DIP-CSE340 ASSIGNMENT 1
Deadline : 4/9/2024

Total Marks : 40 Marks **Total Days : 14 Days**

Instructions:

- Standard institute plagiarism policy holds.
- This is an individual assignment. State any assumptions you have made clearly.
- Even a second late will be considered late, so do submit your assignments at least before 11:56 PM on the date of the deadline to avoid any unexpected issues. Late submissions are not entertained.
- Viva 5 marks will be taken during the demos (written/oral).
- Submit a Jupiter notebook (dip_rollnumber.ipny) with results from section A and section B. You can use either Python/Matlab. Jupiter Notebook for Matlab is also available. Wherever required use text cell/comment to answer the questions.

Section A - Geometric Transformations

(15 marks)

Create an image (name.png) in paint with white canvas. The image should contain text (your name) in any color (one/many) of your choice except black/white (see figure 1(a)).

1. Perform the following geometric transformation : $(0.5 + 0.5 + 1 + 3$ marks)
   (a) Load the image and display it and its shape.
   (b) Covert the image to greyscale and display it and its shape.
   (c) Resize the greyscale image to (200 x 200) and plot its histogram.
   (d) Perform the following geometric transformations on the greyscaled resized image:
      i Rotation (60° and 140°)
      ii Translation (to the four corners of the image. See figure 1 (b))
      iii Vertical shearing
      iv Horizontal shearing

   Make sure to keep the white background (see figure 1 (b)). Zero marks if the background of the new image is different from white.

2. Answer the following questions in the Notebook: $(1.5 + 1.5 + 2 + 3 + 2$ marks)
   (a) What are color spaces and how many are there ? Describe and display any 4 different color spaces using the given image (name.png).

(a) Original image (b) Translated image

Figure 1: Example of geometric transformation. The image (b) is greyscale image of (a)

(b) Using the given image demonstrate and explain the different methods (at least 3) that can be used to "resize" an image ? How does"resize" affects the original image ?

(c) Describe and demonstrate using the image (name.png) how down-sampling differs from quantization (use any method).

(d) Write the Algorithms (step-by-step) required to perform the Geometric transformations (from scratch without OpenCV) in question 1 part (d).

(e) Explain Image Registration using the given image (name.png).

Section B - Image Intensity
(20 marks)

Take four distinct pictures with your phone/camera. Each picture should be captured three times: in the early morning, in the afternoon, and at night/sunset. (Total 4 $\times 3 = 12$ images). Ensure you include information about the phone/camera model used to take the photograph in your comment. (Avoid adding enhancements; otherwise, describe the same).

1. Perform the following intensity transformation : $(1 + 2 + 1 + 2$ marks)

   (a) Load and display the image variations captured in the early morning, afternoon, and at night/sunset. Display the shape of the image. (Perform resizing if required).

   (b) Perform the following intensity transformations on the image:

      i Gamma transformation

      ii Negative transformation

      iii Logarithmic transformations

      iv Contrast stretching

   (c) Covert the image to greyscale, display its shape and plot its histogram.

   (d) Repeat steps (b) for the greyscale image.

2. Answer the following questions in the Notebook: $(5 + 3 + 2 + 4$ marks)

   (a) Plot and Compare the histogram of each color channel (the red, green, and blue channels) of the RBG image (all) taken at different times, early morning, afternoon, and night/at sunset. Make a statistics table using the 12 images with the following information: max,

(a) Orginal/Source image (b) Reference image (c) Matched image

Figure 2: Example Histogram matching. The image (c) is histogram matching without mask.

min, mode, and mean of the different channels, when it was taken (morning, afternoon, or night/at sunset), and a description of the lighting. What is your inference from the table ?

(b) For the different intensity transformations in (b), plot and compare the histogram for an image and its variations. Comment on how your device (phone/camera) specs affect the source image and how the difference affected your initial source image.

(c) Demonstrate and explain using the images when a histogram equalizer is (i) sound and (ii) disadvantages. (Here no need to plot for all the images.)

(d) Demonstrate histogram matching using two images you took as original/source images. Next, apply a mask to improve the image and then change to another mask. Explain how the different masks influenced the image or helped achieve the intended result. Repeat experiment (d) with a different reference image. Compare the histograms of the original/-source image and the newly matched image (with and without mask). If required, you can download the reference images, but do mention the source (see figure 2). What is your take away ?

Make sure to add all the code required to generate any of the figures (section A and section B) in the notebook submitted. Each missing code/comment will result in -2 marks.

References and Additional Instructions:

- Chapters 1,2, and 3 (up to convolution) from the DIP book (referenced in the classroom) and Open-CV documentation. For the mask in part (d) section B, see documentations on Image masking. You can use inbuilt functions.
- The viva will also include Lecture notes till the date of the deadline and questions related to work done in the assignment.
- In the Algorithm, do not add statements with inbuilt functions such as "Use the cv2.cvtcolor function to covert RBG to greyscale". Such statements will result in -2 marks.
- Make sure to upload a separate zip folder with your 12 images (and if present the additional reference image) that are required to run the code. (Failing to do so will result in -2 marks)

End