Venkat Varun Velpula

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EDUCATION

University of Pennsylvania, School of Engineering & Applied Science — *Philadelphia, PA*

- Master of Science in Robotics — ***GPA: 3.78/4.00*** — *May 2021*
- *Relevant Coursework:* Machine Learning, Linear Systems and Theory, Introduction to Robotics, Model Predictive Control, Learning in Robotics, Deep Learning for Data Science, Adv. Perception for Robotics,

National Institute of Technology Karnataka, Department of Mechanical Engineering — *Mangalore, India*

- Bachelor of Technology in Mechanical Engineering — ***GPA: 9.12/10.00*** — *May 2019*
- *Relevant Coursework:* Automatic Control Engineering, Theory of Sensors and Actuators, Robotics: Mechanics and Control, Pattern Recognition and Machine Learning, Linear Algebra, Product Development and Prototyping

PROFESSIONAL EXPERIENCE

University of Pennsylvania, Modular Robotics Laboratory (ModLab) — *Philadelphia, PA*

Graduate Research Assistant for ModQuad project, guided by Prof. Mark Yim — *June 2020- Current*

- Developed a RL algorithm to train a quadcopter attached with a gripper to grasp objects mid-air during motion
- The algorithm trains for determining the waypoints for motion, yaw angle of the quadcopter for optimal grasping and angle of the gripper for grasping
- Developed the simulation environment with a custom gripper-quadcopter contraption to train the RL algorithm
- Designed and manufactured novel modular structures using SolidWorks and additive manufacturing techniques
- Worked on distributed control for the UAVs for self-assembly during mid-flight and for cooperative swarm behavior

Indian Institute of Science, Department of Aerospace Engineering — *Bangalore, India*

Research Assistant in Autonomous Vehicle Lab, guided by Prof Ashwini Ratnoo — *Summer 2018*

- Developed an experimental setup consisting of autonomous Micro Aerial Vehicles (MAVs) to test laws of guidance such as Pure Pursuit and Good Helmsman and tracking laws based on potential vector fields
- Designed controls (PID tuners) for navigation of MAVs in indoor environment using data from IMU sensor and array of motion capture cameras. Implemented sensor fusion using Kalman filter to minimize noise and improve data reliability
- Devised network for communication of sensor data amongst MAVs, motion capture system and workstation using Robot Operating System (ROS) and MATLAB

PROJECTS EXPERIENCE

RRT* path planning for robot in dynamic environments

- Augmented the vanilla RRT* path planning algorithm for applications in dynamic environments by implementing re-planning of paths. Re-planning is done through regrowth of nodes and then subsequent reconnection to original tree.
- This method of dynamic path planning decreased time of convergence to optimal path by almost 15 times over vanilla RRT* implementation.

Learning Interactions and Dynamics of Swarms

- Explored the application of machine learning for predicting future trajectories of swarms by approximating the non-linear dynamics of swarm models
- Methods from data-driven techniques like SINDy, complex learning methods like CNNs, RNNs, and NeuralODE were implemented and tested. Experiments were carried out for both steady state and transient dynamics of the swarm
- Concluded that better prediction of future trajectories in the transient were only possible with NeuralODE

Predicting Success of Kickstarter crowdfunded projects using Machine Learning

- Performed regression and classification to predict the amount of money a project can get funded for, and whether the project could successfully raise the quoted funding target given the project details respectively
- Combined dataset from Kaggle and data scrapped from Kickstarter website to obtain a dataset of 69210 projects, which contained new features like the number of pictures, textual description of projects, etc. This improved test accuracy by 10% over the baseline model which was used the original dataset

Simultaneous Localization and Mapping (SLAM) using GraphSLAM

- GraphSLAM is used to generate and constantly update the environment around the robot in real time and localize itself in this environment
- Implemented a cost-effective solution by using an ultrasonic sensor for distance measurement and camera for obstacle detection instead of a stereo camera or a LIDAR sensor

TECHNICAL SKILLS, STRENGTHS AND HOBBIES

- *Programming Languages*: Python, C, C++, MATLAB
- *Tools & Skills:* Numpy, Scikit-learn, Pytorch, SolidWorks, Robot Operating System (ROS), Coppelia Robotics (V-REP), Git, Linux, AutoDesk Fusion 360, Arduino, Raspberry Pi, 3D Printing, Laser Cutting
- *Strengths:* Detail orientated, Adaptable (lived in multiple countries), Quick learner