Asrit Ganti

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Education

Trinity College Dublin — Dublin, Republic of Ireland
Masters in Electronic Information/Computational Engineering — *Sept. 2022 – Sept. 2023*

Shiv Nadar University — Uttar Pradesh, India
Bachelor of Science in Physics — *Aug. 2016 – May 2021*

Research Experience

Research Assistant — October 2023 – present
Trinity College Dublin — *Dublin, Ireland*

Title:RootCheck: Image-Based Root Health Assessment Tools for Sustainable Agriculture
Advisor: Dr. Richard Nair

- Conducting stakeholder engagement to better refine the problem statement, ensuring the developed handheld sensor meets the practical needs of farmers and agricultural stakeholders.
- Working on building a minirhizotron instrument using Raspberry Pi 5 to capture high-resolution root data.
- Creating a comprehensive database using hyperspectral imaging of roots, encompassing different crop species and health statuses, and developing a neural network model that can be trained on this data to identify key indicators of root health.
- Developing a technical roadmap for extracting relevant information such as Nitrogen uptake by the roots, utilizing a smartphone app linked to our curated database, enabling rapid and accurate root health assessments in the field.

Master's Thesis — September 2022 – July 2023
Trinity College Dublin — *Dublin, Ireland*

Title:Unveiling the role of phase transitions and control in complex systems on Hypergraphs: A Data driven approach using sensing data
Advisor: Dr. Harun Siljak

- Investigating the coupled dynamics of identical systems and determining the cost and control processes within the system over a period of time
- Using python's NetwowkX library to construct and model hypergraphs
- Created a complex dynamical model that deals with the thermodynamic cost of maintaining a steady non-equilibrium state versus the benefits of energy harvesting on Hypergraphs
- Applying this model to determine wave height using sensing data and control of drones over ocean surface

Sr. Project Assistant (Tech) — September 2021 – July 2022
Indian Institute of Technology Delhi — *New Delhi, India*

Title:Developing district-level forecasts of vaccine coverage and inferring vaccine confidence across India using large public health data-sets
Advisor: Dr. Sumeet Agarwal

- Developed district-wise and state-wise raw coverage data based on NHFS-4 and NHFS-5 data
- Developed visualizations based on the coverage data using QGIS for India state and District boundaries
- Created and hosted a web server and portal for the public to access the various vaccine coverage data in the form of visualization
- Generated geostatistical model coverage estimates for 1kmX1km area using R-INLA and MCMC sampler

Undergraduate Thesis — May 2020 – June 2021
Shiv Nadar University — *Uttar Pradesh, India*

Title: Studying the Ising model using classical and quantum simulations and its application in epidemiological research
Advisor: Dr. Syed Kamil

- Aim to present an exact simulation of a one dimensional transverse Ising model using QISKit

- Aim to present the SIR epidemic model using an Ising-like model with the rate of recovery, rate of infection, etc. as it's parameters
- Constructed a quantum circuit which exactly diagonalizes the Ising Hamiltonian and successfully establishes all the eigenstates
- Simulated an 1-D Ising model classically in python using the metropolis algorithm and also simulated the SIR compartmental model using Euler's algorithm
- Aim to compare the above results and study the effect on time and space complexities in the quantum computational approach as compared to classical computation

Research Assistant August 2019 – February 2020

Shiv Nadar University *Uttar Pradesh, India*

Title: A study of coherent states and phase operations
Advisor: Dr. Bijan Bagchi

- Worked on a review paper under the guidance of Dr. Bijan Bagchi
- Eigenstates of linear combinations of the Susskind and Glogower phase operators for the harmonic oscillator are constructed
- It was shown that such eigenstates are squeezed states which are a particular linear combinations of the creation and annihilation operators

Research Assistant May 2018 – July 2018

QuNu Labs *Bangalore, India*

- Worked as a research intern at India's first startup on Quantum Cryptography
- Reviewed multiple papers on Quantum Key Distribution protocols and Quantum Information Processing and worked on optimization of their experiment to achieve better and more secure Data Transfer
- Worked on COW and Decoy based QKD to counter the inadequacy of a single photon generator
- Understood and reviewed the working of a True Quantum Random Number Generator

Projects

Title: *Breaking Waves: Simulation* Mar. – May. 2023

- Worked on writing the code for the Cauchy problem with the periodic domain for a nonlinear shallow water equation and has been analyzed to establish an inequality condition for wave breaking. This condition has been confirmed through numerical computation, as waves with a selected initial profile that satisfies the condition break.

- This condition has been confirmed through numerical computation, as waves with a selected initial profile that satisfies the condition break. The code was implemented using **MATLAB**.

