Unscented Kalman Filter Project Starter Code

Self-Driving Car Engineer Nanodegree Program

In this project utilize an Unscented Kalman Filter to estimate the state of a moving object of interest with noisy lidar and radar measurements. Passing the project requires obtaining RMSE values that are lower that the tolerance outlined in the project rubric.

This project involves the Term 2 Simulator which can be downloaded here

This repository includes two files that can be used to set up and intall uWebSocketIO for either Linux or Mac systems. For windows you can use either Docker, VMware, or even Windows 10 Bash on Ubuntu to install uWebSocketIO. Please see this concept in the classroom for the required version and installation scripts.

Once the install for uWebSocketIO is complete, the main program can be built and ran by doing the following from the project top directory.

1. mkdir build
2. cd build
3. cmake ..
4. make
5. ./UnscentedKF

Tips for setting up your environment can be found here

Note that the programs that need to be written to accomplish the project are src/ukf.cpp, src/ukf.h, tools.cpp, and tools.h

The program main.cpp has already been filled out, but feel free to modify it.

Here is the main protcol that main.cpp uses for uWebSocketIO in communicating with the simulator.

INPUT: values provided by the simulator to the c++ program

["sensor_measurement"] => the measurment that the simulator observed (either lidar or radar)

OUTPUT: values provided by the c++ program to the simulator

["estimate_x"] <= kalman filter estimated position x
["estimate_y"] <= kalman filter estimated position y
["rmse_x"]
["rmse_y"]
["rmse_vx"]
["rmse_vy"]

Other Important Dependencies

- cmake >= 3.5
- All OSes: click here for installation instructions
- make >= 4.1 (Linux, Mac), 3.81 (Windows)
- Linux: make is installed by default on most Linux distros
- Mac: install Xcode command line tools to get make
- Windows: Click here for installation instructions
- gcc/g++ >= 5.4
- Linux: gcc / g++ is installed by default on most Linux distros

- Mac: same deal as make - [install Xcode command line tools]
- Windows: recommend using [MinGW]

Basic Build Instructions

1. Clone this repo.
2. Make a build directory: `mkdir build && cd build`
3. Compile: `cmake .. && make`
4. Run it: `./UnscentedKF` Previous versions use i/o from text files. The current state uses i/o from the simulator.

Editor Settings

We've purposefully kept editor configuration files out of this repo in order to keep it as simple and environment agnostic as possible. However, we recommend using the following settings:

- indent using spaces
- set tab width to 2 spaces (keeps the matrices in source code aligned)

Code Style

Please stick to [Google's C++ style guide] as much as possible.

Project Result

In this project, I fixed the set of parameters to achieve RMSE results:
1:The standard deviation of the longitudinal acceleration std_a_ was set to 0.5 m/s^2.
2:The process noise standard deviation of yaw acceleration std_yawdd was set to 1.0 rad/s^2.

And, the result is shown on the following figure: