CS 663 - Fundamentals of Digital Image Processing
Assignment 05

Gagan Jain - 180100043
Hitesh Kandala - 180070023

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1 N,N-point DFT

Two Laplacian filter kernels whose N,N-point DFT (where N=201) is to be calculated is given below:

$$k_1 = \begin{pmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{pmatrix} \text{ and } k_2 = \begin{pmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{pmatrix}$$

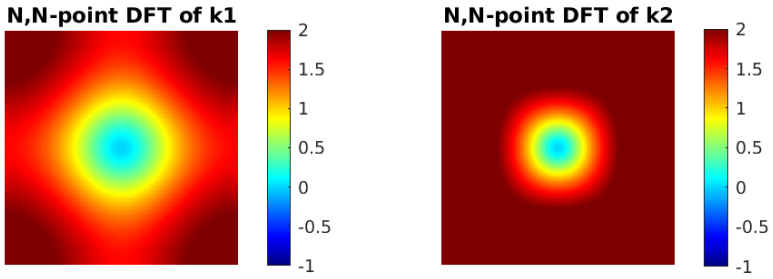

Figure 1: Magnitude of the DFT on a log scale

Difference of the Fourier Transforms of two kernels is the shape of the function, since k_1 has non-zero values in an rotated square shape, the fourier transform also takes the same shape; whereas k_2 has non-zero values everywhere, it therefore has a more circular shape.

Fourier transform of k_1 has more variance than the fourier transform of k_2.

Code snippet for the DFT computation:

```
k1 = [0,1,0; 1,-4,1; 0,1,0];
k2 = [-1,-1,-1; -1,8,-1; -1,-1,-1];

Fk1 = fftshift(fft2(k1,201,201));
Fk2 = fftshift(fft2(k2,201,201));
lf_k1 = log(abs(Fk1)+1);
lf_k2 = log(abs(Fk2)+1);
fig1 = figure(1);
subplot(121); imshow(lf_k1,[-1 2]); colormap(jet); colorbar;
title('N,N-point DFT of k1');
subplot(122); imshow(lf_k2,[-1 2]); colormap(jet); colorbar;
title('N,N-point DFT of k2');
```