Canoo Robotics Engineer Take Home Assignment – Kalman Filtering

Objective: Given longitudinal position estimates for an object from a sensor, implement a Kalman Filter to filter out noise in the detection and show error in prediction.

Setup a Kalman Filter class and filter out noise present in the data. Show accuracy of prediction by displaying the mean-squared error between the prediction and ground-truth.

Use C++ to set up this project and a CMake file for us to compile it. Use C++ STL libraries and only Boost/Eigan for the Kalman Filtering

Task 1

Given Sensor data input from a camera of the longitudinal position of an object (cam_data1.txt), do the following:

- Create noisy data by adding a Gaussian Noise to the camera data
- Perform Kalman Filtering on this noisy data to be able to remove and predict this noise
- Plot the difference in error between estimated value and Ground Truth (cam_data1)

Task 2

Given sensor data input from two sensors of longitudinal position of an object (cam_data2 and rad_data2), estimate/model the noise (error) in the camera detections assuming the radar data (in rad_data2) is the Ground Truth. I.e., assume the radar data (rad_data2) is the Ground Truth position for this object.

- Tune the Kalman Filter designed above to achieve this
- If a camera detection does not have a radar detection at the same timestamp, you can use the closest previous radar timestamp value as corresponding GT
- Plot the difference between estimated value by the Kalman Filter and Ground Truth (rad_data2)

Data and Format:
- Cam_data1.txt - camera data for task1. Format: timestamp, posX (in m)
- Cam_data2.txt - camera data for task2. Format: timestamp, posX (in m)
- Rad_data2.txt - radar data for task2. Format: timestamp, posX (in m)