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Date
Page

ASSIGNMENT :- 02

Qus.1 What is image transformation? Explain the basic gray level transformation in detail. Also detail. Also explain the gamma correction.

Ans: **Image - Transformation :-**

A function or operator that takes an image as its input and produces an image as its output. Depending on the transform chosen the input & output, Depending images may appear entirely different and have different interpretations. Fourier transformation, various spatial Filters, are examples of frequently used image transformation procedures.

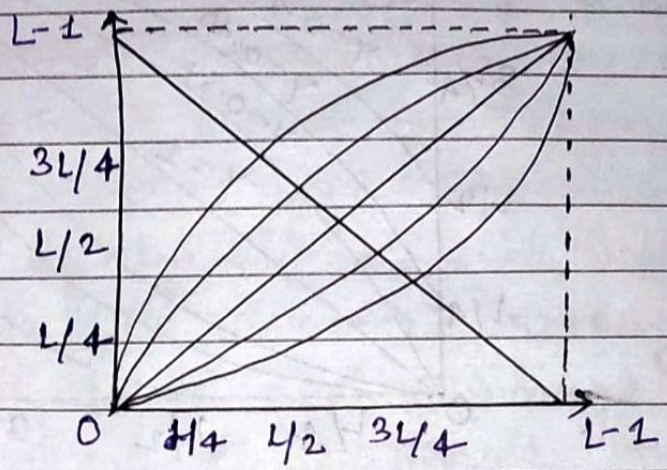
Basic Gray level transformation :-

There are three basic type of function used frequently for image enhancement as follows :-

i) **Image Negatives :-** The negative of an image with intensity

levels in range [0, L-1] is obtained by

$$S = L-1-r$$



ii) Log Transformations :-

The general form of log transform shows :-

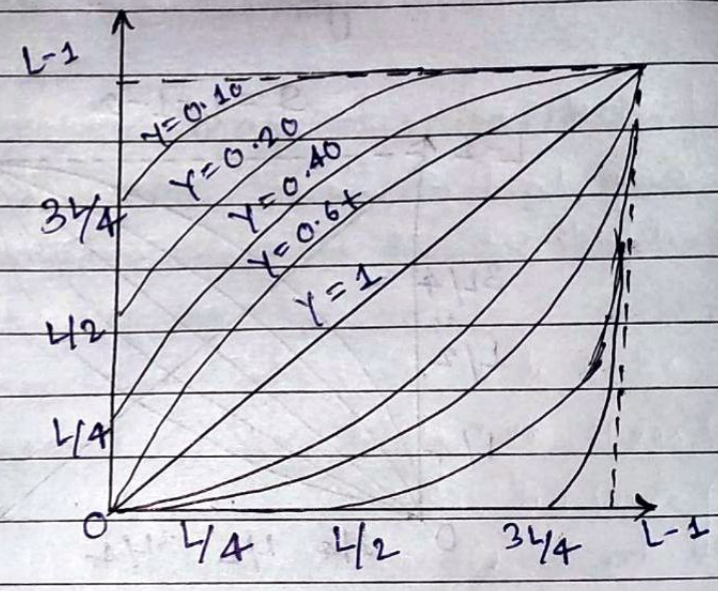
$$S = c \log(1+r)$$

where c is a constant. We use this to expand values of dark pixels while corresponding the higher level values.

iii) Gamma Correction (Power law Transformation) :-

It have basic transformation $S = Cr^{\gamma}$ where C & γ are positive constant sometimes this equation as $S = (Cr+E)^{\gamma}$

Yashasvini Singh
18422102



A variety of device used for image capture printing and display respond according to a power law respond. The power process used to correct these power law responses phenomena is called Gamma correction.

for example :- CRT devices have an intensity to voltage response that is power function exponents varying from approximately 1.86 – 2.5

Ques.2 What is Contrast Stretching? Explain in detail.

