SHRINIDI KUPPURAJAN | ME22B018|

INDIAN INSTITUTE OF TECHNOLOGY, MADRAS

Citizenship: United Kingdom Phone: +91 9677619884 E-mail: shrinidi20@gmail.com

EDUCATION

Program	Institution	%/CGPA	Completion
B.Tech **Mech Engg (Hons.)**, Minor-**AI & ML**	Indian Institute of Technology, Madras	8.58/10.0	2026
Class XII, CBSE	Suguna Pip School, Coimbatore	96.8%	2022
Class X, CBSE	Suguna Pip School, Coimbatore	96.6%	2020

ACADEMIC ACHIEVEMENTS

- Secured an all India rank of **2109** (top 1.5 percentile) in **IIT-JEE Advanced 2022** from over **150 thousand** candidates
- Secured an all India rank of **2785** (top 0.3 percentile) in **IIT-JEE Mains 2022** among more than **1 million** applicants
- Recipient of **National Talent Search Examination (NTSE) Scholarship** in 2020, ranked in the **top 0.2% of 1 million**
- Secured an international rank of **20** (top 0.002 percentile) in the **SOF International Mathematics Olympiad 2019**

TECHNICAL SKILLS

- **Modelling:** Autodesk Inventor, Solidworks, Autodesk Fusion 360, Optimum Kinematics
- **Analysis and Simulations:** MATLAB, Simulink, Simscape, Gazebo, OpenAI Gym, PyBullet, ANSYS IDE
- **Programming Languages:** Python, MATLAB, ROS2, C, C++, Java, Octave, LaTeX

RESEARCH PROJECTS

SWARM INTELLIGENCE - THESIS PROJECT — AUG 2025 - PRESENT

Guide: Dr. Anuj Tiwari, Distributed Intelligence & Robotics Lab, Department of Mechanical Engineering, IIT Madras

- Implemented **MAPPO** based distributed learning drone network and optimized reward function for formation pinning
- Designed an **options framework** for **leader shielding** & **re-elections**, developed **heuristics** for efficient option calls
- Created 'Aviary' env for **PyBullet** simulations and generalised policy training by domain randomization for Sim2Real

FLOW ACCELERATED BEHAVIOR CLONING — AUG 2025 - PRESENT

Guide: Dr. Balaram Ravindran, Head of Data Science & Artificial Intelligence Department, IIT Madras

- Surveyed IL methods & identified limited implementations for datasets with unlabeled & unsafe trajectories (D^U, D^N)
- Proposed **SafeGenClo**, an Energy weighted flow matching model for BC to generate trajectories guided by InfoNCE
- Presently, benchmarking proposed model against SafeDICE and similar baselines, and compiling performance results

VEHICLE DYNAMICS & CONTROLS - FORMULA STUDENT

Guide: Dr. Satyanarayanan Seshadri, Energy & Emissions Laboratory, Department of Mechanical Engineering, IIT Madras

- VEHICLE MODELING — FEB 2024 - NOV 2024
  - Evaluated various **MATLAB Simulink** models for testing and tuning the car to increase cornering speed and stability
  - Iterated over and finalized a **45% Lateral Load Transfer Distribution** to achieve the target of a neutral steering car
  - Developed a **Torque Vectoring System** using **model predictive control** and **PI** to dynamically regulate **vehicle yaw**
- PROGRESSIVE MOTION RATIO ROCKER DESIGN — FEB 2023 - APR 2024
  - Modeled the kinematics of a **double-wishbone** system to track spring-damper actuation through various ride heights
  - Designed a **rocker** with a **progressive motion ratio** to improve handling & greater adaptability for an FSAE vehicle
  - Performed **Finite Element Analysis** and achieved fatigue safety factor of **1.3** after **1.4 million fully-reversed cycles**

COURSE PROJECTS

DISTRIBUTED EMPHATIC REINFORCEMENT LEARNING — JUL 2025 - PRESENT

Guide: Dr. Anuj Tiwari, Distributed Intelligence & Robotics Lab, Department of Mechanical Engineering, IIT Madras

- Extended **emphatic temporal-difference** learning to the multi-agent setting for stable off-policy policy evaluation
- Implemented a **multi-agent off-policy actor-critic** algorithm using emphatic weightings with convergence guarantees
- Conducted empirical evaluations on synthetic MDPs, validating theory & demonstrating **distributed consensus learning**

EXPERIMENTS WITH GENERATIVE MODELS — AUG 2025 - PRESENT

Guide: Dr. Balaram Ravindran, Head of Data Science & Artificial Intelligence Department, IIT Madras

- Surveyed state-of-the-art generative planners & identified potential performance gains with **Past-Token Prediction**

