Anirud Nandakumar

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EDUCATION

Indian Institute of Technology Madras — Chennai, India
M.Tech in Data Science (Interdisciplinary Dual Degree 5-year Program), CGPA:9.1/10 — *Jan 2024- July 2026*

Indian Institute of Technology Madras — Chennai, India
B.Tech in Civil Engineering, CGPA:9.1/10 — *Nov. 2021 - July 2026*

SCHOLASTIC ACHIEVEMENTS

- Secured an All India Rank of **4934** in the **IIT-JEE Advanced 2021** from over **120 thousand** candidates
- Bestowed the **KVPY Fellowship 2021** by IISc Bangalore, placed in the **top 1%** among **150,000 applicants**
- Nominated by IIT Madras for **OPJEMS Scholarship 2022** for securing **Department Rank 1** in 2021-22
- Awarded the **Merit Cum Means Scholarship** by **AT&T Global Network Services India Pvt Ltd**, selected as one of the top **25** students out of **1200** across all departments of IIT Madras for the academic year 2024-25

EXPERIENCE

Visiting Student Researcher, University of California, Riverside — UC Riverside, CA, US
Guided by Prof. Viswanath Saragadam and Prof. Amit K Roy-Chowdhury — *June 2025 - Present*
- Working on 3D thermal imaging, to develop a thermal simulator for training autonomous agents
- Developing algorithms for SFM and 3D reconstruction and novel view synthesis using thermal imagery

Research Intern at Lab for Imaging Sciences and Algorithms — IISC Bangalore, India
Collaboration with Continental Automotive, Guided by Prof. Kunal Narayan Chaudhury — *Dec 2023 – Jan 2024*
- Developed a selective region-based algorithm to enhance visibility in low-light images of outdoor road conditions
- Designed **brightness-based masking** using a **convergence loss**; currently preparing for publication

Visiting Student Intern, Purdue University — Purdue University, IN, US
Guided by Prof. Darcy Bullock, Joint Transport Research Program — *May 2024 - July 2024*
- Data analytics to estimate hard braking events across a **157-mile** segment of US-30 in collaboration with **INDOT**
- Identified critical sections to enhance road safety based on monthly analysis of normalized hard braking events

PUBLICATIONS

- **Fusion of Thermal and RGB Images for Traffic Object Detection**
  Anirud Nandakumar, Prof. Lelitha Devi Vanajakshi, Prof. Chandrashekar Lakshminarayanan
  Accepted in the 3rd International IEEE Applied Sensing Conference (APSCON), 2025
- **Events Data Guided Deblurring and HDR Novel View Synthesis**
  Sally Khaidem*, **Anirud Nandakumar***, Prof. Mansi Sharma, Prof. Kaushik Mitra
  Under Submission
  *Equal Contribution
- **Reinforcement Learning Based Traffic Signal Design to Minimize Queue Lengths**
  Anirud Nandakumar, Prof. Lelitha Devi Vanajakshi, Dr. Chayan Banerjee
  Under Submission

RESEARCH PROJECTS

Event-Camera Guided Deblurring and HDR Novel View Synthesis — IIT Madras
Advised by Prof. Kaushik Mitra, Computational Imaging Lab — *Aug 2024 - Present*
- Developed Novel view synthesis and **HDR** reconstruction using **NeRFs** using event-based self-supervised learning
- Designed a non-learning-based deblurring of RGB frames using event camera data, improved results over SOTA

Reinforcement Learning Based Traffic Signal Design to Minimize Queue Lengths — IIT Madras
Advised by Prof. Lelitha Devi Vanajakshi and Dr. Chayan Banerjee — *Jan 2025 - Present*
- Introduced a novel RL-based TSC to minimise the queueing in signals and integrated with SUMO traffic simulator
- Superior performance as compared to traditional Traffic Signal Control methods and alternate reward formulations

Fusion of Thermal and RGB Image for Traffic Information — IIT Madras

Advised by Prof. Lelitha Devi Vanajakshi and Prof. Chandrashekar Lakshminarayanan — *August 2023 - May 2024*

