Autonomous Car Advanced - Syllabus

Prerequisites: Before learning Autonomous cars, you should be good at calculus, linear algebra, Python 3.0 Programming, C++, Object-oriented programming, and Machine learning.

This course is made for the people who are excited to learn cutting edge technologies, build AI skills, and create innovative products.

Introduction:

- Why a self-driving car?
- Tool: Anaconda tool, Installing Anaconda, Managing Packages, Backup environment using Anaconda, and Installing necessary libraries

Computer vision:

- Camera calibration, Gradient and color spaces, Image segmentation, Image smoothening, Edge Detection, Region of interest, Object detection, Hough transform - Line detection, and Finding lane lines

Deep Learning:

- Neural Network, Tensorflow, Deep Neural Network, Convolutional Neural Network, Image recognition, LeNet for traffic signs, Keras, Transfer Learning and Behavioural cloning

Localization:

- Introduction, Motion model, AI for robotics, Markov Localization, Implementation particle and Particle filter.

Sensor Fusion:

- Sensors- Lidar strengths and weakness and RADAR
- Kalman Filter- Tracking intro, Measurement and motion and Gaussian
- C++ check Point- Kalman Filter in C++
- Geometry and Trigonometry refresher

Path planning:

- Search- Introduction, Path planning(Motion planning) and AI for robotics
- Prediction- Introduction, Frenet coordinates, and More on process models
- Trajectory generation- Introduction, Motion planning, and AI for robotics
- Behaviour planning- Introduction, Finite state machine, Cost function, Behaviour problems.

Control:

- PID control - AI for robotics
- Autonomous vehicle architecture - Introduction, Perception subsystem, Planning subsystem, Control subsystem, and Components inputs wrapup
- Introduction of ROS- Introduction, Node, Message passing, ROS services, Compute graph, Turtlesim.
- Writing ROS Nodes- Introduction, simple mover, Arm mover, Look away and Arm.
- Package and Catkin workspace - Introduction, Catkin packages, ROS launch and ROSdep.

Projects:

Project 1: Traffic Sign Classifier

In this project, you will be creating a model that classifies the traffic signs and signals with a moving vehicle using computer vision from the given dataset.

Project 2: Advanced Lane Finding

In this project, we ask you to classify the track lines with the use of a car which detects the line and moves along the lines of the track.

Project 3: Behavioural Cloning

Create a Self-driving robocar using deep neural networks.

Project 5: Extended kalman filter

In this project, use a Kalman filter to estimate the state of a moving object of interest with noisy lidar and radar measurement.

Project 6: Kidnapped vehicle

In this project, find our own vehicle's uncertain location in a known, mapped area with known

ground truth landmark locations,Lidar data and vehicle control data.

Project 7: Path planning on Highway

In this project, we ask you to find a safe, comfortable and efficient(in that order) path through a set of dynamic maneuverable objects to reach our goal.

Project 8: PID control

Try to minimize the error rate e(t) over time by applying an adjustment or control variable.