

[ENPM673] Homework 1

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1 Introduction

This home work will help you test your understanding of principles of linear estimation. As background source consult the mathematics tutorial discussed at this [page](#). The task is to fit a line to two dimensional data points using different linear least square techniques. Specifically:

- Line fitting using Linear Least Squares
- Least Square Estimation with Regularization
- Outliers rejection using RANSAC

2 Data

Three files of 2D points data are provided in the form of .pkl files ([click here to download](#)). The three data files with different noise levels are shown in the following figure.

3 Problem Statement

- Write python code (using numpy and matplotlib) to visualize the geometric interpretation of the eigenvalues and the covariance matrix as discussed in this [link](#) [30 points]
- Write code to fit to these datasets a line using Least Squares using a.) the vertical distances and b.) the orthogonal distances. [10pts]
- Decide on the best outlier rejection technique for each of these datasets and write code to fit the line. Also, discuss why your choice of technique is optimal [50 points]

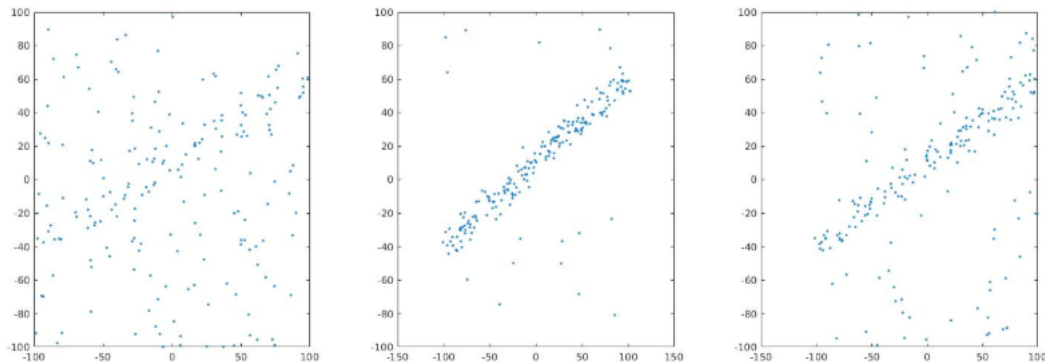


Figure 1: Three data samples

4 Report

For each section of the homework, explain briefly what you did, and describe any interesting problems you encountered and/or solutions you implemented. Include the following details in your writeup:

- Your understanding of eigenvectors and eigenvalues
- Your choice of outlier rejection technique for each dataset
- Limitations of each outliers rejection technique