VISWESH N

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Education

Indian Institute of Technology Kharagpur   **April 2024**
Major: B.Tech. Electrical Engineering | **Minor:** Computer Science and Engineering   GPA - 8.59/10.0

Research Interests

Robotics | Reinforcement Learning | State Estimation | Perception | Motion Planning | Automation

Publications

1. [RE] "From Goals, Waypoints & Paths To Long Term Human Trajectory Forecasting" **Link**
Accepted at ReScience C 2022

2. [RE] "Cross Layer Refinement Network for Lane Detection" **Link**
Submitted at ML Reproducibility Challenge 2022

Experience

University of Toronto   **Toronto, Ontario**
Research Intern | Toronto Intelligent Systems Lab | Prof. Igor Gilitschenski   *May 2023 – Present*
- Experimenting on a 2-stage pipeline for online dynamics estimation of an autonomous vehicle in unforseen environments
- Optimized the pipeline to achieve MSE values of 0.0037 for short term prediction and 0.0069 for long term prediction
- Benchmarked the results on a 1/10th scale autonomous car and implemented the ROS stack to visualize the results

University of California, Berkeley   **Berkeley, California**
Research Intern | Mechanical Systems Control Lab | Prof. Masayoshi Tomizuka   *Dec 2022 – Jun 2023*
- Proposed the Influence Index, novel scalar metric to quantify coordination levels between two-agents in MARL tasks
- Implemented Population play and Fictious Co play multi agent methods to obtain rewards of 118 and 124 on meltingpot
- Reproduced the results of the overcooked-ai work aimed to demonstrate behaviour cloning in Human - AI coordination

Indian Institute of Science Bangalore   **Bangalore, India**
Research Engineer Intern | Stochastic Robotics Lab | Prof. Shishir Kolathaya   *May 2022 – Oct 2022*
- Benchmarked the Soft Actor Critic algorithm on the Stochlite quadruped in Isaac Gym to achieve a reward of over 350
- Explored gradient free methods such as the Augmented Random Search for end-foot trajectory generation of Stochlite
- Worked on the ROS framework, Gazebo and RViz visualization of the Stochlite quadruped to implement off policy ARS

Drive Analytics   **Chennai, India**
Deep Learning and Computer Vision Intern | [Certificate]   *Dec 2021 – Feb 2022*
- Developed an end-to-end pipeline for the detection of basketballs using YOLOv5 in real-time to obtain an mAP of 80%
- Generated a dataset using tracking algorithms and benchmarked several object detection algorithms on the same

Autonomous Ground Vehicle Research Group   **IIT Kharagpur**
Undergraduate Researcher | [Certificate] | Prof. Debashish Chakravarty   *May 2021 – Present*
- Benchmarked basic planning and and path tracking algorithms such as Stanley, Pure pursuit for traversal on turtlebot3
- Implemented and tested various CNN architectures including ENet, UNet, VGGNet and AlexNet on standard datasets
- Inducted a team of freshmen after rigorous task rounds; guiding the trajectory prediction and control systems module

Projects

Adobe Behavior Simulation Challenge | [Github] [Paper]   **Oct 2023 - Dec 2023**
Winner | Inter IIT Tech Meet 12.0
- Explored finetuning LLaVA-1.5, LLaMA-2, and NExT-GPT LLMs using Keyword Retrieval and UCB Bandit methods
- Proposed a transformer-MLP based framework to to leverage BLIP-2 embeddings and BERT tokens for predicting likes
- Implemented a neural ensemble of six different models to model temporal, visual and textual information in tweets

A Multi-Agent Multi-Task Reinforcement Learning Framework | [Paper]   **Aug 2023 – Present**
- Proposed an extension of the DreamerV3 work for multi-agent settings, incorporating SF-GPI for Multi-Task RL
- Explored Transformers for latent vector embedding and investigated SP, PP and FCP Multi-Agent RL methods
- Benchmarked the DreamerV3 pipeline on various tasks including the Proprio Control Suite, Atari 100k and Atari 200M
- Conducted a thorough literature survey on Multi-agent, Model-based and Multi-task Reinforcement Learning methods

Reinforcement Learning for bipedal walking | [Presentation] [Paper] [Video]   Aug 2022 – Oct 2022
- Implemented reward shaping and integrated with ray rllib to ensure stable convergence using 5 different seeds
- Implemented the Proximal Policy Optimization algorithm on the BipedalWalker-v2 environment on OpenAI Gym
- Performed hyperparameter search and implemented generalized advantage estimation to achieve average reward of 386