Yashaswini Singh
18422419122

Date
Page

Ans :- **Contrast Stretching** :-

One of simplest piecewise linear transformation function is a contrast stretching transformation Low contrast stretching image can result from poar illumination. Lack of dynamic range in image sensors, or even the wrong setting of a lense during image acquisition. If process is that expands the range of intensity levels in an image so that it spans the full intensity range of recording medium or display device.

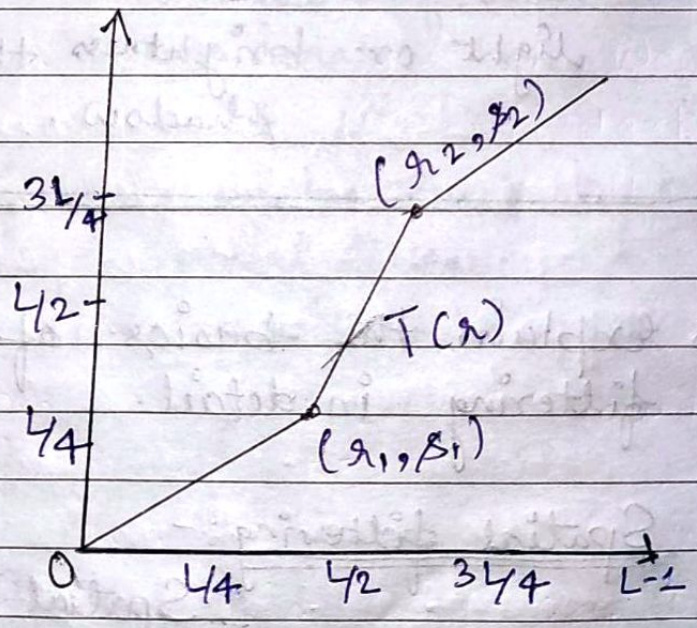


fig shows a typical transformation used for contrast stretching. The location of points (r_1, s_1) & (r_2, s_2)

control the slope of transformation.

(1) If $r_1 = s_1$ & $r_2 = s_2$, the transformation is a linear function that produces number of number in intensity.

(2) If $r_1 = r_2$, $s_1 = 0$, $s_2 = L-1$, the transformation becomes thresholding function that creates a binary image.

(3) If $r_1 \leq r_2$ & $s_1 \leq s_2$ the function is single valued and monotonically increasing.

It makes all the different whether one darkness through light or brightness through the shadow.

Qus.3 Explain the basics of spatial filtering in detail.

Ans:- Spatial filtering:-

Spatial filtering technique is used directly on pixels of an image. Mask is usually considered to be added in size so that it is moved on

the image such that the center of the mask traverses all image pixels.

→ The subimage is called a filter, mask, kernel, template or window.

→ The values in a filter sub-image are referred to as coefficients, rather than pixels.

→ The process consists of moving the filter, mask, kernel, template or window from point to point in an image.

Classification on the basis of linearity :-
- Linear Spatial Filter
- Non-linear Spatial Filter.

General classification :-

i) Smoothing Spatial filter :-

Smoothing filter is used for blurring and noise reduction in the image.

Yashaswini Singh
1824210122

Types of Smoothening filter :-

a) Mean filter :- It is simply the average of the pixels contained in neighbourhood of the filter mask.

b) Order Statistics filter :-

It is based on the ordering pixels contained in the image area encompassed by the filter.

ii) Sharpening Spatial filter :-

It is also known as derivative filter. The purpose of the sharpening spatial filter is just the opposite of the smoothening spatial filter.

Its main focus is on the removal of blurring and highlight the edges.

