16-811 Assignment 3: Resubmission 2

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1 Problem 4

I used the following references to help me solve this problem:

(1) Derpanis, K. "Overview of the RANSAC Algorithm." May 13, 2010. http://www.cse.yorku.ca/~kosta/CompVis_Notes/ransac.pdf Visited 10/29/2019.

(2) Wikipedia. "Random sample consensus." https://en.wikipedia.org/wiki/Random_sample_consensus Visited 10/29/2019.

(3) Math Insight. "Distance from Point to Plane." https://mathinsight.org/distance_point_plane Visited 10/29/2019.

(4) Rosenberg, J. "Lines, Planes and MATLAB." 2009. http://www2.math.umd.edu/~jmr/241/lines_planes.html Visited 10/29/2019.

(5) Collins, Robert. "Lecture 15: Robust Estimation: RANSAC." Penn State. http://www.cse.psu.edu/~rtc12/CSE486/lecture15.pdf Visited 11/21/2019.

Please note that the code for all parts of this problem is contained in code/q4.m.

1.1 Part a)

I wrote a function that uses SVD to compute the best fit plane to the data set. My fitted plane and the data is shown in the figures below. I calculated the average distance of a point in the data set to the fitted plane as 0.002854679760707 m.

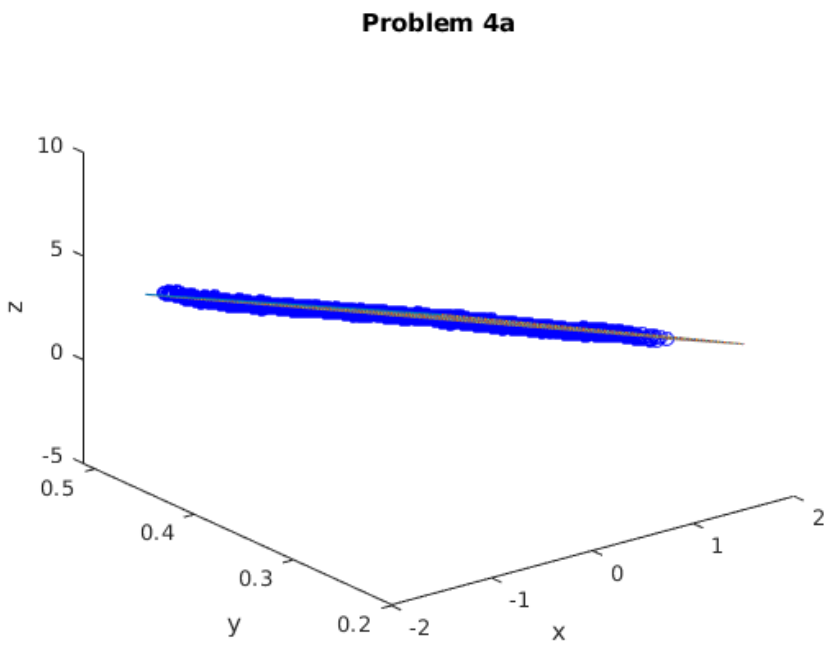

Figure 1: Plot for 4a).

