FINAL - 04/25

**Digital Image Processing**

**Students:**

1.

2.

**Problem 1**. *Looking for a patch in an image*

In the image “barbara.jpg”, find the position of the patch represented by the image “patch.png”. Draw a bounding box on “barbara.jpg” to indicate this patch. (*Hint*: use the Euclidean distance between two vectors or two images to look for similar patches.)

Repeat the above process by replacing “patch.png” with “patch\_1.png”. Comment.

*[Code]*

*[Figures/Tables]*

*[Explanation]*

**Problem 2**. *Fourier Transform*

Given a grayscale image , is the Fourier Transform of . We can represent as follows

where is the phase spectrum of image and is the magnitude spectrum of image .

Now we consider two grayscale images and (of the same size). Then *we exchange the magnitude spectra of the two images*, i.e. *we combine the magnitude spectrum of one image with the phase spectrum of the other image*.

**Requirements**:

We reconstruct the resulting images in the spatial domain. Show the results and comment. (The students freely choose the images for simulation.)

What happens if we replace the magnitude spectrum of an image with random values (while keeping the phase spectrum unchanged)?

*[Code]*

*[Figures/Tables]*

*[Explanation]*

**Problem 3**. *K-means segmentation*

Using the K-means method (K = 5) to segment the image “kodim23.png”.

a) Represent the data matrix (X) used as input in the K-means method (i.e. write X using mathematical representation).

b) Run the K-means method 3 times and show the segmentation results.

c) How should we do if we want to obtain *the same segmentation result* for several runnings (with the same input and the same value of K)?

*[Code]*

*[Figures/Tables]*

*[Explanation]*