SNS COLLEGE OF ENGINEERING

(Autonomous)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

19EC351 – IMAGE PROCESSING AMD COMPUTER VISION

UNIT -2

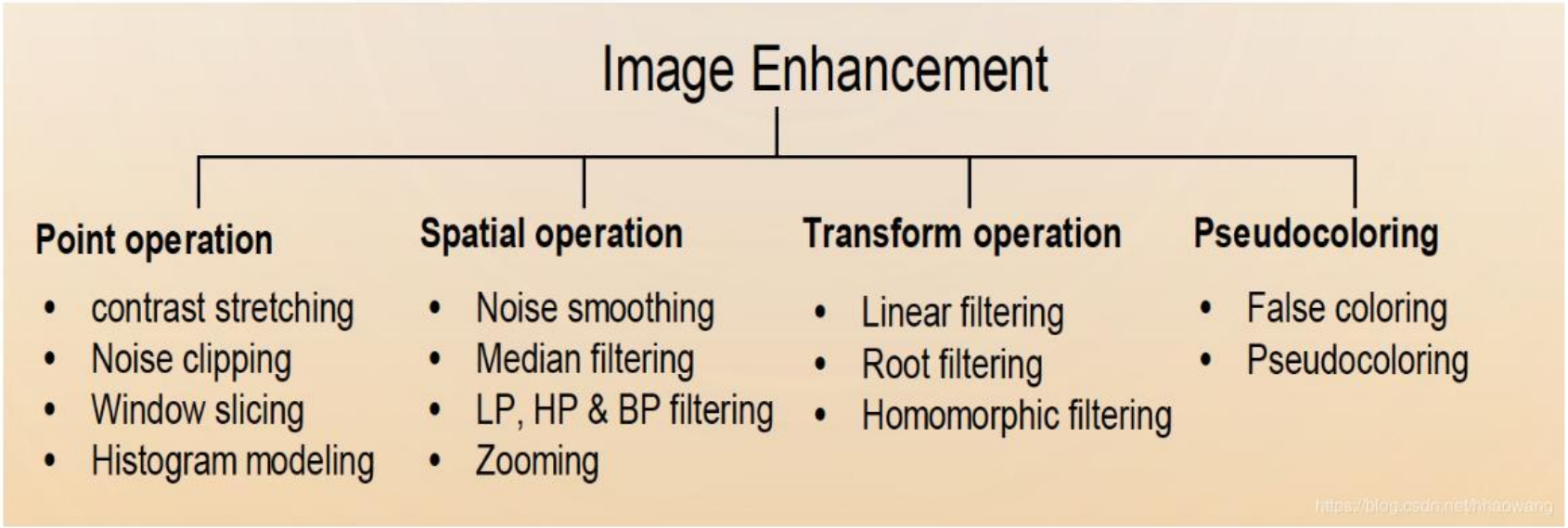
Image Enhancement

- Introduction
- Image enhancement methods:
  - Spatial-Frequency domain enhancement methods
  - Point operations
  - Histogram operations
  - Spatial operations
  - Transform operations
- Multi-spectral image enhancement
- False color and pseudocoloring
- Color image enhancement

Introduction

- The principal objective of image enhancement is to process a given image so that the result is more suitable than the original image for a specific application.
- It accentuates or sharpens image features such as edges, boundaries, or contrast to make a graphic display more helpful for display and analysis.
- The enhancement doesn't increase the inherent information content of the data, but it increases the dynamic range of the chosen features so that they can be detected easily.

