

CS143 Introduction to Computer Vision Homework assignment 1.

Due: Problem 1 & 2 September 23 before Class

Assignment 1 is worth 15% of your total grade.

It is graded out of a total of 100 (plus 15 possible extra points, which must be done for graduate credit).

Goals.

- Introduce you to Matlab and the manipulation of images and vectors in Matlab.
- Introduce convolution and filtering.
- Introduce image pyramids.
- Allow you to experiment with image “de-noising”.
- Experiment with image feature detection.

Files you need.

The images that you should work with are in the directory

```
/course/cs143/asgn/asgn1/.
```

Additionally, we provided four Matlab scripts `problem[1-4].m` in the directory `/course/cs143/asgn/asgn1/`, which you should start from. Their main purpose is to make it easier for us to grade your homework. You are therefore asked to copy those files and modify them, so that they perform the appropriate task and display your results. You are of course free to write your own scripts and/or functions and only add calls to these to the scripts we provided.

What to hand in.

You will hand in your Matlab code (and our support code needed to run your program), which is supposed to show all your results, and any text or explanations

that are required. Make an effort to submit neat commented code so we can attempt giving you partial credit where necessary. If the result is wrong and we cannot follow your line of reasoning, we will not be able to award you any points. Please hand in the modified `problem[1-4].m` scripts as well as any other Matlab scripts or functions that your solution requires. Make sure that all your results are displayed properly! **Pay attention to the efficiency of your program. You will lose points if your program is very slow.**

You will also hand in any text or explanations electronically. They should either be in plain text format, in Postscript, or in PDF.

To handin the assignment run the commands below from the folder that contains your solutions. The entire contents of that folder will be zipped and sent to us.

For assignment 1, problems 1 and 2: `/course/cs143/bin/handin asgn1_p1_p2`

For assignment 1, all problems: `/course/cs143/bin/handin asgn1all`

General Remarks.

You may use built-in Matlab routines to perform convolution and image resizing. See the Collaboration Policy on the website:

<http://www.cs.brown.edu/courses/cs143/collaboration.html>

Problem 1. Image pyramids.

(20pts) For the “Mona Lisa” image, build a 5 level Gaussian pyramid and display it in a format *similar* to the one in the figure.



Also implement and display a Laplacian (difference of Gaussian (DoG)) pyramid.

Problem 2. Image derivatives.

(20pts) In this part of the assignment you are to compute the first partial derivatives of the Barbara image in the x and y directions. Do this at every scale in the Gaussian pyramid and show the results. Also state which masks you used to implement your derivative filters.

Using these derivatives, compute the gradient magnitude at each scale; ie $|\nabla I| = \sqrt{I_x^2 + I_y^2}$.

Choose a threshold to detect edge locations using the gradient magnitude. Show the detected “edge” locations as black points on a white image.

Write a paragraph explaining how you chose the threshold and what problems this approach might have for edge detection.

(5 extra pts) Combine information across scales in your detection of edges above. Explain what you did, how it worked, and why.