Palawan State University
College of Sciences
Computer Studies Department

DIGITAL IMAGE PROCESSING LABORATORY EXERCISE #6

Display of FFT (1-D & 2-D) of an image

The display of FFT (Fast Fourier Transform) of an image involves representing the frequency components of the image in the frequency domain. The FFT is a mathematical algorithm that converts spatial domain data, such as an image, into frequency domain data, revealing patterns and structures that may not be immediately apparent in the spatial domain.

1-D FFT:

- For a 1-dimensional signal or image, the FFT converts the signal from its spatial representation to its frequency representation.
- In the context of image processing, a 1-D FFT would typically be applied along rows or columns of the image matrix to analyze the frequency content along that particular direction.

2-D FFT:

- For a 2-dimensional image, the FFT converts the image from its spatial representation into a frequency representation in both the horizontal and vertical directions.
- The 2-D FFT provides information about the distribution of frequencies across the entire image.
- It decomposes the image into its constituent spatial frequencies, revealing details about the image's texture, edges, and other features.

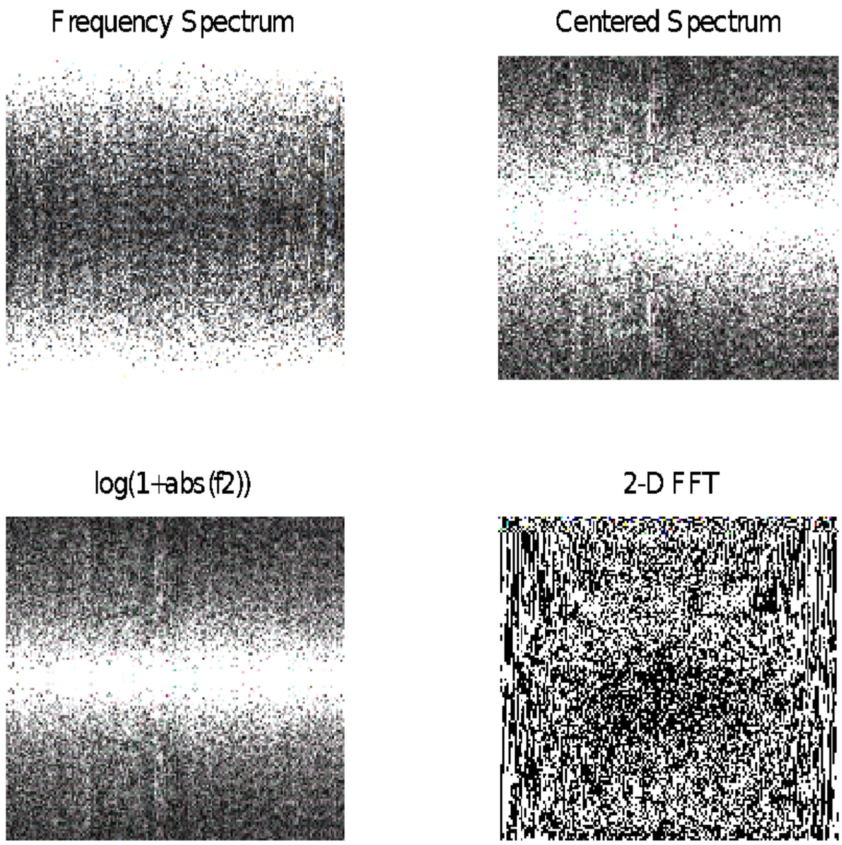
Displaying the FFT of an image involves visualizing the magnitude and phase information obtained from the FFT computation. This visualization is typically done using techniques such as magnitude spectrum plots, phase spectrum plots, or combined magnitude-phase representations.
Common applications of displaying the FFT of an image include:

- Image filtering in the frequency domain: By manipulating the frequency components of the image, various filtering operations such as low-pass, high-pass, or band-pass filtering can be performed.
- Feature extraction: The FFT can help identify prominent frequency components in an image, which can be useful for feature extraction tasks such as texture analysis or pattern recognition.
- Compression: Transforming the image into the frequency domain allows for efficient compression techniques, such as JPEG compression, which exploit the redundancy present in the frequency components.

Overall, displaying the FFT of an image provides valuable insights into its frequency content and can be a powerful tool for various image processing tasks.

```
I=im2double(imread('cancercell.jpg')); f1=fft(I); f2=fftshift(f1);
subplot(2,2,1); imshow(abs(f1)); title('Frequency Spectrum'); subplot(2,2,2); imshow(abs(f2)); title('Centered Spectrum');

f3=log(1+abs(f2));
subplot(2,2,3); imshow(f3); title('log(1+abs(f2))'); I=fft2(f1); I1=real(I);
subplot(2,2,4); imshow(I1);title(' 2-D FFT');
```



Exercise #6

Display of FFT (1-D & 2-D) of an image

Name:
Year/Block:
Application/Software:

1. Codes
2. Output
3. Answer the following questions:

   A. How do high-amplitude peaks in the magnitude spectrum plot correspond to distinct features or textures in the original image?
   B. How can information from the phase spectrum plot be used in image processing tasks like image registration or texture analysis?
   C. What are the differences between frequency representations obtained from the 1-D FFT along rows versus columns of an image, and how do they reflect the image's orientation or dominant features?