# Kushal Kedia

kushal.k.2000@gmail.com · kushal2000 · Kushal · Website · Scholar

## Research Interests

**Robotics & AI:** Motion Planning, Multi-Agent Systems, Machine Learning, Human Robot Interaction

## Academics

**B. Tech in Electronics & Communication** **2018 - 2022**
Indian Institute of Technology, Kharagpur 9.56/10

## Publications Under Review

1. K. Kedia, R. Jenamani, A. Hazra, and P. Chakrabarti. Optimal Multi-Agent Path Finding for Precedence Constrained Planning Tasks. [Submitted to AAMAS 2022] [PDF]
2. T. McMahon, A. Sivaramakrishnan, K. Kedia, and K. Bekris. Terrain-Aware Learned Controllers for Kinodynamic Planning over Physically Simulated Terrains. [Submitted to ICRA 2022]

## Peer-Reviewed Workshop Papers

1. K. Kedia*, R. Jenamani*, R. Kumar*, and P. Mall*. Robotic Motion Planning Using Learned Critical Sources & Local Sampling. In *MLPC Workshop*, ICRA 2020 [PDF] [Video]
2. K. Kedia and A. Nandy. Offensive Language Identification in Dravidian Languages. In *First Workshop on Speech and Language Technologies for Dravidian Languages*, EACL 2021 [PDF]

## Research Experience

**Pracys Group - Rutgers University** *Guide: Kostas Bekris* *Mar '21 - Current*

- *Objective:* To learn heuristics for kinodynamic motion planning in non-holonomic robotic systems
- Generated a dataset of trajectories using a **SAC-HER** controller for first & second order cars
- Built a network to predict the cost-to-go using the start & goal states of the system

**Microsoft Research Labs India** *Mulitlingual NLP Intern* *April '21 - July '21*

- Identified a set of features that could influence the downstream task performance of a model on target languages and built a predictive model (XGBoost) using those features
- Analysing predictive model using multiple scenarios with few data points available in target language

**Kharagpur RoboSoccer Students Group** *3-D Simulation Humanoid Team* *Feb '19 - Mar '21*

- Worked on skills like passing & defense on top of **C++** framework to enhance game strategy for Robocup
- Optimized parameters of walk-engine using **CMA-ES**; increased speed of humanoid from 5m/s to 9.5m/s
- Developed environment using **PyBullet** to train end to end walk-engine for 22 DOF humanoid robots

## Teaching Positions

**Head, Technology Robotix Society, IIT Kharagpur**

Leading a 3-tier team to execute the annual Robotix fest & conducting workshops; In charge of Makerspace - an open source lab for robotics enthusiasts seeking guidance & components

**IEEE Mentor, Winter School of AI & Robotics, IIT Kharagpur**

Mentored 100+ students in week-long workshops on Machine Learning & Image Processing

## Projects

**Optimal Collaborative MAPD** *Guide: Prof. Partha Pratim Chakrabarti* *Jan '21 - Current*

- Designing optimal algorithms for the problem of sequential task assignment and collision-free routing for large teams of robots in applications with inter-task precedence constraints
- Introduced collaboration constraints between agents to ensure same time of pickup and delivery

**Semi-Supervised Hate Domain Adaptation** *Guide: Prof. Animesh Mukherjee* *Jan '21 - Apr '21*

- Used a model trained on rationale-annotated hate-speech classification dataset for domain adaptation
- Implemented entropy based SSDA algorithms to improve performance in low-resourced target domain

**Annotator Influence on Hate-Speech Detection** *AI Ethics Term Project* *Jan '21 - Apr '21*

- Analysed the influence of demographic attributes (like gender, race, religion etc.) of the annotators on hate speech detection by ablation studies
- Showed there was no bias in presentation of the data to the annotators; individual judgement differed

**Leveraging Experience for Motion Planning in Complex Environments** *Dec '19 - July '20*

- Designed efficient planning algorithms that exploit samplers learnt from experience. Learned model used global features to find bottleneck-regions and local samplers connected these regions.
- Improvement of 30% in success rates was observed in 2-D and 7-D robotic manipulation tasks [3]

**Exploiting Code-Switching Patterns in NLP** *Guide: Prof. Animesh Mukherjee* *May '20 - Dec '20*

- Formulated 24 handcrafted features based on code switches and language spans in sentences
- Concatenated features with BERT embeddings improving F1 scores by 10% in 3 classification tasks

**RRT* Simulator on Turtlesim** *Personal Project* *Feb '19 - Mar '19*

- Developed interactive GUI to simulate growth of RRT* avoiding obstacles using **OpenCV**
- Controlled movement from start to goal using a P-controller and animated the path in **ROS** Turtlesim

## Technical Skills

**Programming Languages:** Python | C | C++ | MATLAB

**Libraries & Tools:** ROS | PyTorch | Keras | Tensorflow | OpenCV | Scikit-Learn | PyBullet | NetworkX | Unix

## Relevant Coursework

**Programming:** Computer Vision | Machine Learning | AI & Ethics | Information Retrieval | Data Mining

**Others:** Probability & Stochastics | Microcontrollers | Network Theory | Signals & Systems | Control Systems

## Achievements

- **Top 1% among 1400+** undergraduate students in the institute; **Ranked 5th** in department
- Part of **bronze-winning** contingent at the 9th Inter-IIT Tech-Meet
- Awarded **KVPY 2018 fellowship** by the Department of Science & Technology, India
- Among top 10 teams in the world that qualified for **RoboCup Humanoid League, 2021**
- Felicitated by **Chief Minister** of West Bengal for outstanding academic performance in ISC 2018

## Extra-Curricular Activities

- Proposed a **bluetooth communication service** during disasters in **IBM Green Hackathon** in Feb 2020
- **Semi-Finalist** in the XRIG FIFA Tournament at Spring Fest 2020, IIT Kharagpur
- Tennis Player under the **National Sports Organisation (NSO)** India