Yashaswini Singh
18422l0122

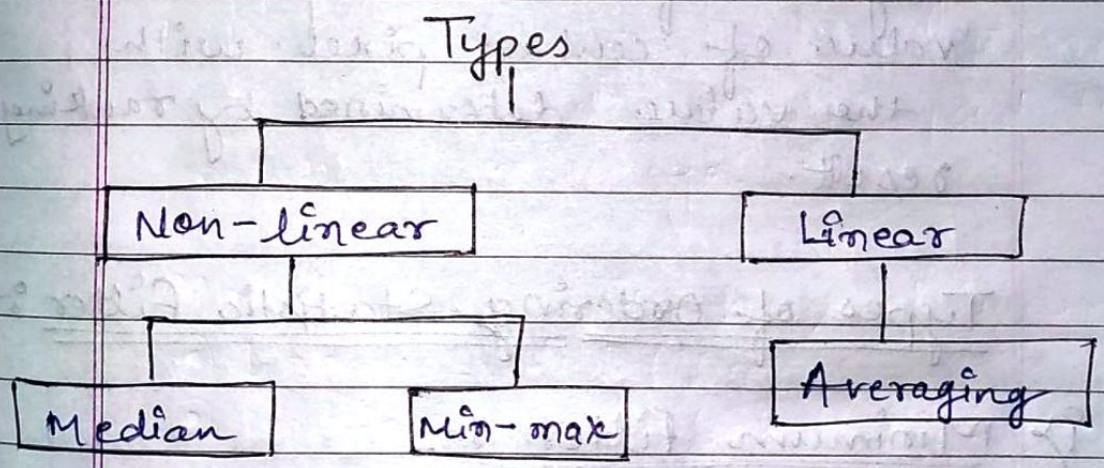
Date
Page

Ques: Explain the smoothening and sharpening filtering in detail.

Ans: Smoothening Spatial filters :-

Smoothening filters are used for blurring and for noise reduction. Blurring is removal of small details from image.

Noise reduction is blurring with linear or non-linear filter.



1) Linear or mean filter :-

Linear spatial filter is simply the average of the pixels contained in the neighbourhood of the filtering mask.

Yashaswini Singh
18422210122

Date
Page

Types of Linear filter :-

* **Averaging filter :-**

It is used in reduction of the detail in image. All coefficients are equal.

2) **Order Statistics filter :-**

It is based on the ordering the pixels contained in the image area encompassed by the filter. It replaces the value of center pixel with the value determined by ranking result.

Types of Ordering Statistic Filter :-

i) **Minimum filter :-**

0th percentile filter is the minimum filter. The value of center is replaced by smallest value of window.

ii) **Maximum filter :-**

100th percentile filter is the maximum filter.

Yashaswini Singh
1842210122

The value is replaced by largest value in window.

iii) Median Filter :-

Each pixel in the image is considered. First neighbouring pixels are sorted and original values of pixel is replaced by median of the list.

Sharpening Spatial Filters :-

It is also known as derivative filtering. The main objective of sharpening is to highlight transitions in intensity.

The image blurring is accomplished by pixel averaging in a neighbourhood.

Since, averaging is analogous to integration.

Some Applications :-

- Photo enhancement.
- Medical Image visualization

Yashaswini Singh
18422010122

Date
Page

- Industrial defect detection.
- Electronic printing.

We are interested in the behaviour of these derivatives in areas of constant gray level, at the onset and end of discontinuities.

Ques: Explain basics of filtering in frequency domain neither proper diagram.