Reproduction of a trajectory prediction architecture   Oct 2021 – Feb 2022
Machine Learning Reproduciblity Challenge 2022 | Guide: Dr. Debashish Chakravarty
- Reproduced the results of a paper based on Y Net, a trajectory prediction architecture for pedestrians
- Performed ablation studies, hyperparameter search and preprocessed raw InD , ETH/UCY and SDD datasets
- Proposed a novel transfer learning experiment that improved on state of the art methods to achieve an ADE of 4.59

Localization and Mapping of an Autonomous Racing car | [Github]   Jul 2021 – Aug 2021
Indy Autonomous Challenge 2021 | Guide: Dr. Debashish Chakravarty
- Used PointCloud and Odometry data from Carla Simulator and generated PCD files of the map in Open3D
- Implemented KD-tree search algorithm to obtain the local map of the autonomous racing vehicle to optimize ICP
- Implemented ICP Algorithm to localize the vehicle and achieved an improvement of 20cm over Odometry data

Unmanned Rover for Astronaut Assistance   May 2021 – Dec 2021
University Rover Challenge 2022 | Guide: Dr. Debashish Chakravarty
- Developed the ROS2 packages to implement the Ackermann steering drive system for an unmanned rover
- Performed static and dynamic simulations of the rover to optimise for load carrying, gradeability and handling.

Hand Gesture controlled bot | [Github] [Presentation] [Video]   Jun 2021 – Jul 2021
- Used Mediapipe to translate over 6 hand gestures into translation and rotational actuations of a two-wheeled robot
- Benchmarked on hardware successfully to achieve translation,rotation clawing of objects for industrial manipulation

Technical Skills

Languages and Frameworks: C, C++, Python, MATLAB, Git, ROS, ROS2, RViz, Gazebo
Libraries: Eigen, PyTorch, Numpy, ,TensorFlow, OpenCV, matplotlib, pandas, Arduino, Open3D, PCL, wandb
CAD/CAE: Simulink, TinaTI, LTSpice, Proteus, Solidworks, AutoCAD, Circuit Maker
Simulations: Gazebo, CARLA, OpenAI Gym, NVIDIA Isaac Gym **Others**: LaTex,

Relevant Coursework

Software:Deep Learning Foundations, Programming and Data Structures, Artificial Intelligence, Reinforcement Learning
Mechatronics: Signals and Systems , Basic Engineering Mechanics , Analog Electronic circuits , Digital Electronic circuits
Robotics: Programming for Robotics- ROS , Autonomous Robotics
Mathematics: Advanced calculus, Linear Algebra, Numerical analysis, Probability and Statistics, Stochastic Processes

Teaching Experience

Mechatronics and Deep Learning Mentor   IIT Kharagpur
Autonomous Ground Vehicle Research Group   *May 2022 - Present*
- Mentoring a team of 18 freshmen on introductory robotics work in the domain of computer vision and control systems

Student Mentor, Electrical Engineering   IIT Kharagpur
Student Welfare Group, IIT Kharagpur | [Certificate]   *Nov 2022 - July 2023*
- Mentored 4 freshmen of the Electrical Engineering department at IIT Kharagpur for improved academic performance

Autonomous Robotics Mentor   IIT Kharagpur
IEEE Winter Workshop | [Certificate]   *April 2022*
- Mentored 160+ first year students in robotics by teaching them about ROS, RViz, Gazebo and Arduino basics

Achievements

- Received the presitigous **MITACS GRI 2023** scholarship and a grant of over 9000 CAD to pursue summer research internship at the **Toronto Intelligent Systems Lab** at **University of Toronto** under **Prof. Igor Gilitschenski**
- One among **25** Indian students awarded the **DAAD Wise 2023** scholarship to conduct research at **TU Darmstadt**
- Part of the **Gold** winning team in **Adobe Behaviour Simulation Challenge** at Inter IIT Tech Meet 12.0
- Invited for a poster presentation at **NeurIPS 2022** for winning the **ML Reproducibility Challenge 2022**
- Awarded the **IIT Kharagpur Foundation Scholarship** to pursue research internship at **UC Berkeley**
- Ranked **in the top 10%** in major in the department of Electrical Engineering among 200+ undergraduate students
- Ranked among the top **0.19%** out of over 1.3 million candidates in the Joint Entrance Examinations 2020

Extracurriculars

- Student member at **English Dramatics Society**, **Quiz Club** and **Debating Society**, IIT Kharagpur
- Member of the **Football** and **Athletics** (short distance sprinting) team, Meghnad Saha Hall, IIT Kharagpur
- Recipient of the **Black Belt** in Isshinryu Karate | Student Volunteer, **National Service Scheme**, IIT Kharagpur