ASSIGNMENT2

DIGITAL IMAGE PROCESSING (DIP) - CSE 478

DEADLINE: 2ND SEPTEMBER (WEDNESDAY)

(1) Template matching is an approach for finding small parts of an image which matches a given template. Perform the following tasks:

a.) Given the image "vegan.jpg" and a template "soy-dessert.jpg", implement a simple template matching algorithm which slides the template over the image and makes comparison at each position. Use a simple absolute sum of difference metric for the comparisons and mark a rectangle at the position of minimum cost (distance). [Note: you can resize the images to half of their size for faster computation].

b.) Using the same template ("soy-dessert.jpg"), apply matching on a new image i.e. "vegan-modified.jpg". Does the simple matching with absolute sum of differences as the comparison metric still work? If not, explain the reason of its failure.

c.) Use normalized cross correlation (NCC) as the comparison metric (`https://en.wikipedia.org/wiki/Cross-correlation#Normalized_cross-correlation`) instead and perform template matching on "vegan-modified.jpg". Does it work? If yes, explain the observed results.

d). Can you use integral images to perform the task of template matching with NCC faster? Use matlab "tic and tac" functions to compare the time taken with algorithms with and without using integral images. [Note: you will need integral images of both first and second order].

e.) Compare your implementation with "normxcorr2" function in matlab. Do you think you can further speed up your code using ideas from convolution in frequency domain? Explain with the help of equations or experiments.

(2) Find the orientation of the text images given in the folder ("test-images-for-q2"). [Hint: Approximately estimate using the techniques taught in class, precision is not expected, but if can be done, you will be rewarded with extra credit for the question.]

(3) Given an image $x[m, n]$ with DFT $X[k, l]$, determine the effect of the following manipulations on its transform $X[k, l]$. Do this by first deriving it mathematically and next verifying them experimentally. Use a greyscale image of the Indian rupee symbol (rupee-symbol.jpg) for your experiments. Specify the value you chose for the various constants in the experiments.
a. Scaling the function: $x[m, n] \rightarrow ax[m, n]$
b. Scaling the argument: $[m, n] \rightarrow [am, an]$
c. Shifting the argument: $[m, n] \rightarrow [m + m_0, n + n_0]$
d. Reflection about a vertical line(n=N/2: N is the width of the image): $x[m, n] \rightarrow x[m, N - n]$