Homework #2 Filtering, and Feature and Edge Detection

CAP 5415, Computer Vision, Fall 2016

Department of Computer Science, Florida State University

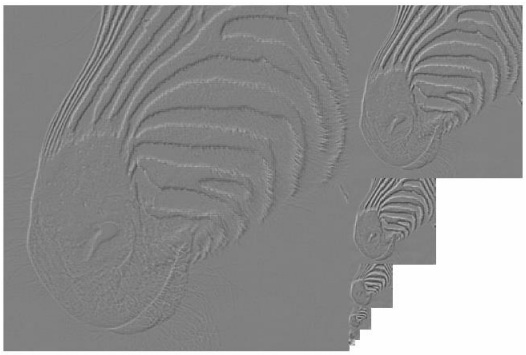
Points: 90

Due: At the beginning of class on Monday, October 10, 2016

Submission: Hardcopy with source code attached. If you obtain a program from others, please reference the original source clearly.

Problem 1 (15 points) Write a program to generate a Laplacian pyramid of an image (assuming a square image with size of an integer power of 2). Then apply your program on the following image (available at http://www.cs.fsu.edu/~liux/courses/cap5415-2016/assignments/pictures/lena_256.pgm) from 256×256 to 8×8.

You need to arrange your results in the following format:

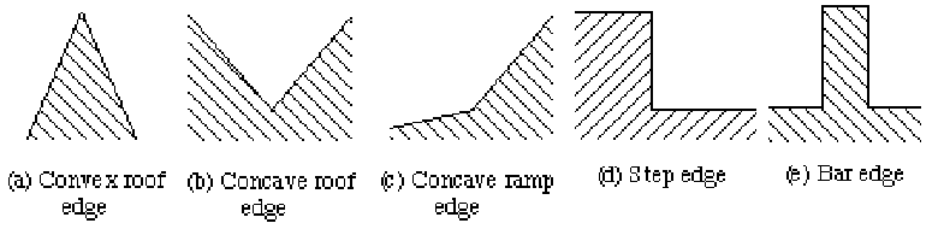


Problem 2 (15 points) Following Algorithm 4.1 given in the textbook, implement 1) Shi-Thomasi feature detection (by thresholding the minimum eigenvalues at each point), 2) Harris-Stephens feature detector (using Equation (4.9) in the textbook), and 3) Harmonic mean feature detector (using Equation (4.11) in the textbook). Apply your detectors on the following image (available at http://www.cs.fsu.edu/~liux/courses/cap5415-2016/assignments/pictures/group-face.pgm).

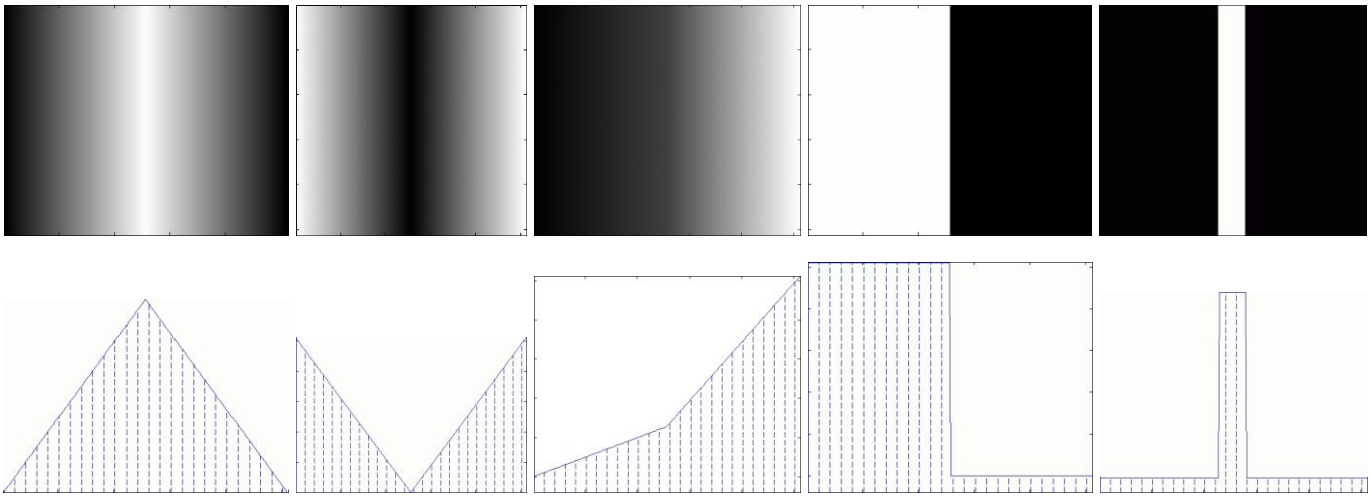
Problem 3 (20 points) Give a step-by-step description of how SIFT points are detected and then how the SIFT descriptors are computed. You can find more information about SIFT in the original paper http://download.springer.com/static/pdf/941/art%253A10.1023%252FB%253AVISI.0000029664.99615.94.pdf

?auth66=1410970913_0280742220416ba4c3e8f36e74a8bcba&ext=.pdf. Would the locations of SIFT features generally agree with the features detected by Shi-Thomasi method? Briefly justify your answer.

Problem 4 (20 points) Suppose we use the following masks [-1 0 +1] and [+1 -2 +1] for edge detection, sketch the output for the following typical edges, and then state how to detect the edge point in each of these cases; for the cases the edge point can not be detected, give a justification. Note that these drawings show the profile of different one-dimensional edges.



Clarification: The drawings above show a profile of each type of the edges. To clarify, for each type of the edges, an example image is given below along with one profile (one row from the image).



(a) **(b)** **(c)** **(d)** **(e)**

Problem 5 (20 points) Use the following two images for evaluation of scale and contrast threshold effects in Canny's edge detector. (available on the class web site http://www.cs.fsu.edu/~liux/courses/cap5415-2016/assignments/pictures/tstim_10.pgm and http://www.cs.fsu.edu/~liux/courses/cap5415-2016/assignments/pictures/group-face.pgm .) (Information: A Canny edge detector was implemented in Matlab (function "edge" by "edge(I,'canny',thresh,sigma)"); you can also find a C implementation at http://www.cs.fsu.edu/~liux/courses/cap5415-2016/assignments/canny.c.)