Image Enhancement

Purpose: Modify img (hidden otherwise)
to bring out
features.

Machine.
Human.

Two kinds

- Spatial domain
- Frequency domain

Spatial filtering

$f(x,y)$ = input.

$g(x,y)$ = enhanced image. = output.

Space domain process: Transform T

$$T[\, f(x,y)\,] = g(x,y)$$

T can be ... only effect either

of (x,y) pixel in f, or

neighbouring pixels in (x,y)

Simple case:

T looks at single pixel in $f(x,y)$ $\longrightarrow$ Gray level. Trafo

T . looks at single pixel in $f(x,y)$.

T . determine g at (x,y).

$$S = T(r)$$

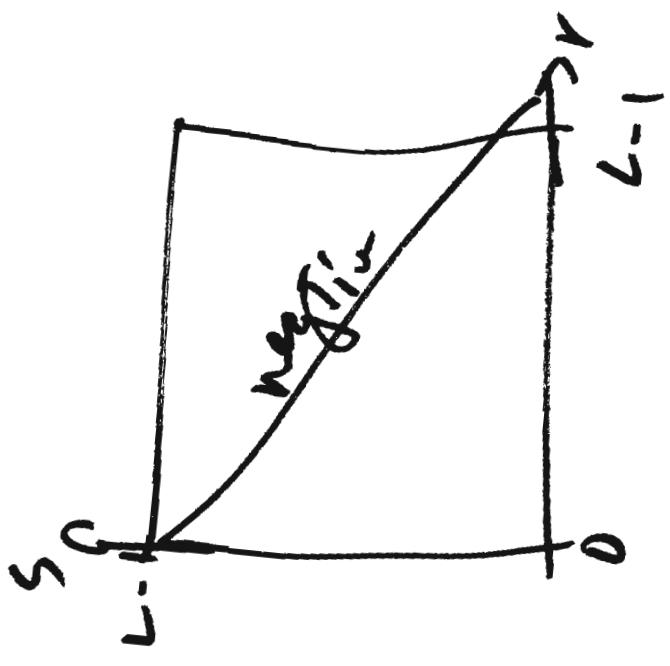input pixel at (x,y)

output pixel at (x,y)

Show 3.2 of b/w.

More complex *

$3,3$ regions.

5×5
7×7

masks.

Gray level Transforms:

① Image Negative:

$$S = L - 1 - r$$
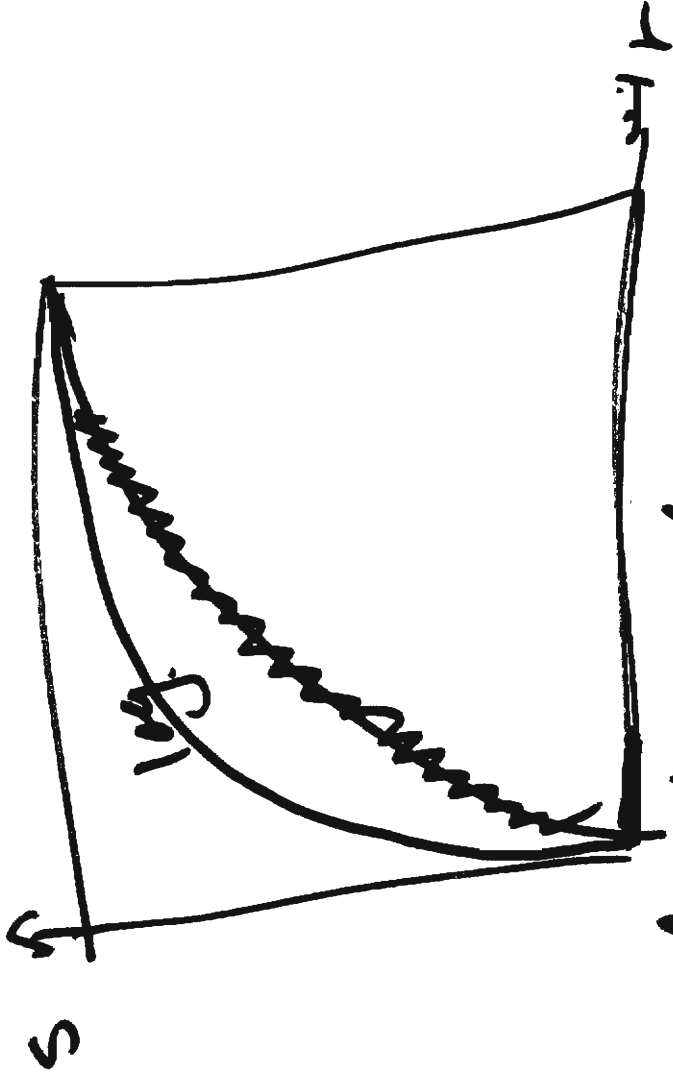

3.3 G/W

② log Transformation:

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

- expand values of dark Pixels → overall '?yle.

- Compresses the dynamic rang.

③ Power - Law Trofermch.

