Prewitt at 0°

$$\begin{bmatrix} -1 & 1 & 1 \\ -1 & 2 & 1 \\ -1 & 1 & 1 \end{bmatrix}$$

Prewitt at 45°

$$\begin{bmatrix} 1 & 1 & 1 \\ -1 & 2 & 1 \\ -1 & -1 & 1 \end{bmatrix}$$

$$\begin{array}{c} \begin{array}{ccc} & -3 & \end{array} \\ \begin{bmatrix} -3 & \cancel{0} & -3 \\ -3 & 0 & 5 \\ -3 & -3 & 5 \end{bmatrix} \end{array}$$

$$\begin{bmatrix} -3 & 5 & 5 \\ -3 & 0 & 5 \\ -3 & -3 & -3 \end{bmatrix}$$

Step edge :

Slant edge .

Signal edge

Triangle edge

$$0^\circ \qquad\qquad\qquad 45^\circ$$

$$\begin{bmatrix} A & 0 & A \\ B & 0 & B \\ A & 0 & A \end{bmatrix} \qquad \begin{bmatrix} 0 & C & D \\ -C & 0 & C \\ -D & -C & 0 \end{bmatrix}$$

Step edge

$2A+B$ $\qquad\qquad$ $A+B$

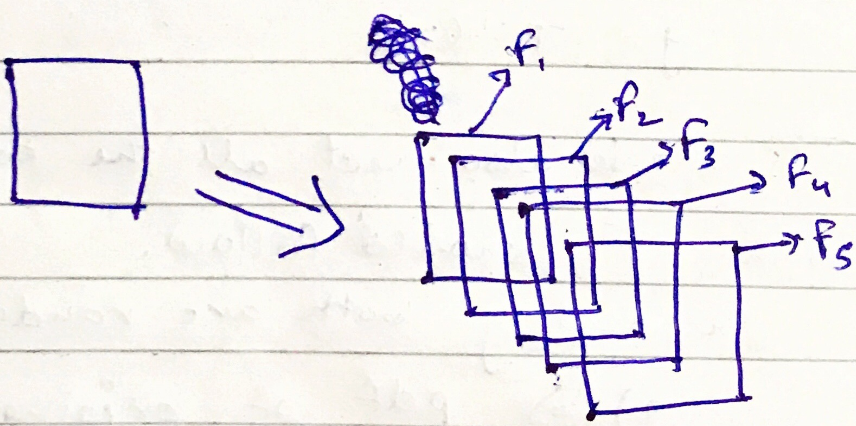
$C+D$ $\qquad\qquad$ $2C+D$

Computer Vision

Morphological Operators/ function / Transforms
→ Dilation
→ Erosion *tools
→ Opening
→ Closing.

Enhancement * Application

H - Transform (Dissecting)
→ Take a GLI (Grey level image)
→ Break the grey level into groups
(0 - 10, 11 - 20, ...)



Lattice : $F_1(\hat{x}, \hat{y}, \hat{z}) \rightarrow F_2() \rightarrow F_3() \rightarrow$
Tension and so on

Enhancement

$\Downarrow$

Histogram Equilization

$g \rightarrow$ No. of gray levels of an image

$\Downarrow$

Normalised to $\{0, 1\}$.

$T(g) \Rightarrow$ Monotonically increasing function.

Single valued function.

$0 < T(g) < 1 \quad , \quad 0 < g < 1$

$x = T(g) \longrightarrow$ Enhanced image

$g = T^{-1}(x)$

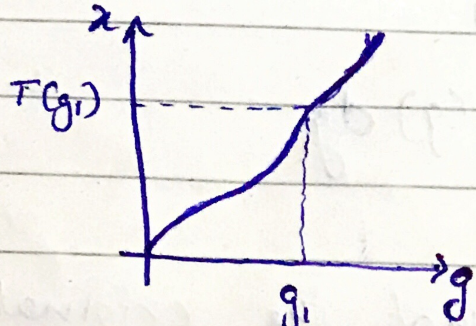
T^{-1} should also meet all the conditions which T should follow.

x and g both are random.

