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 review for IEEE Access
  *Equal Contribution
- **Reinforcement Learning Based Traffic Signal Design to Minimize Queue Lengths**
  Anirud Nandakumar, Prof. Lelitha Devi Vanajakshi, Dr. Chayan Banerjee
  Under submission for IEEE Transactions for ITS

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)