Sensor Fusion Syllabus

Contact Info

While going through the program, if you have questions about anything, you can reach us at support@udacity.com. For help from Udacity Mentors and your peers visit the Udacity Classroom.

Nanodegree Program Info

Learn to detect obstacles in lidar point clouds through clustering and segmentation, apply thresholds and filters to radar data in order to accurately track objects, and augment your perception by projecting camera images into three dimensions and fusing these projections with other sensor data. Combine this sensor data with Kalman filters to perceive the world around a vehicle and track objects over time.

Prerequisite Skills

A well-prepared learner is able to:

- Intermediate C++ knowledge, and be familiar with calculus, probability, and linear algebra.
- For aspiring sensor fusion engineers who currently have a limited background in programming or math, we've created the Intro to Self-Driving Cars Nanodegree program to help you prepare. This program teaches C++, linear algebra, calculus, and statistics. If you have a limited background in programming, we've created the C++ Nanodegree program to help you prepare for the coding in this program.

Required Software

- MATLAB Required
- Python 3.6 or higher
- Anaconda 4.7 or latest
- Jupyter notebook 6.0.1 or latest

Version: 2.0.0

Length of Program: 86 Days*

** This is a self-paced program and the length is an estimation of total hours the average student may take to complete all required coursework, including lecture and project time. Actual hours may vary.*

Part 1: Welcome

Part 2: Lidar Obstacle Detection

Project: Lidar Obstacle Detection

In this lesson, students will submit the project that they have developed over the previous lessons.

Supporting Lessons

Lesson	Summary
Introduction to Lidar and Point Clouds	Learn about lidar and point clouds. Use a simulation highway environment to explore lidar sensing and generate point clouds.
Point Cloud Segmentation	In this lesson, you will be using Ransac with a plane model to segment point cloud data and separate it into points that are part of the road and points that are not.
Clustering Obstacles	Perform Euclidean clustering, and learn how to build KD-Trees to use them to do efficient nearest neighbor search for clustering.
Working with Real PCD	Take what you have learned in the previous lessons and apply it to real pcd being played back in a video.

Part 3: Camera

Project: Camera Based 2D Feature Tracking

Supporting Lessons

Lesson	Summary
Introduction	
Autonomous Vehicles and Computer Vision	
Engineering a Collision Detection System	
Tracking Image Features	

Project: Track an Object in 3D Space

Supporting Lessons

Lesson	Summary
Combining Camera and Lidar	

Part 4: Radar

Project: Radar Target Generation and Detection

Supporting Lessons

Lesson	Summary
Introduction	
Radar Principles	Review Radar functionality, FMCW waveform, Radar Hardware, Schematic and the Radar Equation
Range-Doppler Estimation	Estimate the range and velocity of the target using the FMCW radar
Clutter, CFAR, AoA	Discuss - Clutter formation and then its removal using CFAR technique. After that
Clustering and Tracking	

Part 5: Kalman Filters

Project: Unscented Kalman Filter Highway Project

In this lesson, students will submit the project that they have developed over the previous lessons.

Supporting Lessons

Lesson	Summary
Introduction and Sensors	Meet the team at Mercedes who will help you track objects in real-time with Sensor Fusion.
Kalman Filters	Learn from the best! Sebastian Thrun will walk you through the usage and concepts of a Kalman Filter using Python.
Lidar and Radar Fusion with Kalman Filters in C++	In this lesson, you'll build a Kalman Filter in C++ that's capable of handling data from multiple sources. Why C++? Its performance enables the application of object tracking with a Kalman Filter in real-time.
Unscented Kalman Filters	While Extended Kalman Filters work great for linear motion, real objects rarely move linearly. With Unscented Kalman Filters, you'll be able to accurately track non-linear motion!

These Career Services will ensure you make meaningful connections with industry professionals to accelerate your career growth - whether looking for a job or opportunities to collaborate with your peers. Unlike your Nanodegree projects, you do not need to meet specifications on these Services to progress in your program. Submit these Career Services once, and get honest, personalized feedback and next steps from Udacity Career Coaches!

Project: Improve Your LinkedIn Profile

Find your next job or connect with industry peers on LinkedIn. Ensure your profile attracts relevant leads that will grow your professional network.

Supporting Lessons

Lesson	Summary
Industry Research	You're building your online presence. Now learn how to share your story, understand the tech landscape better, and meet industry professionals.

Project: Optimize Your GitHub Profile

Other professionals are collaborating on GitHub and growing their network. Submit your profile to ensure your profile is on par with leaders in your field.

Udacity

Generated Thu May 14 12:06:15 PDT 2020