Computer Vision Course
Homework Assignment 1
September 27, 2021

Due: Monday, October 06 at 11:59 PM.

- Assignment 1 is graded out of a total of 100 (there is extra points for this assignment).
- Assignment 1 is due at the beginning of the due date, Sunday 11:59 PM, October 03, 2021
- You should prepare a well written report, please upload the report as well as your code to our google classroom under the Assignment 1 section.
- There is no Hand-in process, the submission MUST be through the google classroom.
- Late days cover unexpected clustering of due dates, travel commitments, interviews, hackathons, etc. *Do not ask for extensions to due dates*—we give you a pool of late days to manage yourself.

Brief:

- Project materials including writeup template is uploaded to Assignmenet1.zip (911 KB).
- All the required files, such as the README file, initial MATLAB codes, images are also provided in the **Assignmenet1.zip**.

Overview:

The main goal of this assignment is to be familiar with the following points:

- 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 blending.
- Experiment with image feature detection.

Details:

- 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 "***pyramid_gaussian.m***" scripts as well as any other MATLAB scripts or functions "***Gaussian_Kernel_Filter.m***" 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 Microsoft word, please check the "***Report_Assignment_Template_FIRST_LAST_NAme.docx***".

- To hand in the assignment run the commands below from the folder that contains your solutions (your report and MATLAB code), name it as you FIRST and LAST NAME.
- The entire contents of that folder will be zipped or RAR and uploaded to our google classroom.

Problem 1: Image Pyramids.

(100 pts) 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.

Lena Gaussian pyramid results with 3x3 Gaussian kernel with sigma=2

Level 1	Level 2	L3	L4	L5	L6
					

Zebra Gaussian pyramid results with 3x3 Gaussian kernel with sigma=2

Level 1	Level 2	L3	L4	L5	L6
					

Extra Points:

Problem 2: Image derivatives.

(50 pts) In this part of the assignment you are to compute the first partial derivatives of the Lena 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, i.e.,

$$|\nabla I| = \sqrt{I_x^2 + I_y^2}$$

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.