Homework 2

Problem 1: a) Prove the simple, but extremely useful, result that the perpendicular distance from a point (u, v) to a line $ax + by + c = 0$ is given by $|au + bv + c|$ when $a^2 + b^2 = 1$.

Problem 2: a) Find the formula for the perpendicular distance of a point from a circle. b) Assume now that you are given a collection of points $(x_i, y_i), i = 1, \ldots, N$ and you would like to draw a circle. Propose an optimization problem which leads to the circle with the smallest sum of square-perpendicular-distances from the points. c) Find the (nonlinear) system of equations that will give you the desired solution.

Problem 3: Load the image contained in the file image2-1.mat (Matlab). a) Apply edge detection techniques to identify edges (use smoothing plus edge detection since there is noise in your image). b) Apply the Hough Transform by parametrizing the straight line in the way we described in the class (θ, r) and generate a grid of sufficient density to identify the lines of interest. Indicate how many cells get significant number of votes (there should be at least three!!). c) Count the number of edges you would like to identify (should be exactly three!!!!). Apply the variation of k-means to estimate the corresponding lines that fit the edges. In both cases b) and c) plot the resulting lines you have found to verify the quality of your estimate.

We will meet on Tuesday, April 10, at 11AM, in CBIM-22 to discuss the problems.

Your answers, in *hard copy*, must be submitted on Thursday, April 12 in CBIM room #5, between 10 and 11:30AM. Mr Neelesh Kumar, our TA, will welcome you and collect them.

Please respect the indicated time because Mr. Kumar has many other tasks, besides TAing.