Enhancement Techniques



Enhancement Techniques

- Spatial domain
- Frequency Domain

Spatial Domain

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

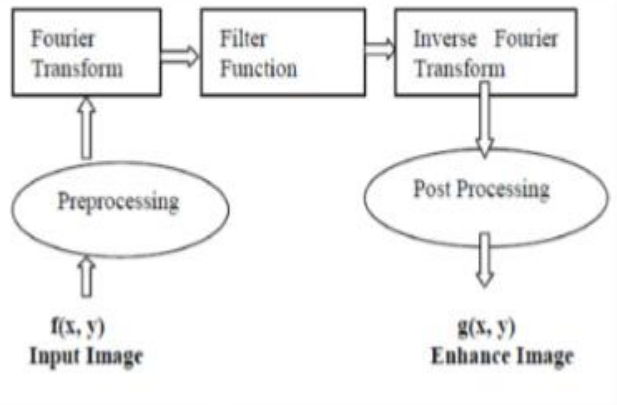
$s = T(r)$

- Point Processing
- Histogram Processing
- Neighborhood processing

Frequency Domain

$g(x, y) = h(x, y)^* f(x, y)$

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



Grey Level Transformation in Spatial Domain

Point Processing

Digital Negative

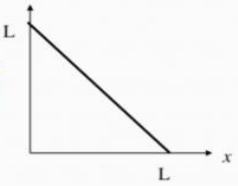


Figure: (a) Input image (b) negative image

Logarithmic Transformation

$$y = c\log_{10}(1+x)$$

c=100

Figure: (a) input image (B) log transformation

Power Law Transformation

- $s = c \times r^{\gamma}$

γ=1.5

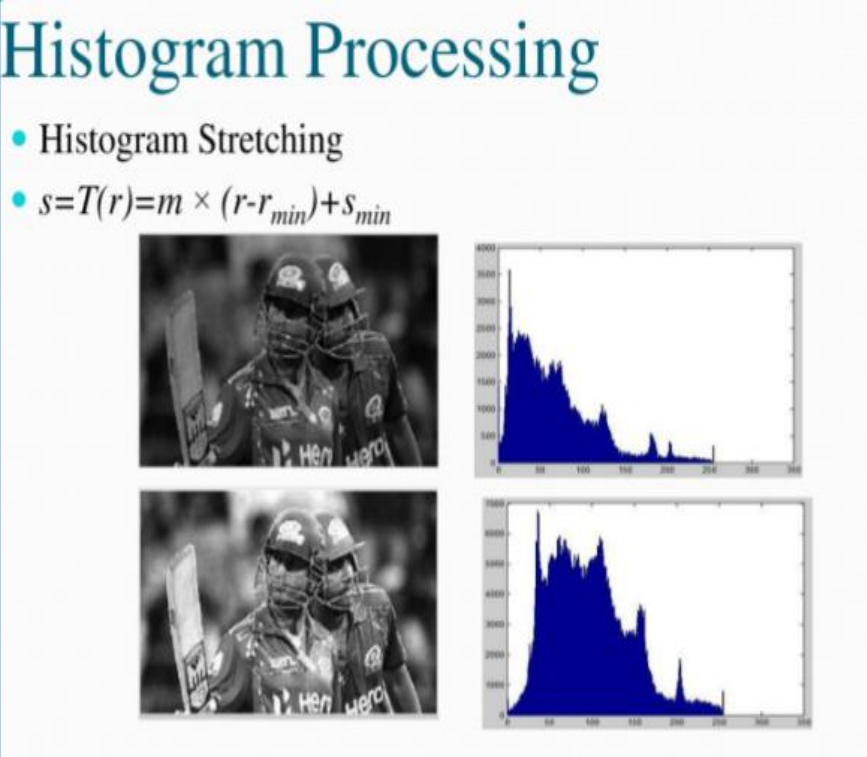
Figure: (a) input image (B) power law transformation image

Histogram Processing

•The **histogram** of an **image** is a function that maps each gray level of an **image** to the number of times it occurs in the **image**.

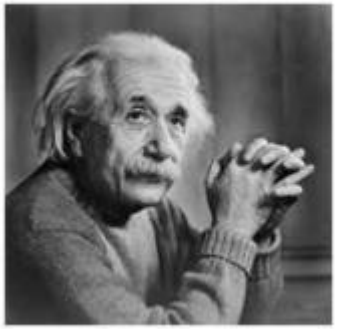
•The histogram analysis is based on an assumption that the gray-scale values of foreground (anatomical structures) and background (outside the patient boundary) are distinguishable.