$p_g(g) \Rightarrow$ pdf of original image
(Probability density function)

$f_x(x) \Rightarrow$ pdf of Transformed image

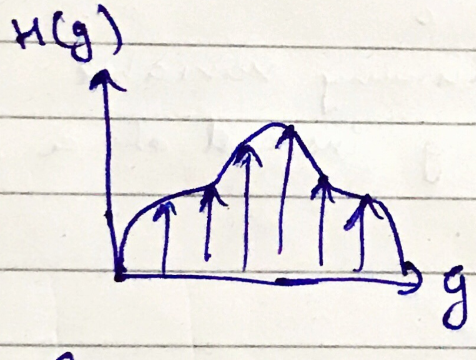
$$P_x(x) = \left| P_g(g) \frac{dg}{dx} \right|_{g = T^{-1}(x)}$$



$x = T(g)$

Prob. Density function (PDF) (Derivative)

Cummulative Density function (CDF) (Integral)



$$\int_0^{g_1} H(g)\,dg = \underline{CDF}$$

$$x = T(g) = \int_0^{g_0} P_g(g)\, dg$$

The cummulative probability of the original grey levels

$$x = T(g) = \int_0^{g_0} P_g(a)\, da$$

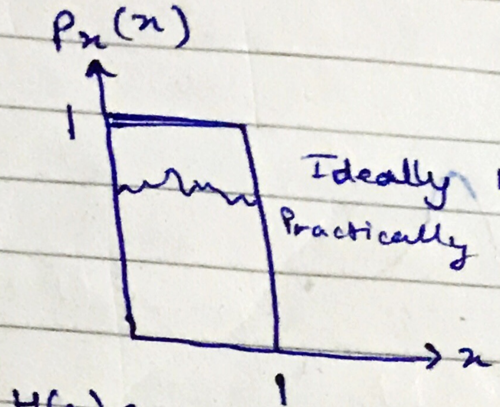
$a \rightarrow$ dummy variable

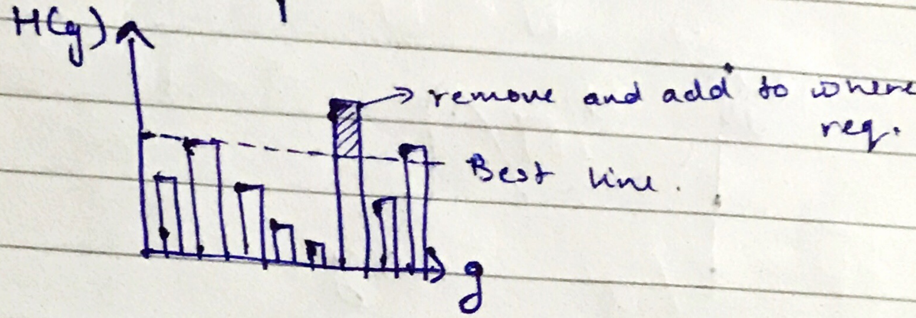
can use g instead of a.

$$0 < g < 1$$

$$\frac{dx}{dg} = P_g(g)$$

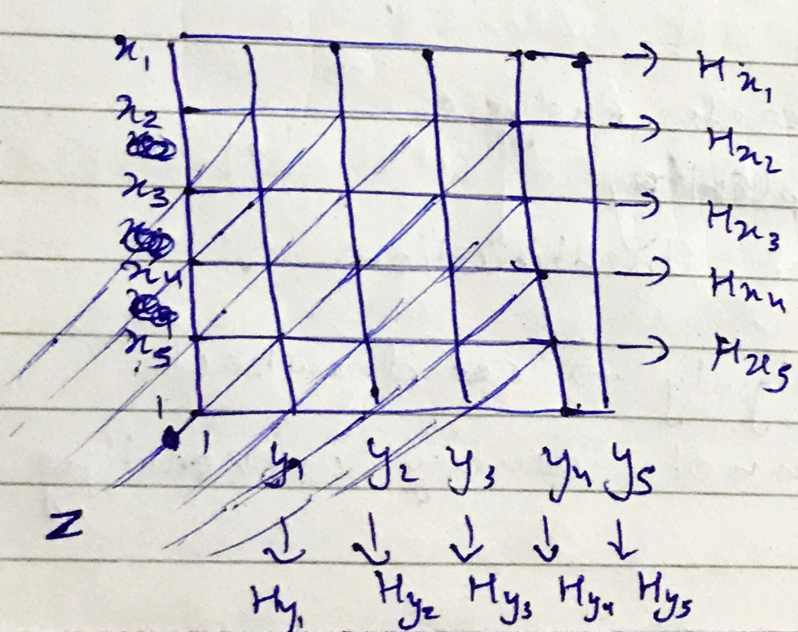
$$\Rightarrow \quad P_x(x) = \left| \cancel{P_g(g)} \frac{1}{\cancel{P_g(g)}} \right|_{g = T^{-1}(x)}$$

