* 1. **Aim:**

# LAB Manual PART A

(PART A : TO BE REFFERED BY STUDENTS)

Experiment No.06

Write a program to apply Discrete Fourier Transform (DFT) to an image and compare the results.

## Prerequisite:

1 Python programming syntax (Refer the documentation).

2. Knowledge Discrete Fourier Transform.

2. Availability of Soft copy of your Photograph for experiment.

## Outcome:

### After successful completion of this experiment students will be able to

* + 1. Understand the fundamentals of DFT Transforms and its effects on digital images.
    2. Understand different properties of the transform.
    3. Identify applications of transforms studied.

## Theory:

### Discrete Fourier Transform

In spatial domain, we perform convolution of filter mask with image data. In frequency domain we perform multiplication of Fourier transform of image data with filter transfer function.

The general idea is that the image (***f(x,y)*** of size ***M*** x ***N***) will be represented in the frequency domain (***F(u,v)***). The equation for the two-dimensional discrete Fourier transform (DFT) is:

DFT equation

The concept behind the Fourier transform is that any waveform can be constructed using a sum of sine and cosine waves of different frequencies. The exponential in the above formula can be expanded into sines and cosines with the variables ***u*** and ***v*** determining these frequencies.

The inverse of the above discrete Fourier transform is given by the following equation:

Inverst DFT equation

Thus, if we have ***F(u,v)***, we can obtain the corresponding image (***f(x,y)***) using the inverse, discrete Fourier transform.

Things to note about the discrete Fourier transform are the following:

* the value of the transform at the origin of the frequency domain, at ***F(0,0)***, is called the dc component
  + ***F(0,0)*** is equal to ***MN*** times the average value of ***f(x,y)***
* http://www.cs.uregina.ca/Links/class-info/425/Lab5/Equations/imaginary_definition.pngthe values of the Fourier transform are complex, meaning they have real and imaginary parts. The imaginary parts are represented by i, or j which is defined solely by the property that its square is −1, ie:
* we visually analyze a Fourier transform by computing a **Fourier spectrum** (the magnitude of ***F(u,v)***) and display it as an image.
  + the Fourier spectrum is symmetric about the origin
* the fast Fourier transform (FFT) is a fast algorithm for computing the discrete Fourier transform.

## Procedure/Algorithm:

* + 1. **: TASK 1:**
       1. Read the i/p image.
       2. Apply DFT Transform to the image.
       3. Plot the response of DFT Transform.
       4. Apply the inverse DFT Transform to the output of step 2 .
       5. Compare the two images - Input of step 1 and output of step 4.
       6. Save and close the file and name it as **EX6\_Task1\_your Roll no.m**

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# PART B

(PART B : TO BE COMPLETED BY STUDENTS)

***(Students must submit the soft copy as per following segments within two hours of the practical. The soft copy must be uploaded on the Blackboard or emailed to the concerned lab in charge faculties at the end of the practical in case the there is no Black board access available)***

|  |  |
| --- | --- |
| Roll No. | Name: |
| Class : | Batch : |
| Date of Experiment: | Date of Submission |
| Grade : |  |

## Software Code written by student:

***(Paste your Matlab code completed during the 2 hours of practical in the lab here)***

## Input and Output:

***(Paste your program input and output in following format, If there is error then paste the specific error in the output part. In case of error with due permission of the faculty extension can be given to submit the error free code with output in due course of time. Students will be graded accordingly.)***

### Input Images:

**Output Images:**

* + 1. **For each Transform (Hadamard, Walsh and FFT ).**

## Observations and learning:

***(Students are expected to comment on the output obtained with clear observations and learning for each task/ sub part assigned)***

## Conclusion:

*(****Students must write the conclusion as per the attainment of individual outcome listed above and learning/observation noted in section B.3)***

## Question of Curiosity

***(To be answered by student based on the practical performed and learning/observations)***

Q1: Discuss Different Properties of DFT Transform.

Q2: Discuss any one application of DFT/FFT in detail.

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