•It is effective tool for image quality assessment as well as for manipulating the contrast and brightness of an image.



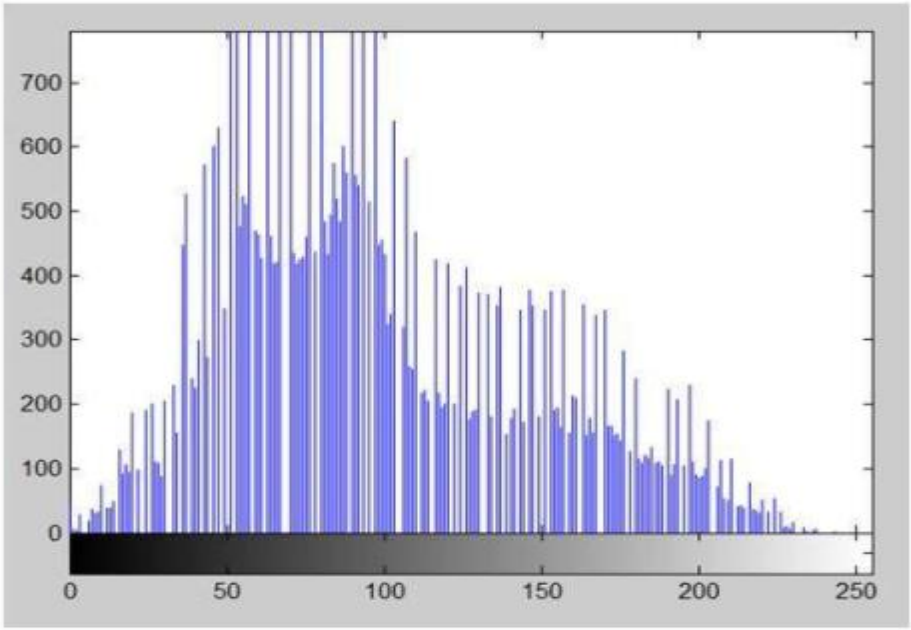
Histogram Equalization

- Histogram equalization is one of the Pixel brightness transformations techniques.
- It is a well-known contrast enhancement technique due to its performance on almost all types of image.



Histogram of this image

The histogram of this image has been shown below.