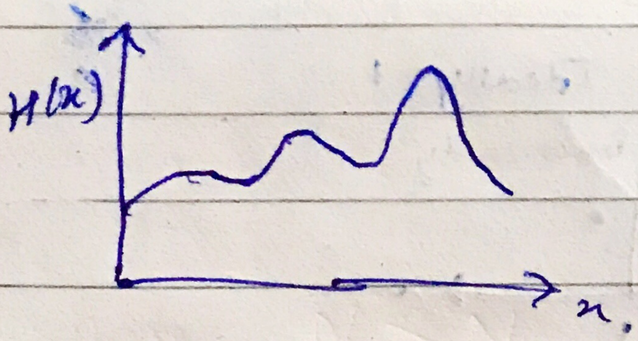


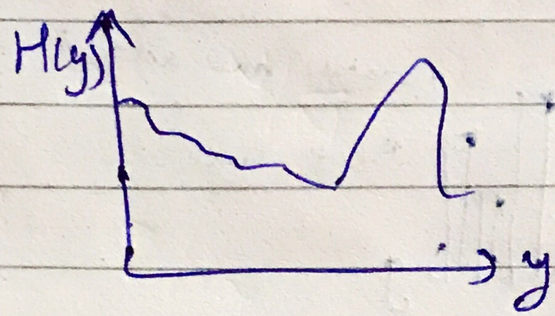


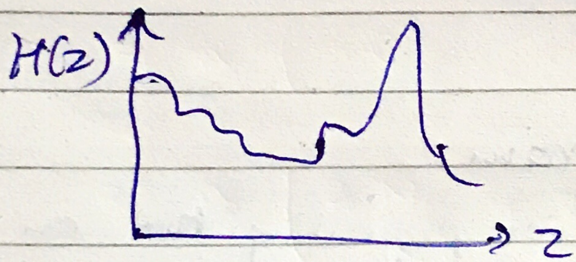
Lateral Histogram:

It is a way of projecting an image on two or more than two axes.









To solve
- → Discrete Analysis
- → complexity
- → Object Identification.

★ Ambiguity → drawback

→ It cannot identify intersecting points.

- Let the image be of size $N \times N$
- Object inside image of size $(n \times n)$

Template Matching $\rightarrow$ Nn complexity

$$R_{LAT} = 2aN^2 + 2bNn + cp^2n^2$$

assuming $a \approx b \approx c$

$p \rightarrow$ No. of objects in the image.

Eg:-

$N = 256$ $\quad$ $p = 20$

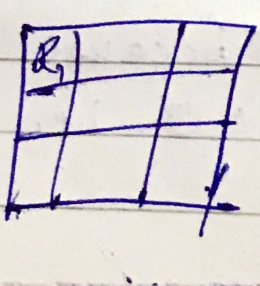
$n = 7$

$$R_{LAT} = a\left[2N^2 + 2Nn + p^2n^2\right]$$

$$= a\left[2 \times (256)^2 + 2 \times 256 \times 7 + (20)^2 (7)^2\right]$$

Complexity $\rightarrow$ N^2 (template Matching)

Sub - image Analysis



= n parts

No. of objects in Subimage $\propto$ Part size

No. of objects in Sub image = $K(\text{Part-size})^2$

Let the Size of Sub image = $\bar{N} \times \bar{N}$

where $\bar{N} < N$.

$$\alpha = N/\bar{N} \Rightarrow \alpha > 1$$

$$\bar{P} = P/\alpha^2$$

$$\bar{R}_{LAT} = \alpha\left(2\bar{N}^2 + 2\bar{N}n + \bar{p}^2 n^2\right)$$

$$= \alpha\left(\frac{2N^2}{\alpha^2} + \frac{2N}{\alpha}n + \frac{p^2}{\alpha^4}n^2\right)$$

$$= \frac{2N^2}{\alpha} + 2Nn + \frac{p^2}{\alpha^3}n^2$$

$$= \alpha\left[2N^2 + 2\alpha Nn + \frac{p^2}{\alpha^2}n^2\right]$$

- Too big $\alpha \Rightarrow$ loss of information.
- Complexity has reduced because of loss of information as $p \rightarrow 0$. i.e. p becomes nearly 0, zero.