Chi squared tests, Bayesian Models.
- Data Visualization - Sympy(symbolic), Scipy, Matplotlib, Seaborn, Plotly, Obsidian, Mindmaps.
- High-performance computing and Parallel computing - IISER TVM HPC cluster-link, MPI, slurm batch scripting, ensemble modelling.
- WebUI Development(NodeJS & flask) & NLP Intent Recognition
- Optimisation - Gradient descent, Metaheuristic algorithms (PSO, GA), Simulated Annealing, Bayesian optimisation.

Scientific Computing and Quantum Simulation

- Qiskit
- Quantum Algorithms - VQE, QPE, QFT, etc
- Rigid strategies for Bell and Network Non classical correlations
- Neural Network Architecture - Restricted Boltzmann NN ansatz, Nonlocality witness.
- Scientific packages & techniques - TensorFlow, MatLab, Mathematica, R
- Qutip Quantum Channels and Density States
- Perturbation theory, Variational methods, Adiabatic Approximation, DFT, Path Integral Formulation, Quantum MonteCarlo Methods
- Solving PDEs (Shooting, Relaxation methods - Gauss Seidel Algorithm)

Software skills

- Experienced in Adobe Photoshop, Adobe Lightroom, MS Office, Origin Pro, and Blender.
- Image processing and Curve fitting in Biological and Chemical systems.
- Biological and Chemical system illustration using Blender
- Experienced in using finesse and Pygwin packages and used it in a project in Build a Detector Workshop, LIGO-India
- Intel One API, MPI, SLurm batch script, GCC

WORKSHOPS & CONFERENCES

- I am presenting my work on **Quantum Network Nonlocality using Machine learning** at the Frontier Symposium Physics 2024 in IISER Thiruvananthapuram.
- Qiskit Global Summer School (QGSS) 2021, 2022, 2023 on Quantum Machine Learning, Quantum Simulation and Algorithms, and Theory to Implementation.
- Participated in Hackathon - **Datathon IndoML 2023**
- **Brain, Computation, and Learning (BCL)** 2023 workshop at IISc, Bangalore.
- Attended the Summer school on **Quantum Information and Quantum Technology (QIQT)** 2021
- Participated in 2021 **Build a Detector Workshop** organized by the **NewtonBhabha** and **LIGO India** partnership
- Attended the **Intel one API HPC Free Training & Workshop** at IISER Thiruvananthapuram
- Attended the **MatLab workshop** on image processing, curve fitting, and parallel computing at IISER Thiruvananthapuram
- Attended the **International Workshop on HPC in Science and Engineering 2021** at IISER TVM
- Participated in **IAAC 2020, 2021, 2022 and 2023.**

RESEARCH ACHIEVEMENTS & MANUSCRIPTS

Master Thesis Defense "**Exploring Triangle Nonlocality using Machine Learning**"

📅 May 3rd 2023

📍 IISER TVM, Kerala, India

Minor Thesis Defense "**Superadditivity of Coherent Information in Noisy Quantum Channels**"

📅 July 20th 2022

📍 IISER TVM, Kerala, India

Genuine Quantum Network Nonlocality using X States

📍 IISER TVM, Kerala, India

Soon to be peer-reviewed - check-here

COMMUNICATION & TEAMWORK

- Clear and concise **scientific writing**.
- Made flyer and actively volunteered for **23rd NCAMP conference school** in **IISER TVM**
- Experience working in **research teams** or **collaborative projects** like with **NCAMP-23** and **Cloud Cuckoo Land, India**.
- **Mentoring** undergraduate students or junior researchers at IISER TVM.
- **Ishya & IICM Cultural Fest** design coordinator and participant.
- **Humanities Collective** member.
- Continuous learning and participation in workshops, conferences, and training programs.

REFEREES

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MBBS, DPM