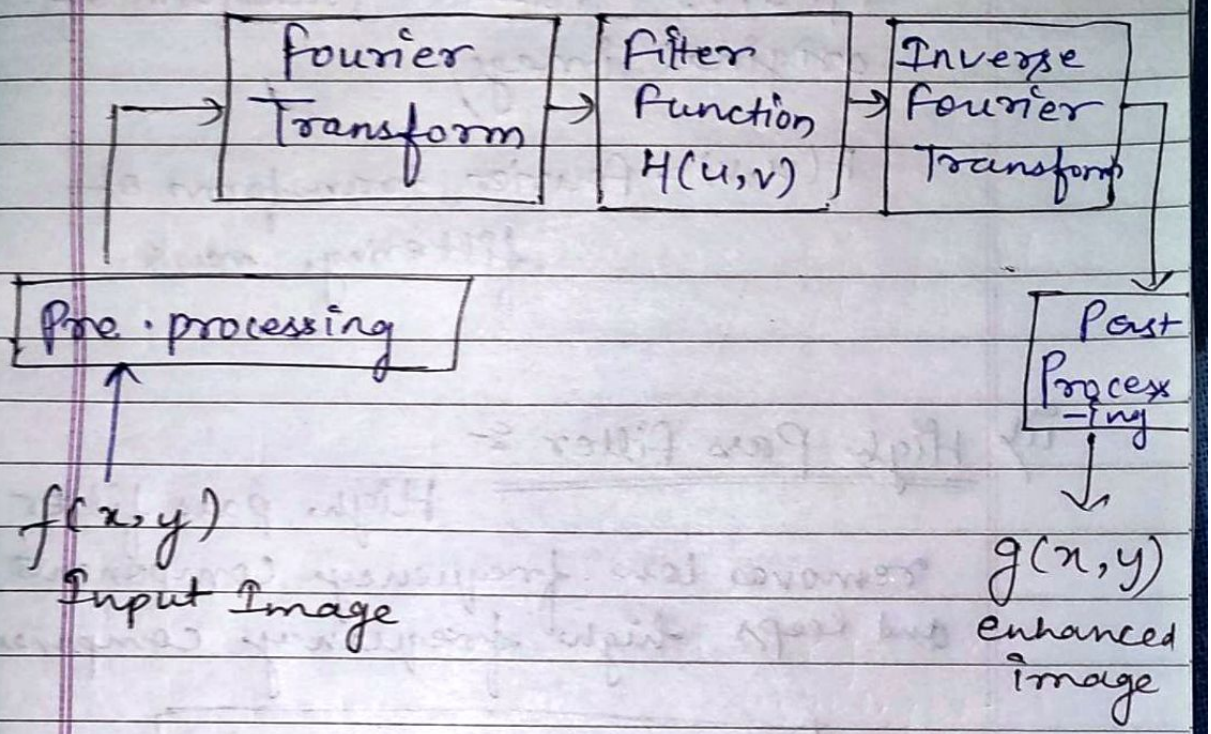
Ans: **Basic of filtering in Frequency Domain :-**

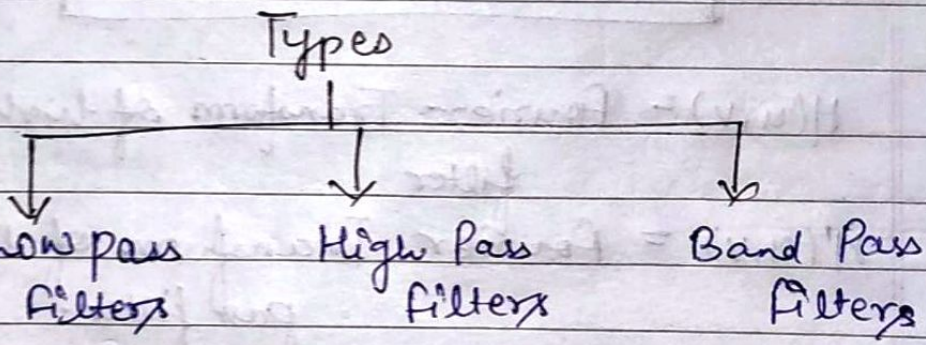
Frequency domain filters are used for smoothening and sharpening of image by removal of high or low frequency components.

Yashaswini Singh
18422210122

Date
Page

Basic Steps of filtering in frequency Domain :-





i) **Low Pass filters :-**

Low pass filters removes the high frequency components that means it keeps low frequency components.

Yashaswini Singh
18422210122

$$G(u,v) = H(u,v) \cdot F(u,v)$$

where,

$H(u,v)$ = Fourier transform of original image.

$F(u,v)$ = Fourier transform of filtering mask.

iii) **High Pass filter :-**

High pass filter removes low frequency components and keeps high frequency components

$$H(u,v) = 1 - H'(u,v)$$

$H(u,v)$ = Fourier Transform of high pass filter

$H'(u,v)$ = Fourier Transform of low pass filter.

iii) **Band Pass filter :-**

It removes the very low frequency and very high frequency components that means it keeps the moderate range band of frequencies.