Chaitanya Rajasekhar Reddi

CONTACT INFORMATION

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RESEARCH INTERESTS

Reinforcement Learning, Nonlinear Control, Data Driven Control, Computer Vision, Machine/Deep Learning, Probabilistic Robotics.

TECHNICAL SKILLS

- Languages: Matlab, C++, python, C, Embedded C, Shell (Bash - basic).
- Frameworks/Libraries: Simulink, OpenCV, ROS, Eigen, sci-kit-learn, LaTeX.
- Deep Learning Libraries: Keras, Tensorflow, PyTorch.
- Technologies: Machine/ Deep Learning, Computer Vision, Control Theory (Nonlinear).
- Other: Unix/Linux, Windows, Git/Github, Arduino, MPLAB, Solidworks.

EDUCATION

University of Florida, Gainesville, Florida USA

M.S., Electrical and Computer Engineering — **May, 2018**
GPA: 3.6/4

VIT University, Chennai, Tamil Nadu India

B.Tech., Electronics and Communication Engineering — **May, 2015**
GPA: 7.74/10

ACADEMIC EXPERIENCE

University of Florida, Gainesville, Florida USA

Graduate Student Researcher — **January, 2017 - December, 2017**

- *Closed Loop Buoyancy Control System:* Designed and worked on the hardware implementation of PID coupled bang-bang controller to make depth adjustments of a small submarine by controlling the mass of water stored in its bladder. Pump and pressure sensor were used for actuation and depth measurements respectively. Tools: Simulink, Arduino, MPLAB (Embedded c).
- *Model Reduction of a system using Isomap:* Worked on developing a geodesic based model reduction technique using Isomap to solve partial differential equations which may conceptually overcome the limitations of Proper Orthogonal Decomposition. Tools: Matlab.

Teaching Assistant — **May, 2017 - August, 2017**

Duties have included office hours and grading for the course 'State Variables in Controls' taught by Dr. Jacob Hammer.

PROJECTS

Adaptive Depth Control for thruster based Underwater Vehicles

Designed a nonlinear adaptive controller using Lyapunov analysis and achieved global asymptotic tracking considering depth and velocity state variables as measurable. The controller was implemented in Simulink to track a trajectory of a tanh function and its performance was robust for 5% measurement noise.

Model Predictive Controller

Developed MPC for a car considering kinematic bicycle model to predict steering and throttle values for the trajectory received from path planner module. The cost function was selected to minimize the use of actuators and gap between sequential actuations. Ipopt solver with cost function and constraints was used to generate car's control inputs.

Manatee Call Detection

Designed a classifier in Matlab using two adaptive FIR filters in parallel to identify manatee calls in a given noisy audio signal. One filter was trained on manatee calls and the other on noise. Filter with the least output error determines the result when the noisy test signal is passed. The accuracy of 92.85% and 93.87% was achieved using LMS and RLS training algorithms respectively. RLS had better accuracy and faster convergence.

Semantic Segmentation

Fully Convolutional Network (FCN) was developed using the pre-trained VGG16 architecture for pixel-wise classification of a road in an image. The network was trained on Kitti road dataset with Adam optimizer. Classification accuracy of approximately 90% was achieved on the test set.

Behavioral Cloning

Adapted and implemented Nvidia's End-to-End CNN architecture in tensorflow to predicts steering angles from the front dashboard camera video images. The network was trained on images and steering angles collected by manually driving a car in the simulator. For testing, Network drove the car in the simulator track at 9mph without crossing the lane lines.

Extended Kalman Filter

Developed an EKF in C++ to track the bicycle using sensor fusion of lidar and radar data. Achieved RMSE of 0.09 and 0.45 for position and velocity tracking assuming constant velocity model.

Particle Filter - Localization

Designed a 2-d particle filter in C++ to localize the robot in a given map of landmarks. The filter was initialized with a noisy GPS estimate. Prediction, update, and resampling of the particles was done using odometry and landmark observation data received at each time step.

Vehicle Detection

Developed a software pipeline to identify cars in a front-facing dashboard camera video using the sci-kit-learn library in python. The linear SVM classifier was trained on Histogram of Oriented Gradients and Color features of the cars and not cars dataset with an accuracy of 99%. A sliding window search with the classifier along with thresholding was used to generate a bounding box for a detection.

Advanced Lane Lines

Designed a pipeline to detect and display lane line boundaries, road curvature, and position of a car from lane center in a car's front dash cam video images. Techniques like camera calibration, undistortion, thresholding (HLS- channel, absolute Sobel), perspective transform, and polynomial fit were utilized from the OpenCV and NumPy libraries in python.

Professional Experience

Research Center Imarat, DRDO, Hyderabad, Telangana India

Intern, FPGA based Data Acquisition **June, 2013 - July, 2013**

Worked on XC3S200 a Spartan 3 family FPGA to assist the processor with applications like address decoder, clock divider, phase shifter, counter and interrupt generator. Tools: Xilinx, VHDL.

Certifications

Udacity, Self-Driving Car Engineer Nanodegree Program September, 2018

Coursera, Robotics - Perception July, 2018