

Sensor Calibration Internship Assignment

1.

(a) Examine the given data in the CSVs. Do you find any error in the given datasets?

The CSV files contained the following errors: missing values and even lines where commas are also missing. There are gaps in the timestamps when the sensor does not record any data.

(b) Do the measurements cover the same time range? How would you tell if they overlapped other than based on their timestamp values?

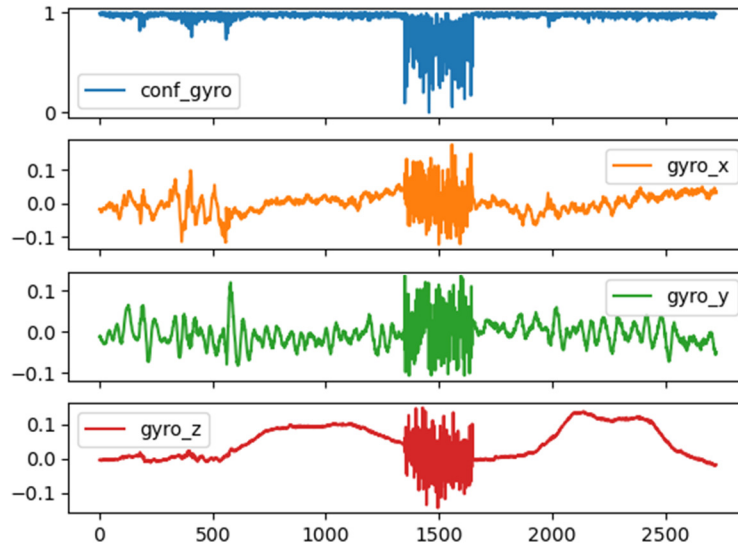
The measurements largely overlap but don't fully match the same time range. For example, according to Unix epoch time, the DBW dataset starts on Wednesday, 23 November 2022, 22:37:20.203, while the IMU dataset begins on Wednesday, 23 November 2022, 22:37:22.240.

Without the timestamps, I could decide whether they overlap by the "yaw_rate" and "gyro_z" values since they measure the same thing. The problem is that the IMU sensor has much finer resolution in time and much higher precision. The DBW sensor uses a quantised value, a fixed-point representation. To overcome this challenge, I would transform the IMU sensor readings to the same accuracy. This would result in many repeated values after each other, so I would only keep one value from each repeated sequence. The resulting columns now should have a similar number of rows. Then, I would shift the column with fewer rows beside the other column and calculate the mean squared error between the two columns. When this error is minimal, that means that they overlap in time.

(c) How would you describe the quality of the IMU's gyro and acc signals? Are they always the same quality? Is there a way to tell just by those signals when the sensor is less reliable?

To quickly analyse the provided data, I created a jupyter notebook in which I parsed the CSV files with pandas. After that, I made plots from the dataframes. The "conf_acc" and "conf_gyro" columns provide data about the sensor confidence level. There are several drops in the quality of the signals, but one section is particularly bad.

Without these columns, I could still tell when the signal is unreliable since there are large value swings when the signal quality is bad, often with a change of sign.



2.

I provided a Visual Studio solution in the GitHub repository containing the CSV Parser and the imGUI application. The parser reads in CSV files, where the values are float. The parser only stores rows where there is no missing value. The first line must be the column names in the CSV file.

I used win32 and DirectX 11 as a backend. I created line plots for each column except the timestamps.