Mohammad Sareeb Hakak

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Education

Master of Science in Electrical Engineering GPA: 4.0/4.0
North Carolina State University, Raleigh, NC, USA *Aug. 2018 – May 2020*

Bachelor of Technology in Mechanical Engineering GPA: 8.514/10.0
National Institute of Technology, Srinagar, India *July 2013 – June 2017*

Experience

Robotics Engineer June 2020 – Present
Akrobotix *Syracuse, NY*

- Working on developing a modular, platform agnostic Autonomous Navigation Stack for indoor (GPS denied) and outdoor navigation of UAVs and UGVs under the NSF SBIR program with prototyping and developing the hardware from ground up and software with the ROS framework.
- Implemented multimodal sensor fusion for 6 DoF State Estimation and Localization for UAVs through tightly coupled IMU and Visual Odometry. Performed extensive experimental analysis of Lidar Odometry and SLAM.
- Implemented algorithms for path searching, trajectory optimization and occupancy based collision avoidance.
- Implemented high-level Geometric control scheme for aggressive trajectory tracking for PX4 and DJI autopilots.
- Working on implementing the perception pipeline for the autonomous navigation of Akrobotix UGV including 3D Point Cloud analysis using Deep Learning, Semantic Segmentation, Fusion of Depth and Camera Imagery, Mapping for Navigation and Obstacle Detection.

Robotics Engineer Intern Jan. 2020 – May 2020
Akrobotix *Syracuse, NY*

- Worked on a novel Distributed Multi-Agent Robust and Stable Guidance Navigation and Control under the NSF SBIR. Contributed to system and control architecture and hardware design.
- Implemented an MPC controller within PX4 source code by modifying the attitude, rate, and position controllers.

Projects

Master's Independent Project | *Python, C++, ROS, Docker*

- Implemented developer level APIs for Autonomous Operation of UAVs for various cases and applications through Drone-kit in Python and MAVROS in C++, SITL testing with ROS and Gazebo.
- Containerized the software stack with Docker for testing of UAVs by the 5G Communications Lab and by students in the graduate course ECE 592 Autonomous Aerial Robotics.

Reinforcement learning based LQR | *Matlab, Simulink, EKF, LQR*

- Developed a LQT optimal trajectory tracker through the LQR controller and the Integral Reinforcement Learning
- Implemented an extended Kalman Filter (EKF) to track the states in real world conditions.

Deep Learning based Music Genre Recognition | *Python, Keras, OpenCV, CNN, RNN*

- Implemented a deep learning architecture that combines CNNs and RNNs to classify music into 8 genres. Compared a CRNN and parallel CNN-RNN model.

Leaf Wilt Detection with Deep Learning | *Python, Keras, OpenCV, CNN, Autoencoder*

- Developed CNN with Transfer learning (VGG-19) with data augmentation techniques for multi-classification of soybean crop images and improved accuracy with semi-supervised learning (unlabeled data) based on Autoencoder

A-star Route Planner | *C++, OpenStreetMap API, IO2D visualization library*

- Implemented a route planning pipeline in C++ using A* algorithm to find the shortest path on a real-world map using OpenStreetMap data and the IO2D visualization library

Advanced Lane Finding | *Python, OpenCV, Numpy*

- Developed a software pipeline to identify the lane boundaries from a centrally mounted front facing camera on an autonomous car achieved through various image manipulation techniques

Technical Skills

Programming: Python, C, C++, ROS, OpenCV, Tensorflow, Keras, PCL, Matlab, Latex, Docker, Git, Bash
Software: Simulink, Solidworks, Gazebo, RViz, Mathematica, CloudCompare
Miscellaneous: Robot Navigation, Route & Motion Planning, Localization, sensor fusion & state estimation (6 DoF), SLAM, Pointcloud application, SITL, HITL, PX4, ArduPilot, Drone-kit, DJI, Deep learning (MLP, CNN, RNN, LSTM, GANs, Autoencoder), Python libraries (NumPy, Pandas, Matplotlib, OpenCV), Frameworks (TensorFlow, Keras, TensorFlow Lite), Robotic Control (Geometric, MPC and LQR), Robot Kinematics, CAD and 3-D printing