Institute of Robotics, University of Innopolis

Sensors and Sensing
Home Work 01

March 22, 2022

1 Attention

This is valid for each and every lab class, you can do your lab tasks with the most preferred language but these standards need to be fulfilled.

- C++ 11
- C 99
- Python 2.7.x or 3.6.x
- Matlab 17a onwards

You need to submit your source code along with a clear description of how to run your implementation.

2 Task One

2.1 Case 1

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UAV flies through the strong wind and begins to oscillate. The pitch angle change was measured with the gyro during a few seconds. Exclude from the consideration rare random deviation (outliers) and estimate the true value of the roll angle. Calculate the confidence interval of error for 99.9% confidence level. Consider that the gyro errors are normally distributed, except for the rare random deviations. Proper regression technique should be applied so as to fit the data while excluding rare random deviations.

2.2 Case 2

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UAV flies through the strong wind and begins to oscillate. The roll angle change was measured with the gyro during a few seconds. Exclude from the consideration rare random deviation (outliers) and estimate the true value of the roll angle. Calculate the confidence interval of error for 95% confidence level. Consider that the gyro errors are normally distributed, except for the rare random deviations. Proper regression technique should be applied so as to fit the data while excluding rare random deviations.

2.3 Case 3

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UAV performs loop-the-loop. The pitch angle change was measured with the gyro during 1 seconds. Exclude from the consideration rare random deviation (outliers) and estimate the true value of the roll angle. Calculate the confidence interval of error for 95% confidence level. Consider that the gyro errors are normally distributed, except for the rare random deviations. Proper regression technique should be applied so as to fit the data while excluding rare random deviations.

2.4 Case 4

Email
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The human CoM (center of mass) during the walking has been measured with Kinect sensors. Estimate the true value of the x-component of acceleration. For example, you can use a moving average filter. Calculate the confidence interval of error for 95% confidence level. Consider that the errors are normally distributed, except for the rare random deviations. Proper regression technique should be applied so as to fit the data while excluding rare random deviations.

2.5 Case 5

Select this dataset if your name is not listed any of cases

Inside the right hand of the AR-601 robot there is an accelerometer. Engineers fixed the robot on the crane and went for a lunch. Robot was swinging by inertia for a few minutes. Engineers came back after lunch and read the data from accelerometer. Help them to understand what they measured. Exclude from the consideration rare random deviation (outliers) and estimate the true value of the y-component of acceleration. Calculate the confidence interval of error for 99.9% confidence level. Consider that the accelerometer errors are normally distributed, except the rare random deviations. Proper regression technique should be applied so as to fit the data while excluding rare random deviations.

Note: regression is needed to be implemented by yourself. Please comment on it

3 Task Two

You are given a dataset (select the dataset with corresponds to your ID), includes some data points in R^3. Your task is to estimate whether it represents a plane, line or something else. You must use the RANSAC for this task. Explain the way you selected your minimal sample set, number of iteration and the threshold level? It would be better to provide an analytical solution derivation as well as graphical interpretation.

Id	Name
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4 Submit

Please upload the single zip file which includes your source code and the report. The report should include what you did and why you did it.

5 Deadline

The deadline: October 29, 23:59:59 GMT+3.