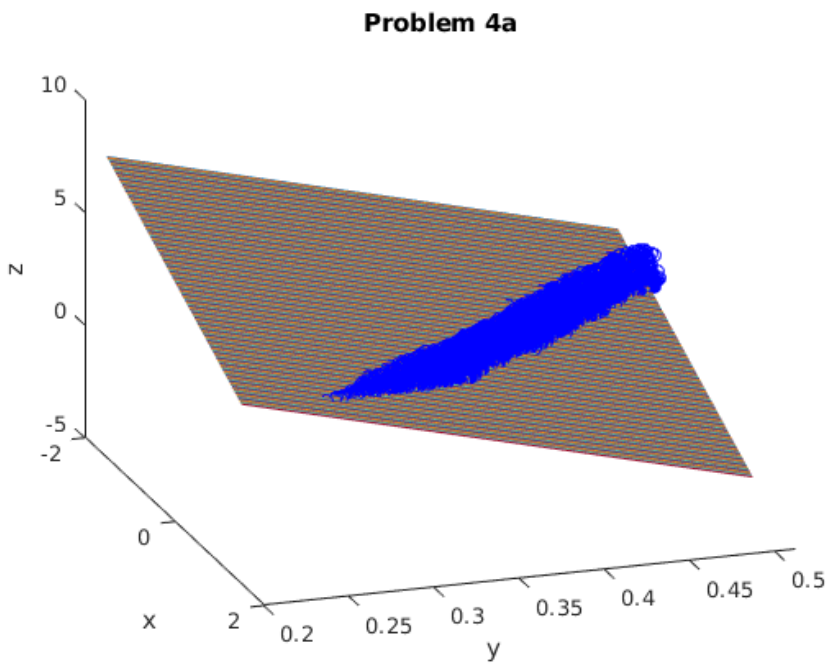

Figure 2: Plot for 4a).

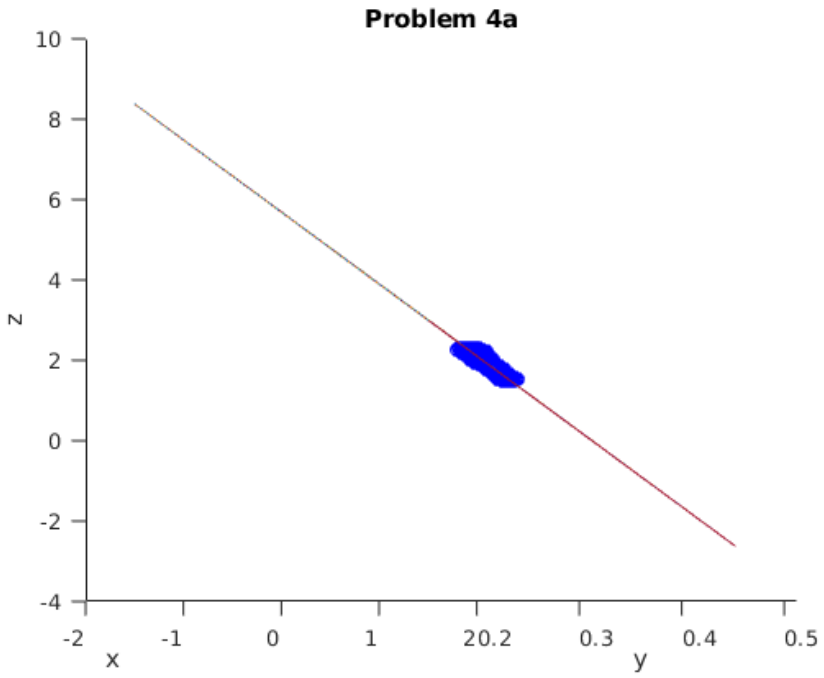

Figure 3: Plot for 4a).

1.2 Part e)

My plane fits to the cluttered hallway data set are shown in the figure below. I chose to characterize the smoothness of each surface as the average distance of the subgroups of points from their respective plane fit. If the average distance is larger, it means that the surface of the wall is more rough.

Please note that I was not able to fit a plane to the 4th wall so I am reporting the smoothness characteristic for the first 3 walls I found.

For the plots shown below, the average smoothness characteristic for each wall was $[0.5525m, 0.3523m, 1.070m]$. From these values, we can see that the third wall is the most rough and the second wall is the smoothest.

