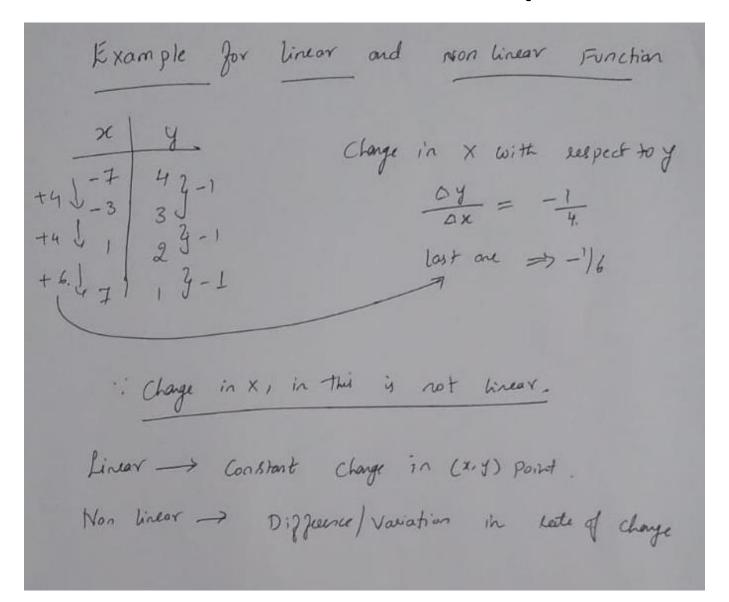
Linear and non-linear operations



Linear and non-linear operations

- H be an operator whose input and output are images
- H is linear if for any two images f & g and any two scalars a & b
 - H(af+bg) = aH(f)+bH(g)
 - then Linear otherwise non-linear

{{ The result of applying linear operator to the sum of two images is identical to applying the operator to the images individually, multiplying the results by the appropriate constants and their adding results. }}

How to check?

H be an operator whose I/P & o/P are imager.

H is linear if

H(ag+bg) = a H(7)+b H(g) -- (i)

- a & b are arbitary constants.

- 2 & g are image matrix / Functions.

- H is Function [eg: max, median, min]

$$E_{1}$$
 $a_{1} = 2$, $a_{2} = 4$
 $8_{1} = \begin{bmatrix} 3 & 7 \\ 4 & 2 \end{bmatrix}$
 $8_{2} = \begin{bmatrix} 6 & 8 \\ 8 \end{bmatrix}$

$$= 2 \left[2 * \left[\frac{3}{4} \frac{7}{1} \right] + 4 \left[\frac{5}{6} \frac{5}{8} \right] \right] 2 * 2 \left[\frac{3}{4} \frac{7}{2} \right] + 4 * 2 \left[\frac{5}{6} \frac{5}{8} \right]$$

$$= \left[\begin{bmatrix} 6 & 14 \\ 8 & 4 \end{bmatrix} + \begin{bmatrix} 4 & 20 \\ 24 & 32 \end{bmatrix}\right] = 2 \times 16 + 4 \times 20$$

$$= 112$$

$$\begin{bmatrix}
10 & 34 \\
32 & 36
\end{bmatrix}$$

Max Function taken at example a, =1, ag = -1, X1-X02 %, = [0 2; 2,3] 82=[6 5; 4 7] $\max \left\{ \begin{bmatrix} 0 & 2 \\ 2 & 3 \end{bmatrix} + (-1) \begin{bmatrix} 6 & 5 \\ 4 & 7 \end{bmatrix} \right\} \max \left[\begin{bmatrix} 0 & 2 \\ 2 & 3 \end{bmatrix} + (-1) \times \max \left[\frac{6}{4}, \frac{5}{7} \right]$ \Rightarrow max $\begin{bmatrix} 0 & 2 \\ 2 & 3 \end{bmatrix} + \begin{bmatrix} -6 & -5 \\ -4 & -4 \end{bmatrix} \Rightarrow 3 + (-1) 7$ =) max [-6 -3] Not equal

Illumination and Reflectance

 The types of images in which we are interested are generated by the combination of an "illumination" source and the reflection or absorption of energy from that source by the elements of the "scene" being imaged.

- Illumination is the amount of source light incident on the scene. It is represented as i(x, y).
- Reflectance is the amount of light reflected by the object in the scene. It is represented by r(x, y).
- Illumination is defined as the energy of light (ε) striking a surface of specific unit area per unit time.

A Simple image formation model

We denoted image by 2D Functions of the Form g(x,y). The value or amplitude of g at Spatial Coordinates (x,y) is a +ve Scalar quantity whose physical meaning is determined by the Source of images.

When an image is generated from a Physical Process is its intensity values are proportional to the energy seadiated by a Physical source.

As a consequence f(n,y) must be non-jew & Finite.

ie $0 < f(n,y) < \infty$

The g(x,y) may be characterized by 2 components.

- 1. The amount of Source illimination incident on the Scene being viewed.
- 2. The amount of illumination replaced by the objects in the scene.

There are called illumination & Reflectance i(n,y) and &(n,y)

There two Functions are combined to form. the product ie &(x,y) = i(x,y) * &(x,y) Where 0 < 1 (x,y) < 00 0 < L(x,y) <1 means total obsorption is o and total sefter leglectona is I

Ronges	of i(x,y) for visible hight	
Sun	- day time -> Produces 90000 lm/m²	
	of illumination on surface of ear	けた
Clea	a evening moon -> 0.1 lm/m² illumination	
Co	monercial / official -> 1000 lm/m2 -11 -	
	age reflectance values 2.(x,y)	
	0.01 -> Black Velvet Im means lumen -	
	0.65 -> Stainless Stel International Unit of	

0.9 -> Silver plated metal 0.93 -> Snow