Philadelphia University

Student Name:

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Student Number:

Information for candidates
1. *This examination paper contains 6 questions totaling 40 marks*
2. *The marks for parts of questions are shown in round brackets.*

Advices to candidates
1. *You should attempt all questions.*
2. *You should write your answers clearly.*

Basic notions: *The aims of the questions in this part are to evaluate the required minimal student knowledge and skills. Answers in the pass category represent the minimum understanding of basic concepts: Image Processing Systems, Relationships between pixels, Distance Measures, Intensity Transformation, Histograms and Spatial Domains Filtering.*

Question 1 Multiple choices (circle the most appropriate one): (7 marks)

1) Computer vision defined as a discipline in which ----------
   a) Both the input and output of a process are images.
   b) The input of a process is an image description and the output is image
   c) Both the input and output of a process are descriptions.
   d) The input of a process is an image and the output is an image description.

2) MRI Technology used --------- band.
   a) Gamma Rays
   b) CT Scan
   c) Visible
   d) Radio waves

3) -----------Filter cannot be implemented using convolution mechanism.
   a) Average
   b) Gaussian
   c) Median
   d) Disk

4) To remove "salt-and-pepper" noise without blurring we use
   a) Max Filter
   b) Median Filter
   c) Min Filter
   d) Smoothing Filter

5) Edge detection in images is commonly accomplished by performing a spatial ------ of the image field.
   a) Smoothing Filter
   b) Integration
   c) Differentiation
   d) Min Filter

6) Both the -------- and -------- filters are used to enhance horizontal edges (or vertical if transposed).
   a) Prewitt and Sobel
   b) Sobel and Gaussian
   c) Prewitt and Laplacian
   d) Sobel and Laplacian

7) Transforming the pixel values of an image using the log ( ) transformation is an example of contrast compression of the dark pixels
   a) True
   b) False

Question 2 (13 marks)

a) List two kinds of image representation methods? (2 marks)

Solution

b) Name the types of connectivity and explain (3 marks)

Solution

c) Name three types of sharpening filters? (3 marks)

Solution

d) Give the formula for calculating D_4 (city block distance) and D_8 distance (chess board distance). (2 marks)

Solution

e) Explain the concept, steps and equations involved in unsharp masking technique in image enhancement. (3 marks)

Solution

Question 3   (4 marks)

Write a Matlab script code to display the histogram of an image using a **bar** graph; reduce the resolution of the horizontal axis into 10 bands. Add suitable horizontal and vertical **axes**, **xtick** and **ytick** for your graph.

Solution

Question 4   (4 marks)

Write matlab script code to read a gray scale image named "**pout.tif**" and apply the following mathematical function to stretch its contrast levels:

$$g = \frac{1}{\left(1 + \left(\dfrac{m}{f}\right)^E\right)}$$

Where: **g** is the enhanced output image, **f** is the input image, **m** and **E** must be interactively entered by the user using Matlab **input** command. Display the original and the contrast stretched images.

Solution

3

Question 5   (6 marks)

Write an M-function for grayscale input image; call it "**immaxmin**" to generate two images:
- The first image contains values computed by finding the **maximum** value of a 3x3 pixel environment (neighborhood of required pixel) and by setting the resulting center pixel to this value.
- The second image contains values computed by finding the **minimum** value of 3x3 neighborhood of required pixel and by setting the resulting center pixel to this value.
- Use **preallocating** array for image.
- Use **low-level** processing.

Solution

Question 6 (6 marks)

Write a matlab function called "**Noise_EdgeFilter**" that accepts a string (image file name) and displays images as shown in figure 1 (original image, image using Gaussian filter, Laplacian image and image using Laplacian filter).

Do the following steps with the input image:

- To reduce the noise use the low pass linear spatial filter "**Gaussian**".
- For edge detection use the high pass linear spatial filter "**Laplacian**".
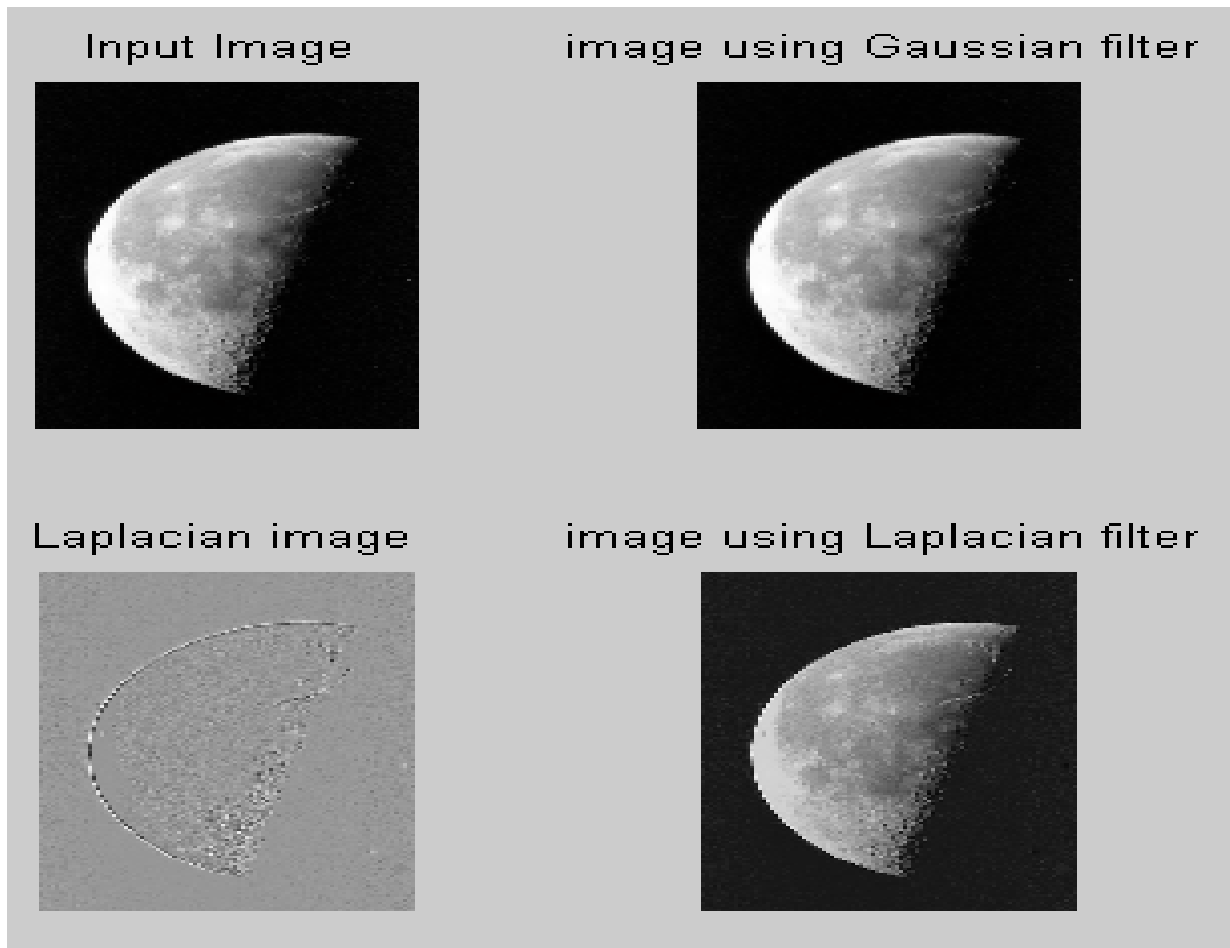- Use **fspecial** matlab command to generate the filters mask.

Figure 1

GOOD LUCK