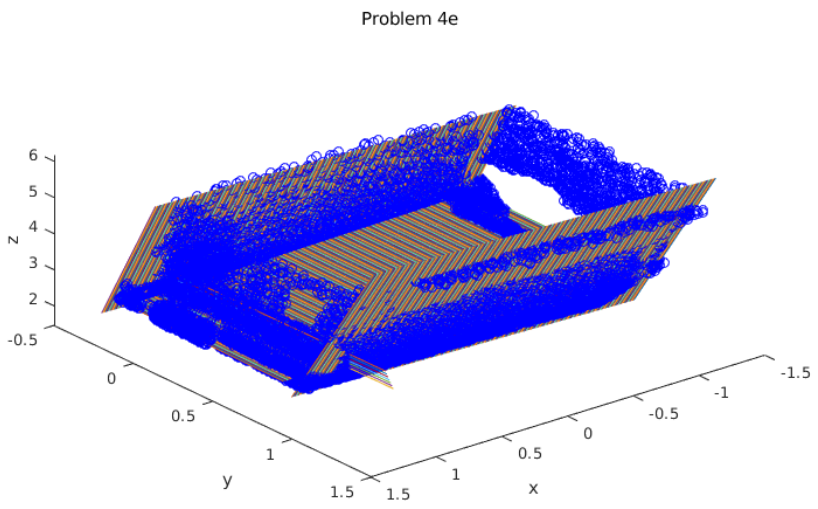

Figure 4: Plot for 4e).

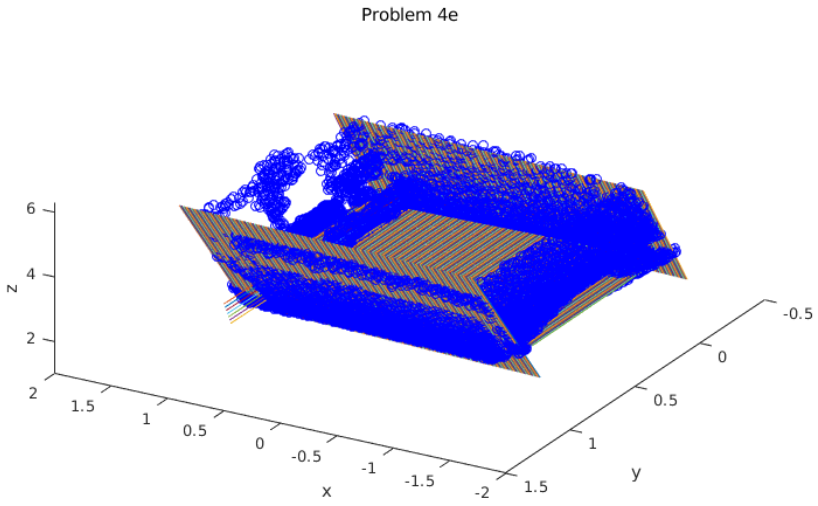

Figure 5: Plot for 4e).

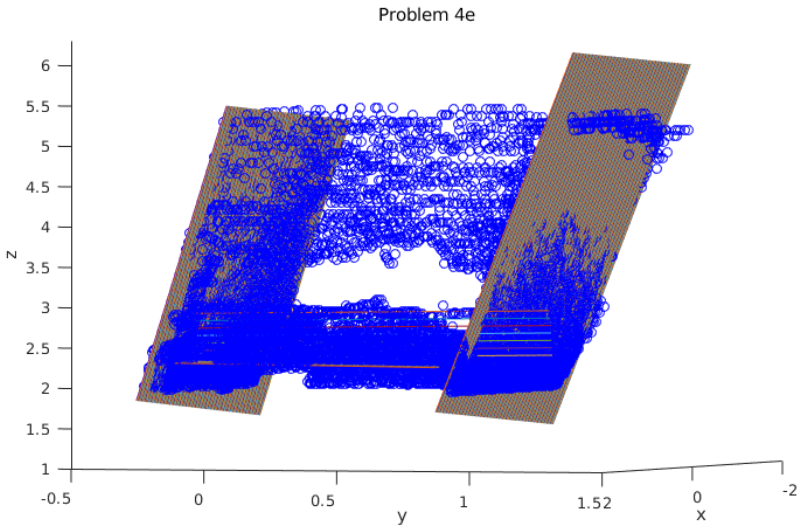

Figure 6: Plot for 4e).