- Introduced a new **RGBT YOLOV-8** architecture for traffic object detection, displaying superior performance
- Implemented **pixel-level**, **feature- level**, and **decision-level** fusion, and compared their performance

Adversarial Offline RL with Reverse Model Imagination — IIT Madras

Advised by Prof. Balaraman Ravindran (Course: Recent Advances in Reinforcement Learning) — *August 2024 - Present*

- Introduced an **adversarial reverse imaginatio**n-based **offline RL** framework, trained using **Soft Actor Critic**
- Designed **reverse dynamics** and **reverse rollout** model, to enhance the synthetic dataset for training.

Video Captioning for Movies — IIT Madras

Advised by Prof. Pravin Ramachandran Nair (Course: Advanced Topics in Artificial Intelligence) — *Jan 2024 - May 2024*

- Developed a **multi-modal** pipeline using frame sampling (optical flow, embeddings) and cascaded **LLaVA**.
- Generated **progressive captions**, structured summaries, and **detailed narratives** directly from video content

COURSE PROJECTS

Reinforcement Learning — IIT Madras

Advised by Prof. Balaram Ravindran — *Jan 2024 - May 2024*

- Employed **Temporal Difference Algorithms** such as **Sarsa** and **Q learning** to solve Grid World problems
- Implemented **1-Step SMDP**[8] and **Intra option Q** Learning to solve the Open AI Taxi V-3 Environment

Pattern Recognition and Machine Learning — IIT Madras

Advised by Prof. Arun Rajkumar — *Jan 2024 - May 2024*

- Implemented unsupervised learning algorithms such as **K-means, Spectral clustering, EM algorithm**
- Developed spam classifier using **Naive Bayes, Perceptron,** and **Ensemble methods,** achieving **94%** accuracy

TECHNICAL SKILLS

Languages: Python, SQL, R, C, C++, , LaTeX
Libraries Frameworks: PyTorch, TensorFlow, NumPy, Pandas, OpenCV, etc
Analysis Simulation: MATLAB, Simulink, PTV Vissim, Ansys Workbench, Abaqus
CAD Modelling: SolidWorks, Autodesk Fusion 360, Autodesk Inventor, AutoCAD, Revit
Core Concepts Tools: Deep Learning, Computer Vision, Data Structures Algorithms, Linux, MS Office Suite

RELEVANT COURSES

Mathematical Background: Linear Optimization, Linear Algebra, Probability, Statistics, and Stochastic Processes
Machine Learning: Pattern Recognition and Machine Learning, Reinforcement Learning, Deep Learning for Imaging, Recent Advances in Reinforcement Learning, Medical Image Analysis, Advanced Topics in Artificial Intelligence
Civil Sciences: Computer Applications in Traffic & Highway Engineering, Highway Engineering, Traffic Engineering, Water Resources Engineering, Hydraulic Engineering

POSITIONS OF RESPONSIBILITY

Chassis & Drivetrain Engineer - Raftar Formula Racing — IIT Madras

Advised by Prof. Satyanarayanan Seshadri — *Mar'22 - Sept'23*

- Ensured that the **Chassis subsystem** adhered with the **design timeline** decided upon by the team
- Devised **procurement** and **resource allocation strategy** for the **7-member Drivetrain** vertical

Sponsorship, PR and Media Manager - Raftar Formula Racing — IIT Madras

Advised by Prof. Satyanarayanan Seshadri — *Jun'22 - Sept'23*

- Presented the team's vision at **Umagine 2023**, Asia's largest tech Summit , to an audience of **150+** companies
- Enhanced team outreach upto **1.5 million** via social media, website, prestigious news channels and conferences

CO-CURRICULAR AND EXTRA-CURRICULAR ACTIVITIES

- Overall **3rd Place** in the **Electric** category in the **Nationwide FSAE** competition held at Kari Motor Speedway
- Recognised by the International Chess Federation as an official FIDE-rated player with an ELO rating of 1479
- Ranked top 30 out of 200+ candidates, selected for NSO Cricket training in the first year of BTech (2022)