EE5175: Image Signal Processing

Lab-6

DFT and Diagonalization

Mar. 11 (Batch-A) and Mar. 12 (Batch-B)

1. Perform 2D DFT on `peppers.pgm` using row-column decomposition. Plot the centred 2D magnitude spectrum.

2. Compute DFTs $F_1(k,l) = |F_1(k,l)|e^{j\phi_1(k,l)}$ and $F_2(k,l) = |F_2(k,l)|e^{j\phi_2(k,l)}$ of I_1(`Image1.pgm`) and I_2 (`Image2.pgm`) respectively. Arrive at two new images I_3 and I_4 such that their DFTs are, respectively, $F_3(k,l) = |F_1(k,l)|e^{j\phi_2(k,l)}$ and $F_4(k,l) = |F_2(k,l)|e^{j\phi_1(k,l)}$.

3. Suppose you are given a kernel

$$h = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 3 \\ 2 & 0 & 2 \end{bmatrix}$$

   which is to be used in the equation g = h $*$ x (where $*$ represents circular convolution). Construct the doubly block circulant matrix H corresponding to the above system by assuming x to be an image of size 5 X 5 . Diagonalise H using the unitary DFT matrix. Verify that the diagonal elements are equal to the 2-D DFT coefficients of h. What do you infer from this exercise?

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