- Developed a flow matching pipeline calling PTP for long-context planning & elevating temporal consistency in actions
- Implemented PTP+flow models on long-horizon tasks(PushT, Franka Kitchen), surpassing baseline diffusion policies

Reinforcement Learning Control Algorithms — Jan 2025 - May 2025

Guide: Dr. Balaram Ravindran, Head of Data Science & Artificial Intelligence Department, IIT Madras

- Developed an options learning framework using **SMDP**, **Intra-option Q learning** to solve the OpenAI gym Taxi Env
- Designed special exploratory options for the agent in the **hierarchical framework** to reliably solve the Taxi domain
- Implemented **MC-REINFORCE** & **DDQN** for continuous cartpole & acrobat env, tuned network hyper-parameters

Modern Control Theory — Jul 2024 - Nov 2024

Guide: Dr. Kallol Roy, Department of Chemical Engineering, IIT Madras

- Modeled the non-linear 4-tank system with ODEs and estimated water heights using **EKF** and **SIR Particle Filters**
- Implemented **constrained** for the same, analyzing stability and pole-zero behavior across operating scenarios
- Analyzed the impact of the EKF performance on Model Predictive Control by varying key **Kalman gain parameters**

Algebraic Multigrid Solver — Jan 2025 - May 2025

Guide: Dr. Kameswararao Anupindi, Department of Mechanical Engineering, IIT Madras

- Developed a **transient SIMPLE** CFD solver with **Algebraic Multi-grid** acceleration to model flow in a lid-driven cavity
- Applied **QUICK** scheme for spatial discretization on finest grid to reduce numerical diffusion and improve accuracy

Professional Experience

Implementation of Dark Warehouse - Hindustan Unilever Limited

Guide: Santosh Gupta, Supply Chain Manager, Hindustan Unilever Limited, Hardiwar

- Automated In-Line Quality Check — May 2025 - July 2025
  - Implemented a **ResNet-50** framework **CNN** for image classification in quality inspection to satisfy CRQS properties
  - Curated a **custom image dataset** with **multiple failure labels** achieving **94%** testing accuracy & **76.2%** for validation
  - Optimized operations by conceptualizing an **automated in-line rejection system** utilizing precision vacuum grippers
- Optimization of Truck Layout — May 2025 - July 2025
  - Implemented a truck layout optimizer using **DeepPack3D**'s **DQN**-based DRL framework for mixed-load scenarios
  - Built a **web app** using **ngrok** to determine optimal truck size, pallet order and generate optimized 3D cargo layouts

Relevant Courses

- Introduction to Reinforcement Learning
- Recent Advances in Reinforcement Learning
- AI: Search Methods for Problem Solving
- Machine Learning Techniques
- Synthesis of Control Systems
- Modern Control Theory
- Network Dynamics & Control
- Multivariate Data Analysis for Process Modeling

Positions of Responsibility

Design & Cost Lead Raftar Formula Racing — Jan 2025 - Apr 2025

- Integrated **system goals** of the Vehicle Dynamics, Powertrain, Structure, Driver Interface and LV Electronic modules
- Prepared **Gantt** charts, **WBS** charts & a **Costed Bill of Material** to ensure the vehicle targets were achieved efficiently

Co-Curricular and Extra-Curricular Activities

- Formula Student Germany 2024 — Aug 2024
  - Represented India at **FSG24** as a **2nd year EV**, qualifying in the **top 10** globally, among 80+ Formula Student teams
  - Won **4th** place globally in **MathWorks Modelling & Simulation Award** and **6th** in the **Cost & Manufacturing Event**
- Formula Bharat 2025 — Jan 2025
  - Secured an **Overall 2nd Place (Electric)** and **1st place** in the Statics category in the **Nationwide FSAE competition**
  - **Winner** of the **Engineering Design Challenge**, **Best Battery Pack Design award** and **Cost & Manufacturing award**
  - Won 3rd place in **MathWorks Skidpad Simulation Challenge** for optimized **torque vectoring** & **velocity estimation**
- AI Hackathon — Aug 2025
  - Built a multi-modal AI agent using **YOLOv8** & **IndicBERT** for plant disease detection and multilingual query handling
  - Trained large-scale predictive models on agricultural big data (KCC, AgMarknet) using **PySpark** for agro-forecasting
  - Packaged AI pipelines by integrating vision & NLP models into a React app for image capture and real-time diagnosis
- Nidar (Drone Federation of India) — Oct 2025
  - Implemented **YOLOv8 CNN** framework to detect and label diseased crops, achieving an inference accuracy of **87%**
  - Deployed the prediction bundle on a ground station & established comms for live inference, **accurate geotagging**