Title: *Created VR and AR applications: Built and Rendered using **Unity*** Jan. – May. 2023

- VR game Link
- AR application (.apk) Link

Title: *Semi-automated binary segmentation with 3D MRFs* Jan. – Mar. 2023

- Implemented Bayesian binary matting techniques using the software **NUKEX** and **MATLAB** for image and video processing.
- Reported the various performance measures and experiments used and the observations made for
  1. Maximum Likelihood Estimate
  2. 2D Markov Random Field
  3. 3D Markov Random Field with and without motion compensation

Title: *Click Removal in Degraded Audio and Audio Restoration* Oct. – Dec. 2022

- Designed an autoregressive model-based algorithm for detection and removal of clicks in archived audio tracks.
- Implemented the code in **MATLAB** and **Python** and restored the audio samples.

Title: *Determining optimal charging station placement across Dublin using Agent-Based Modelling* Oct. – Dec. 2022

- Created a model with specific assumptions which were used to model the population of Dublin city.
- Ran the simulation using **NET LOGO** to generate agents across the city with the placement of charging stations and monitoring of the popularity of certain routes over the others to help understand the usage density of each station.

Title: *Visualizing Qubits: A fractal geometry approach* Oct. – Dec. 2022

- Proposed an alternative way of visualizing qubits using fractals instead of the Bloch sphere.
- Tested this method using the Quantum Teleportation algorithm where we replaced the Bloch sphere output with the corresponding fractals and found some interesting results. Used **IBM quantum experience(QISKIT)** to run the experiment.

Title: *Self Driving Car using deep learning and computer vision* Oct. – Dec. 2022

- A Unity-based simulator (real-time game engine) was used to drive a car around a track and record a video of the front view along with the input commands.
- The recorded data is uploaded to clusters and used to train a CNN in **Python** to predict steering angle from the front view image, which can then be downloaded and used to run the car simulation in autonomous mode.

Title: *CFD based simulation of separated vortex rings in dandelion seeds using Ansys* Aug. – Nov. 2020

- Successfully designed a **CAD based** dandelion seed and created a virtual environment in **Ansys** to run the experiment
- Used **FLUENT** and applied the necessary boundary conditions and material properties to simulate the flow resulting in a separated vortex

Title: *Modular Robot - Terrain Detection and Classification* Aug. – Nov. 2019

- Design and development of a modular robot with intelligent terrain classification based on input from an Inertial Measurement Unit.
- Terrain classification is done between a smooth and rough path using Kernel SVM model.

Achievements: Academic

- **Academic Scholarship** of Rs. 6,00,000/- for Undergraduate studies at Shiv Nadar University from 2016-2020.
- Appointed as **Junior Research Fellow** for conducting research at **Indian Institute of Technology(IIT) Delhi**.
- **Research Fellowship** of Rs. 20,000 /- to work at QuNu labs as a Research Assistant.
- Taught as an instructor for **Trinity WALTON Club**, teaching high school students physic and research methods
- One of the 5 finalists to attend **Inspire National Internship Science Camp (2014)** during High School
- Recipient of **National Merit Award (2013)** with a cash prize of Rs. 5000 /- for securing highest GPA in High School
- Invited to attend **QuICC summer school (2019)** organised by **Imperial College London** which I had to decline owing to medical reasons
- Attended **Summer School (2019),** on Machine Learning and Computer Vision organised by **IIIT Hyderabad**

Achievements: Non-Academic

- Won a **National-Award** for the best short film(Link) for **National Road Safety Week (2017)** by the Government of India and was awarded a cash prize of Rs. 35,000 /-
- **President of CINEU**, the Cinematic Appreciation society of SNU from March 2018 to March 2019.
- **Co-founded Celestia Explora**, the Astronomy club of SNU and conducted multiple star-gazing nights and other astronomy based events in the University (2017 - 2019)
- **Team Lead and Participated** in the **50-hour filmmaking challenge** held by India Film Project for 3 consecutive years (2017, 2018, 2019)
- **Student Volunteer** as a science teacher at a local government school in Dadri, Uttar Pradesh on behalf of the clubs, Aura and Celestia Explora (January 2019 - April 2019).
- **Directed** a Street Play to spread awareness on Mental Health on **World Mental Health Day 2018**
- Won multiple quizzing competitions at prestigious college fests in the country while representing the university (Tarang'17, Oasis'18, Rendezvous'19)

Technical Skills

Languages: **Basic** (Java, HTML/CSS), **Intermediate** (QISKit (IBM), Mathematica, C/C++,), **Advanced** (Python, MATLAB, Aurdino)
Softwares: Ansys, Auto-Cad, Solidworks, LtSpice, Unity, Nuke, DaVinci Resolve **Adobe Suite** - Premiere Pro, After Effects, Photoshop, Illustrator
Libraries: Pandas, NumPy, Matplotlib, Tensorflow, OpenCV, Anaconda, Sci-Kit Learn, NetworkX, R-INLA, Git version control