$$S = C \, r^{\delta}$$

c, δ are positive

Fig 3.6 in G/W

CRT = Cathode Ray Tube

$$I_{luminance} = U^{\gamma}$$

$$I = U^{\gamma}$$
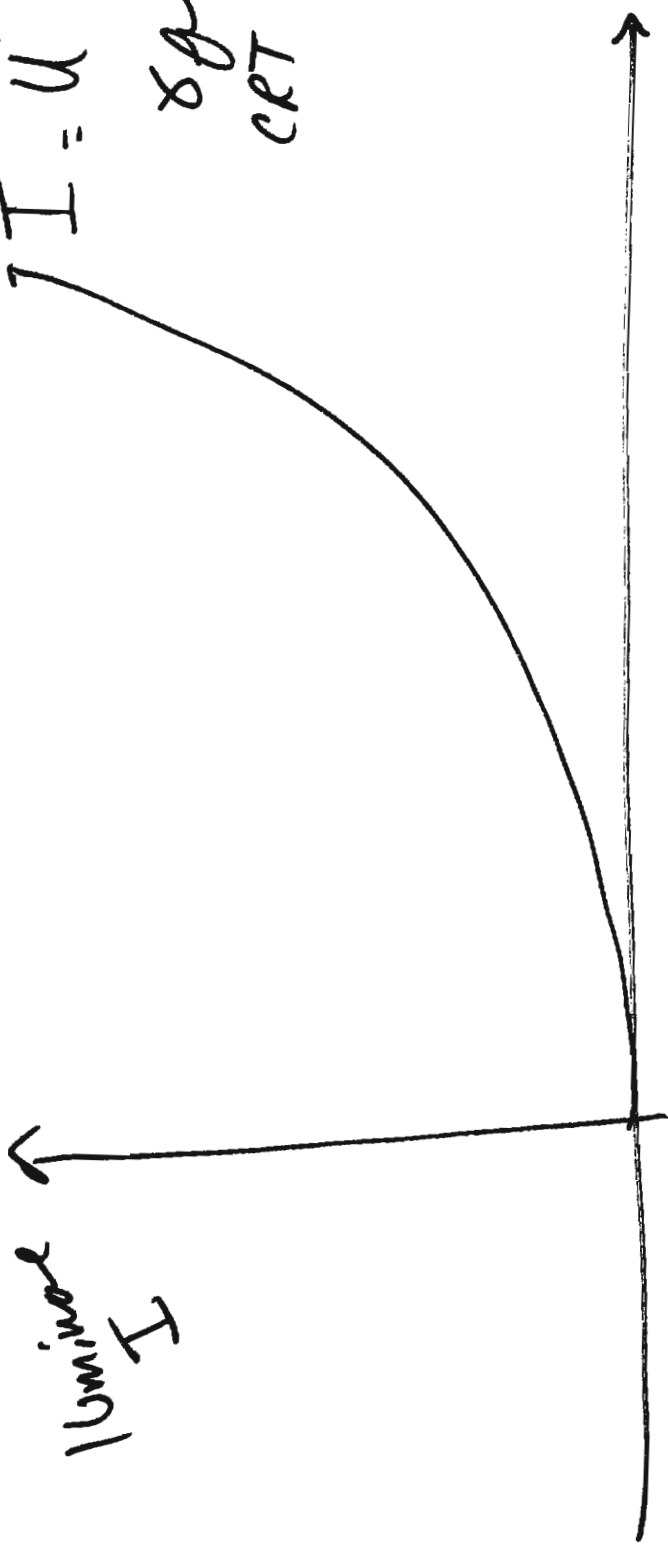
γ for CRT 2.5

$f(x,y) = $ input voltage

input luminance

$f(x,y)^{\gamma}$

Correcting input image to save Power (law) according to it so that it The output device is rendered correctly is rendered correctly Correction Gamma

Piecewise Linear Transformation

(r_2, s_2)

(r_1, s_1)

s

L-1

L-1

0

r
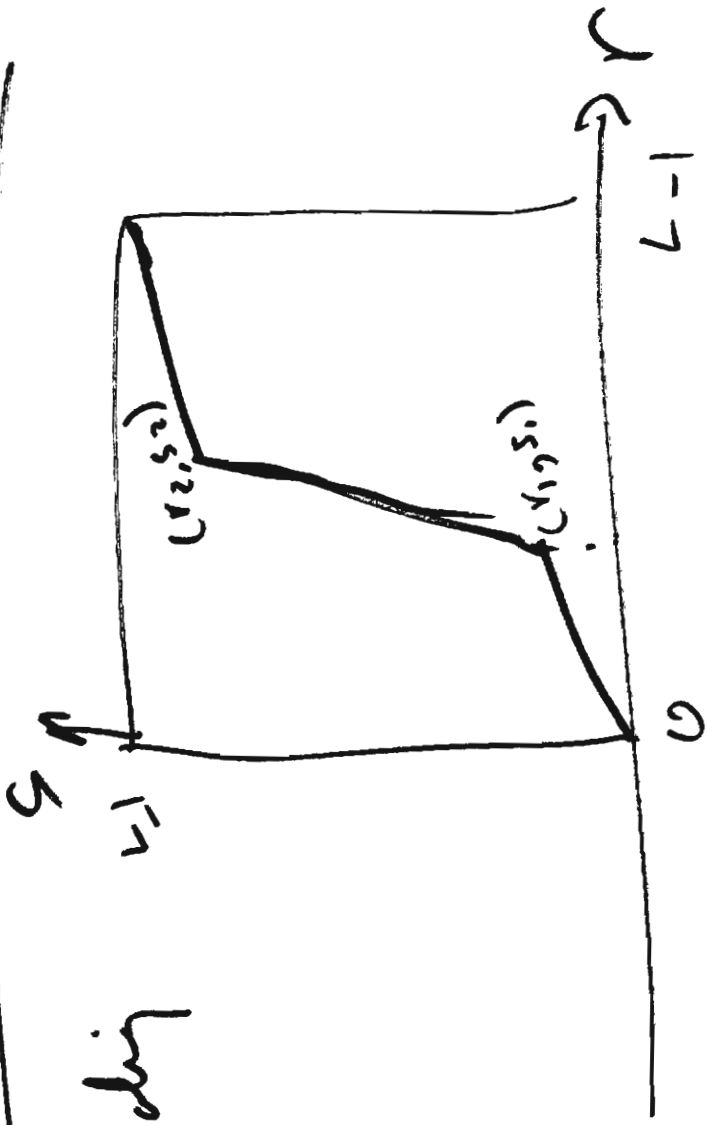
① Contrast stretching

3.10

② Gray level Slicing.

Histogram Processing

what is a histogram?

$$0 \rightarrow L-1 \qquad n_k$$

$P(n_k)$

$n_o \, h_i$

$P(n_k)$

CDF $- P(n_k) \quad n_k$

$P(n_k)$

$$\int P(n_k)\, dn_k$$

0