

Assignment 3 (100 points)

Fitting and Clustering

Due 5/8 (Tue) 9:30AM

This homework is to see whether you can implement the algorithm correctly. Another purpose of this homework is to check your ability to design the experiment set-up and analyze the results you observe during the experiment. So, make sure the analysis and presentation is as important as the implementation.

1. **(RANSAC: 30 points)** Design an algorithm to fit a line using RANSAC in 2D space when you are given a set of points. The algorithm based on RANSAC will have the following components:
 - a. Data generation: several different outlier ratios
 - b. Hypothesis generation: 2 points (minimum number of points) to generate a hypothesis
 - c. Hypothesis testing based on error measure: perpendicular distance
 - d. Choice of best fitting and parameter estimation: least square method

Write a program and test your code for different outlier ratios and numbers of iterations. Discuss the results by comparison with theoretical analysis.

2. **(Image Clustering: 70 points)** Implement a 2-stage image segmentation algorithm based on the k -means clustering followed by the normalized-cut algorithm. First, perform the k -means clustering with a large number of segments and generate an over-segmented image. Let's call the over-segmented segment "superpixel." After that, apply the normalized-cut algorithm over the superpixels with a proper number of segments and obtain the final segmentation result. Use the images posted in the class homepage, and use (x, y, r, g, b) feature for each pixel. You may need to think about the following issues carefully during the implementation.
 - a. Describe how you determine the "proper" number of segments for the normalized-cut.
 - b. Discuss how you defined the distance between superpixels when you construct the affinity matrix.
 - c. What kind of features other than (x, y, r, g, b) can you use for better segmentation?

Submission: Submit your source code and result to class afs submission directory using ftp. You may hand in your report in hard or soft copy.