

CEG-7550 Computer Vision

Project 1: Line Detection by Clustering

Handed out: 9/28/2017

Due: 10/24/2017, 11:00 AM

Edges in an image are given. We would like to find lines among the edges using the locations and gradient directions at the edges.

Find the gradient direction at each edge and create a histogram of the gradient directions. Locate peaks in the histogram and order them according to their strengths. The strength of a peak is the number of edges contributing to its formation. A peak at gradient direction Θ shows lines in polar form with parameter Θ .

To identify different lines with the same parameter Θ , for each edge (x,y) with gradient direction Θ , determine the distance of the polar line with parameter Θ passing through (x,y) to the origin. Then, find a histogram of the distances and locate peaks in the histogram. A peak at distance ρ identifies edges that belong to the polar line with parameters Θ and ρ . Therefore, the polar equation of the line will be $\rho = x\cos(\Theta) + y\sin(\Theta)$.

Find lines that contain at least $n = 10$ edges and display them. n is the number of edges belonging to a peak in the histogram of distances.

Two images and the edge detected in them by the Canny edge detector are given to test your programs. These images are shown below. Find gradient direction at each edge, cluster the edges according to their gradient directions, cluster the edges belonging to each peak Θ according to their distances (ρ) to the origin, and identify peaks in the histogram of ρ 's. Finally, if a peak at ρ contains 10 or more edges, draw the polar line with parameters Θ and ρ .

Write a report (4-8 pages) describing the line detection method and its implementation. Discuss the influence of bin sizes in histograms of Θ and ρ in line detection. What do you consider to be the strengths and weaknesses of this method?

Programs can be in C, C++, or Matlab. 10 points will be for implementation and 10 points will be for report. You may implement the program with a colleague, but you should write the report independently, by yourself.

