

Utsab Karan

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EDUCATION

Indian Institute of Technology Kharagpur

Integrated M.Tech in Electronics & Electrical Communication Engineering; GPA: 9.50/10
Specialization in **Vision and Intelligent Systems**

Kharagpur, India

Aug. 2023 – Present

EXPERIENCE

Vision and Artificial Intelligence Lab, CDS Department

Research Intern | Guide: Prof. Venkatesh Babu

Indian Institute of Science

May 2026 – Present

- Benchmarked SOTA data pruning strategies on **ImageNet** and **CIFAR-100** using **ResNet** architectures.
- Working on **continual** and **data efficient learning** methods for vision models, analysing effects on **data scaling**

Autonomous Robots and Multi-robot Systems Lab, SysCon

IIT Bombay

Research Intern | Guide: Prof. Leena Vachhani

May 2025 – Dec. 2025

- Simulated crowd environments in **Gazebo/ROS2**, analysing human-robot interaction scenarios with SFM metrics
- Worked on gap-based **topological mapping** with safe kinodynamically feasible planning and control.
- Validated exploration and navigation algorithms on **TurtleBot3** hardware, benchmarking against **APFs**

Autonomous Ground Vehicle Research Group

IIT Kharagpur

Vision Head | Guide: Prof. Debashish Chakravarty

Apr. 2024 – Present

- Deployed **monocular depth** estimation models and compared outputs with Intel RealSense **stereo depth**.
- Pipelined ArUco marker detection, grid mapping and autonomous navigation for **TurtleBot** simulations.
- Developed **Pure Pursuit** and **Stanley** controllers for F1tenth racing simulations
- Tested RL algorithms including **DQN**, **A2C** and **PPO** on OpenAI Gymnasium environments.

PUBLICATIONS

- Schneider, Canzano, Hou, Peng, Deepu, **Karan**, et al. "Visual Robustness and Neural Alignment in a Shared Foraging Task: The Mouse vs. AI Benchmark." **NeurIPS 2026 Evaluations and Datasets Track**(Under Review). [[Paper](#)]
- Moshayedi AJ, Roy AS, **Karan U**, Zhang M, Bassir D. "An Integrated Beetle Antennae Search-Enabled Navigation Framework for Omnidirectional AGV Mobile Robots in Unknown Environments". **EAI Endorsed Transactions on AI and Robotics** 2026. [[Paper](#)]
- K. Trivedi, **U. Karan**, A. Sudarshan and L. Vachhani. "Safe Indoor Exploration and Sparse Topological Mapping with Integrated Planning and Control," *11th Indian Control Conference (ICC)*, Bangalore, India, 2025. [[Paper](#)]

PROJECTS / COMPETITIONS

AlphaZero Implementation for the Black-Hole Game [[Link](#)]

IIT Kharagpur

The KGPian Game Theory Society

Jan. 2026 – Feb. 2026

- Implemented a custom **Gymnasium** environment and trained a Deep Q-Network agent via **self-play** RL
- Extended to AlphaZero-style framework with a **dual-headed** ResNet network and **MCTS-guided** action sampling
- Parallelized self-play games for faster replay buffer accumulation and convergence of the learned policy

Diffusion Language Model from Scratch [[Link](#)]

IIT Kharagpur

Self Project

Dec. 2025 – Present

- Implemented a continuous **diffusion-based** language model with a **BERT**-style (~15M parameter) denoiser network
- Implemented end-to-end embedding learning, **posterior regularization** and clamping-based decoding
- Trained on **ROCStories** and **E2E** datasets, analyzing token clusters via t-SNE and optimizing for training stability

Monocular Depth Estimation for Edge Devices [[Link](#)]

IIT Kharagpur

Autonomous Ground Vehicle Research Group

Sept. 2025 – Nov. 2025

- Implemented a **UNet** style (~3.5M parameter) depth estimation model with a pretrained **MobileNetv2** encoder
- Designed a light-weight **4-stage** decoder with skip connections, **inverted residuals** and **pixel shuffle** upsampling
- Trained with a joint depth and segmentation based log-space **BerHu** loss on the **KITTI** and **CityScapes** datasets

Beetle Antenna Search Optimisation for Robotic Navigation [[Link](#)]

Oulu University

Remote Collaboration | Prof. Ata Jahangir Moshayedi

June. 2025 - Aug. 2025

- Implemented the Beetle Antenna Search(BAS) algorithm for optimising **PID** based controls
- Developed a BAS optimised **A* - path planning** algorithm for obstacle avoidance and safe navigation back to track
- Tested and compared **robustness** of the proposed framework across different environment difficulty configurations

Pure Pursuit Controller — F1Tenth [\[Link\]](#)

Autonomous Ground Vehicle Research Group

IIT Kharagpur

Aug. 2024 – Sept. 2024

- Designed a Pure Pursuit controller for **F1Tenth** racing simulations.
- Evaluated performance across multiple tracks using **RViz** and large waypoint datasets.
- Integrated ROS libraries, transformations, message formats and node parameters.

COURSEWORK

Department Courses: Advanced Calculus, Numerical Analysis, Probability and Statistics, Linear Algebra, Optimization Methods, Analog Circuits, Digital Electronics, Network Theory, Signals and Systems, Systems and Control, Electromagnetic Engineering, Communication-I, Communication-II, Digital Signal Processing - I, Digital Signal Processing - II, Algorithms, RF and Microwaves, VLSI Design, Computer Architecture

Electives: High Performance Scientific Computing, Information Theory and Coding

Others: Game Theory-I (Stanford), Programming for Robotics (ETH Zurich), CS182(UCB): Deep Learning, CS285(UCB): Deep Reinforcement Learning, Flow Matching and Diffusion Models(MIT 6.S184)

TECHNICAL SKILLS

Languages: Python, C/C++, CUDA C, Arduino, Verilog, OpenMP, MPI

Libraries: NumPy, Pandas, PyTorch, Matplotlib, OpenAI Gymnasium, D4RL

Frameworks/Software: ROS1/ROS2, Gazebo, RViz, Vivado, LTSpice, Simulink, Docker, Git, Linux

ML/DL: CNNs, Transformers, Diffusion, Generative Modelling, ResNets, RL, Imitation Learning

AWARDS AND ACHIEVEMENTS

- **2nd** in Robust Visual Foraging Competition @ **NeurIPS 2025** [\[Link\]](#)
- **5th** in Qualification and **7th** Globally — Roboracer Sim Racing League @ **CDC-TF 2025** [\[Link\]](#)
- **4th** place in Hardware Modeling in **General Championship 2025** [\[Link\]](#)
- **1st** in Qualification and **9th** Globally — Roboracer Sim Racing League @ **ICRA 2025** [\[Link\]](#)
- Ranked **15** among 124k candidates in **WBJEE 2023**
- Ranked **1784** among 1.27M candidates in **JEE Mains 2023**
- Ranked **1596** among 190k candidates in **JEE Advanced 2023**

EXTRACURRICULARS

- I am the current **President** of the **KGPian Game Theory Society**. Previously helped organize events like Treasure Hunt and Stratathon which saw participation of 700+ students promoting the art of strategic thinking. I have also headed the Academic Team in their research endeavors in the domain of **game theory** and decision-making.
- Participated in Tech Quiz, Biz Quiz and Basketball in Inter-Hall General Championships. I also led the **Hardware Modeling** Team of my Hall and secured 3rd position(unofficial) in the General Championship 2026.