

# Pradyumnan Raghuveeran

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## EDUCATION

Indian Institute of Technology Madras

Bachelor of Technology in Aerospace Engineering

('22 - '26, Expected)

Grade: 9.80/10.0

## PUBLICATIONS AND CONFERENCES

- **Pradyumnan Raghuveeran**, Gaurav Chopra, Ajay Bankar, R I Sujith (2025, November 18-20). *Graph Neural Network Based Rainfall Stability Prediction Over India Using Precipitation Gauge Data* [Poster Presentation]. International Symposium on Tropical Meteorology 2025, Pune, India.
- **Pradyumnan Raghuveeran**, Gaurav Chopra, Ajay Bankar, R I Sujith (2026, January 25-29). *Graph Neural Networks for Predicting Rainfall Stability Over India* [Oral Presentation]. 25th Conference on Artificial Intelligence for Environmental Science, 106th AMS Annual Meeting, Houston, TX.
- Sasinas Alias Haritha Z A, Manoj Kumar Mukundan, Amrisha Srivastava, **Pradyumnan Raghuveeran**, Yegneswaran R V, & Ramanathan Muthuganapathy (2025). *An adaptive sampling-based touching ball approach for the Voronoi diagram of spheres*. Manuscript submitted for publication in Computer-Aided Design.

## RESEARCH EXPERIENCE

### Adaptive Sampling of Points for Faster Voronoi Diagram Construction

(Jan '25 - Present)

Advisor: Prof. M Ramanathan | Principal Investigator, Advanced Geometric Computing Lab, IITM

- Engineered an  $\mathcal{O}(n)$  **adaptive sampling algorithm** for 3 dimensional spheres to capture neighborhood information.
- Deployed CGAL along with my **algorithms in C++ to construct Voronoi diagrams of spheres** in quadratic time.

### Developing GNNs for Rainfall Stability Prediction Across India (GitHub Repository)

(Oct '24 - Present)

Advisor: Prof. R. I. Sujith | Institute Professor, Indian Institute of Technology Madras

Advisor: Dr. Gaurav Chopra | Assistant Professor, Indian Institute of Technology Delhi

- Developing a **GNN pipeline** to model long term dependencies in **complex precipitation time-series datasets**.
- Applying **GNNs to predict rainfall stability** across India in **27k+ locations** for better disaster management.

### Utilising DSMC Methods to Model Rarefied Gas Flow (GitHub Repository)

(May '24 - Jan '25)

Advisor: Prof. Meheboob Alam | Engineering Mechanics Unit, JNCASR

- Utilized SPARTA to simulate flows and **find the lift force on various bodies in Martian atmospheric conditions**.
- **Curated an extensive repository** of Martian atmospheric properties **from the last 50 years** of Mars missions.

### Studying Unsteady-Shock Boundary Layer Interactions

(Apr '24 - Sep '24)

Advisor: Dr. T M Muruganandam | National Centre for Combustion Research and Development, IITM

- Designed and tested an **experimental wedge mechanism** to create unsteady shocks at a frequency of **over 40 Hz**.
- Studied the **interaction of shocks and boundary layer** separation bubbles using techniques in **optical diagnostics**.

### Mechanical Engineering Internship

(Apr '23 - Oct '23)

Company: Krishaka

- **Crafted a mechanism to dig and transplant paddy crops in one motion** along multiple rows simultaneously.
- Developed a **CAD model** for an **autonomous electric vehicle** for paddy and groundnut crop agriculture.

## TECHNICAL PROJECTS

### Project Hydrochurn | Portable Water Filtration Bottle

(Apr '24 - Jul '24)

- Designed a portable water filtration system that utilizes a **UV filtration system with on-the-fly power generation**.
- Finished as **National Runner Up** in the James Dyson Challenge 2024 amongst all submissions in the India region.

- Engineered **India's first SRAD hybrid rocket** engine with liquid nitrous oxide as oxidizer and paraffin as the fuel.
- Secured **1st place in Asia** and **21st worldwide** in Spaceport America Cup 2023, a premier rocketry competition.

DiceForge Pseudo Random Number Generator

(Jan '24 - Apr '24)

- Spearheaded a team of 11 to **code a Pseudo Random Number Generator library in C++** ([GitHub repository](#)).
- Programmed a library that is **~8 times faster than the standard C++ implementation** and **~210% faster than C**.

Quantization and Pruning of Mobilenet V2 ([GitHub repository](#))

(Sep '25 - Oct '25)

Course : Systems Engineering for Deep Learning (CS6886)

- Successfully trained the Mobilenet V2 model on the CIFAR-10 dataset, achieving a **validation accuracy of ~90%**.
- Pruned, fine-tuned the model and quantized the weights to 8 bits** iteratively to obtain a compression of 3.3 $\times$ .

Credit Card Fraud Detection Using Machine Learning ([GitHub repository](#))

(Aug '25 - Sep '25)

Course : Data Analytics Laboratory (DA5401)

- Developed and tuned a classifier to **detect credit card fraudulent transactions** amongst European cardholders.
- Performed **class balancing** of the dataset using **Gaussian Mixture Models and SMOTE** and compared the results.

2D Steady-State Diffusion Solver in MATLAB ([GitHub repository](#))

(Aug '25 - Sep '25)

Course : Foundations of Computational Fluid Dynamics (AM5630)

- Wrote a **highly modular and fast solver** for 2D steady diffusion in MATLAB utilizing Gauss-Seidel iteration.
- Solved a **variety of problems and benchmarked the results**, verifying mesh independence and convergence.

## KEY COURSES AND SKILLS

Teaching Assistantships: Signals and Systems; Algorithms in Computational Geometry;Key CoursesComputational Sciences: Introduction to Scientific Computing; Algorithms in Computational Geometry; Foundations of Computational Fluid Dynamics;AI and ML: Foundations of Machine Learning; Machine Learning Practice; Data Analytics Lab; Systems Engineering for Deep Learning; Data Driven Modeling of Aerospace Systems and Complex Fluid Flows;Mathematics: Mathematical Foundations of Data Science; Linear Algebra; Differential Equations; Complex Analysis; Series and Matrices; Functions of Several Variables;Programming & Skills

- Programming Languages: Python (PyTorch and TensorFlow), MATLAB, C++, SageMath, GNU Octave, Bash
- Software: Fusion360, Ansys, ANSYS Fluent, L<sup>A</sup>T<sub>E</sub>X, MS Office Suite, NASA CEA, XFOIL, XFLR5

## ACHIEVEMENTS

- Secured **National Runner-Up** in the James Dyson Award for development of project Hydrochurn.
- Awarded the **Summer Research Fellowship 2024** by JNCASR among 63 students nationwide
- Achieved **1st place in Asia** and **21st worldwide** at the Spaceport America Cup 2023 with Team Abhyuday.
- Secured **top 0.45%** in JEE Main and **top 0.28%** in JEE Advanced among **~1 million students** in India
- FIDE rated classical chess player** with a rating of 1443

## EXTRA-CURRICULAR ACTIVITIES

- Head of the Mathematics Club**, encouraging the students of IITM to pursue math in novel and intuitive ways
- As a **Student Mentor**, provided guidance and support to a group of newly admitted students
- Trained violinist** in both Carnatic and Classical styles of play
- Selected among few freshmen for the Basketball training camp as part of NSO