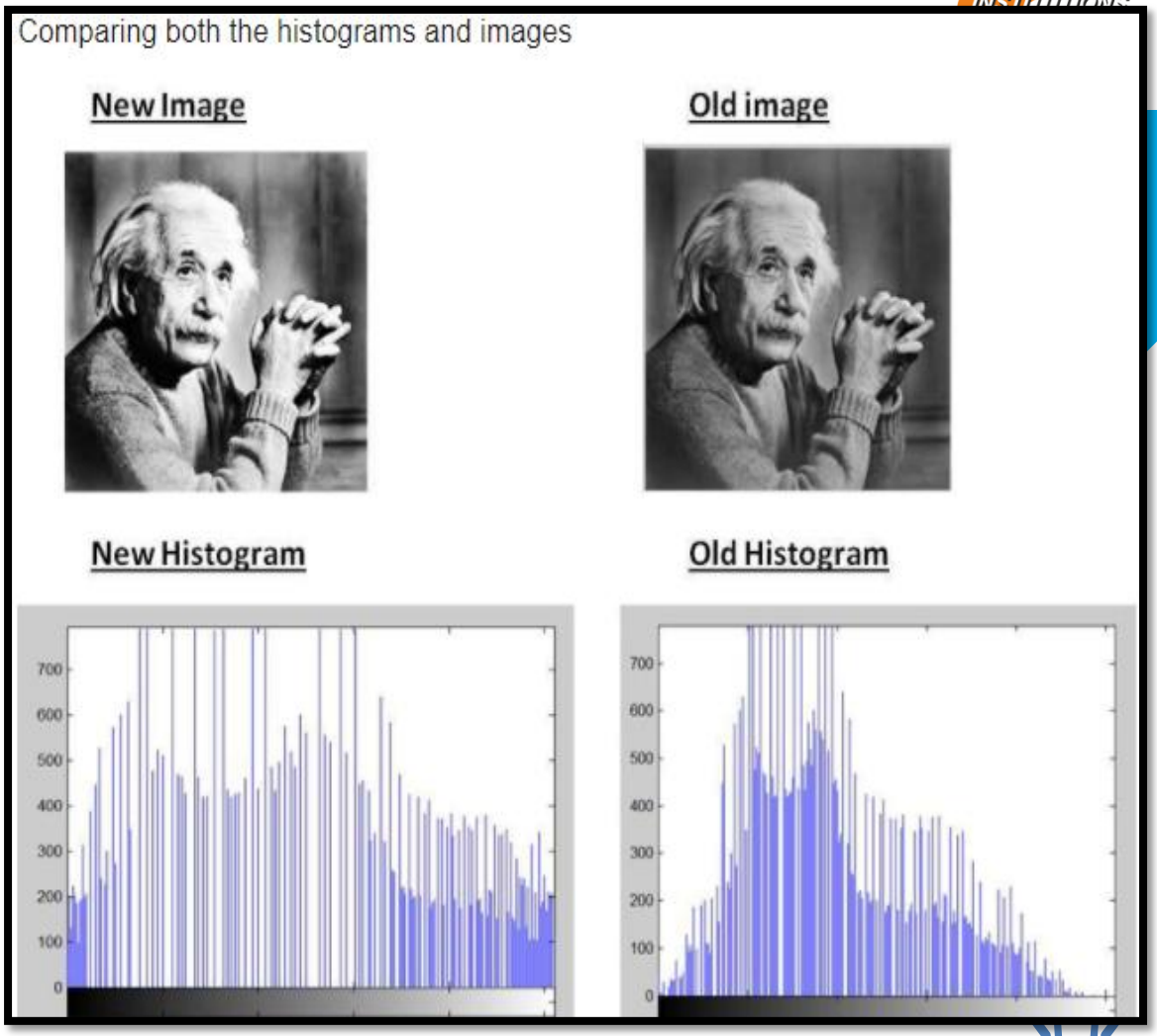


Histogram Modeling

Now we will perform histogram equalization to it.

PMF : First we have to calculate the PMF (probability mass function) of all the pixels in this image.

CDF : Our next step involves calculation of CDF (cumulative distributive function). Calculate CDF according to gray levels



Histogram

0	2	1	3	4
1	3	4	3	3
0	1	3	1	4
3	1	4	2	0
0	4	2	4	4

input: Image A

Pixel Value	Histogram	Equalized Histogram
0	4	4
1	5	9
2	3	12
3	6	18
4	7	25

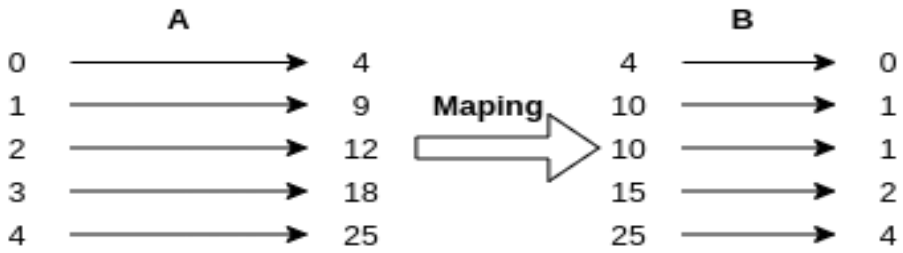
Equalized Histogram of A

2	1	2	1	0
3	3	2	4	4
1	3	2	4	4
0	0	3	2	1
1	3	1	4	0

Target: Image B

Pixel Value	Histogram	Equalized Histogram
0	4	4
1	6	10
2	5	15
3	5	20
4	5	25

Equalized Histogram of B



0	1	1	2	4
1	2	4	2	2
0	1	2	1	4
2	1	4	1	0
0	4	1	4	4

Modified: Image A

THANK YOU