University of Tehran

School of Electrical and Computer Engineering

Digital Image Processing

Instructor: Hamid Soltanian-Zadeh

Assignment 8

Chapter 10 – Digital Image Fundamentals

Due Date: 30th of Ordibehesht 1401

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Spring 2022

Problem 1

In this problem, you are going to find edges of "highway.jpg" image using Canny Edge Detector. Explain briefly the algorithm and then report resulting image after each step and explain what happened. First set the parameters such as standard deviation of gaussian filter and thresholds in thresholding process such that the result is good. Now, change the parameters so the result is different and report it. Explain how important is choosing every parameter and how it affects the result.

Note: You cannot use MATLAB built-in functions.

Repeat the same method using the "edge" function and compare the results.

Problem 2:

Implement Hough Line Transform by your own code, briefly explain the algorithm, and report its result on the "highway.jpg" edge image. Can we have less edges or more edges of the same image? Discuss whether having more edges is better or less edges to use Hough Line Transform and finding lines in the image.

Report an image of the accumulator (see example 10.14 of the textbook).

Note: You **cannot use** MATLAB built-in functions.

Problem 3:

In this problem, we want to compare two segmentation methods.

   a) Implement Otsu's optimum thresholding algorithm described in Subsection 10.3.3 and use it to segment the polymersome cells in the "cells.tif" image.

   b) Apply Otsu's optimum thresholding algorithm to the image "Text.tif" and report the result. Then, apply suitable thresholding based on local thresholding using moving averages. Explain the performance of your method and any heuristics you may use for this segmentation task and compare the two methods.

Note: You **cannot use** MATLAB built-in functions.

Problem 4:

Background subtraction is a simple approach for detecting moving objects in a video stream. This method is a pixel-based segmentation in which the absolute difference of each frame from the background is computed to obtain a difference image. If the absolute difference for a given pixel is larger than a predefined threshold, this pixel is classified as a pixel of a moving object (foreground); else, it is classified as a background pixel. The simplest method for estimating the image background is based on the following average operator:

$$background(i,j) = \frac{1}{N}\sum_{k=1}^{N} frame_k(i,j)$$

where $frame_k$ is the kth frame of the video stream and N is the total number of frames.

a) Using background subtraction, estimate the image background for "road.avi" and display it in your report. For simplification, convert RGB values to gray level values before any processing.

b) Detect moving objects in this video stream based on background subtraction. Show some frames of your result.

Note: You can use the MATLAB built-in functions like the "VideoReader" function.

Descriptive Assignments

Please solve the following questions of the 10th Chapter of the textbook: 4, 8, 12, 16, 36, 49.

Notes:

1. Put written codes for each problem in one m-file, and for each section, intercept them by %%.

2. Analytical problems can be solved on papers, and there is no need to type the answers. The only thing that matters is the quality of your pictures. Scanning your answer sheets is recommended. If you are using your smartphones, you may use apps such as CamScanner or Google Drive Application.

3. Simulation problems need report as well as source code and results. This report must be prepared as a standard scientific report.

4. Your report is particularly important in the correction process. Please mention all the notes and assumptions you made for solving problems in your report.

5. You have to prepare your final report, including the analytical problems answer sheets and your simulation report in a single pdf file.

6. Finalized report and your source codes must be uploaded to the course page as a ".zip" or ".rar" file with the file name format as: Fullname_StudentNumber_HW#.rar.

7. Plagiarisms will be strictly penalized.

8. You may ask your questions from the corresponding TA of each assignment.

Good Luck!