

Project Proposal

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Intensity Transformation

Topic and Objective(s)

What is the topic:

Intensity Transformations:

Manipulation of image pixels to achieve a enhanced image that is more suitable than the original for analysis.

What subtopics do we plan to implement:

Image negative, histogram matching, histogram equalization, log transformation, power law gamma transformation, histogram shaping, and contrast stretching

What is your objective:

To create a tool that is useful in demonstrating various intensity transformations by manipulating pixels through certain techniques and showcase its importance to real - world uses such as medical imaging and industrial manufactory.

Northpole Image



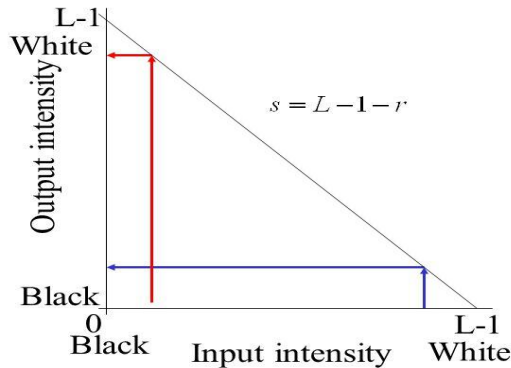
Negative of Northpole



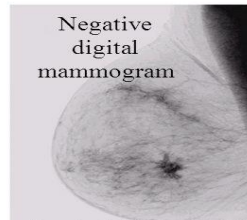
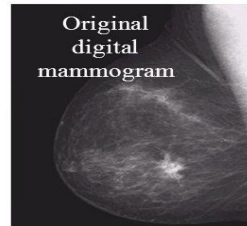
Image Negative

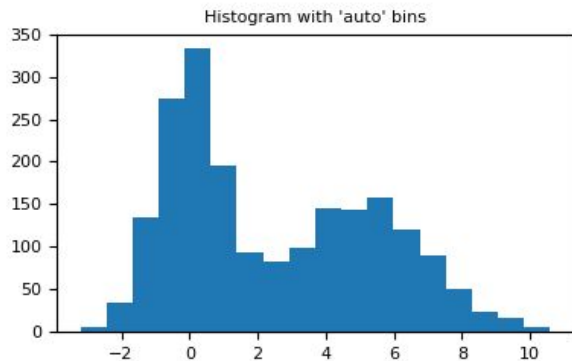
- S = output intensity
- R = input intensity

Used to allow better analysis of certain qualities in images. The lower the input pixel value is, the higher the output pixel value will be. In general, the darker the pixel, the brighter it is when negative.



L = the number of gray levels





Histogram

Provides a statistical viewpoint of the image which provides a lot of information that can be manipulated to make different alterations. Plots the number of pixels for each intensity value.

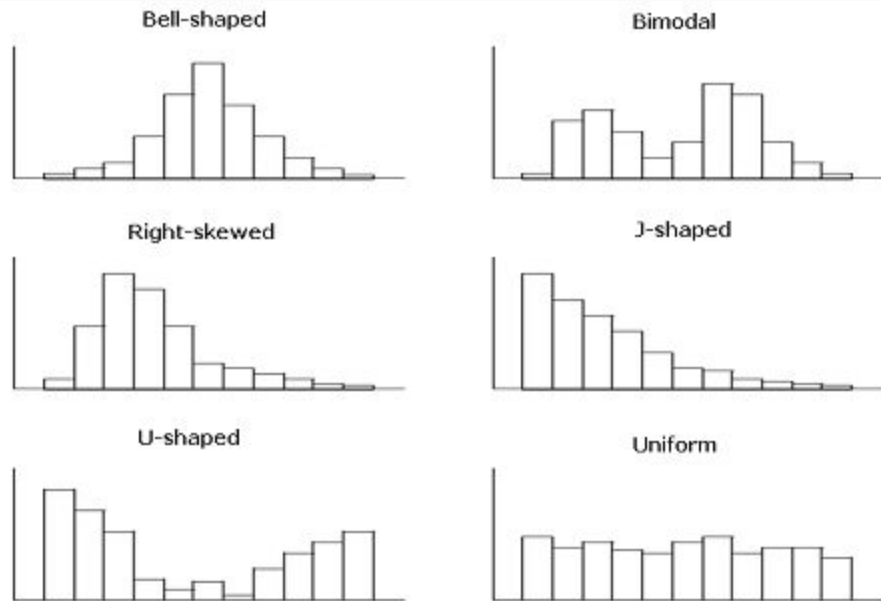


Image from depaul.edu

Histogram Shaping

Modifying an image by altering its histogram to match another histogram shape. Different methods of shaping results in different results of the digital image.

Source



Template



Matched

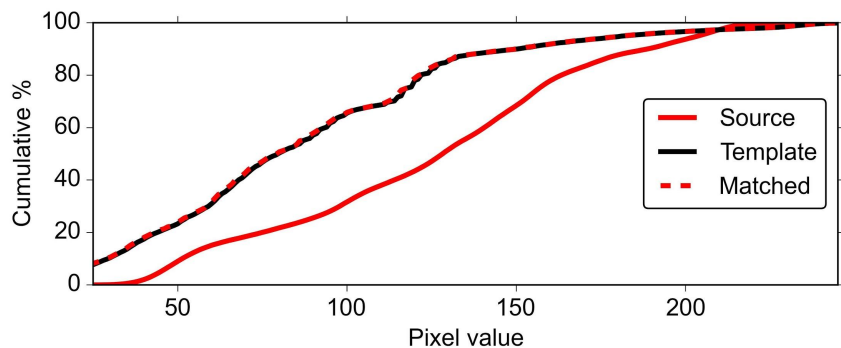


Image from Stack Overflow

Histogram Matching

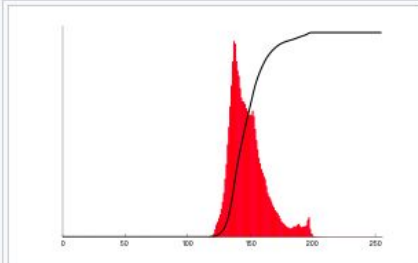
A special case of Histogram Shaping where the histogram of one image is matched to that of a target image.



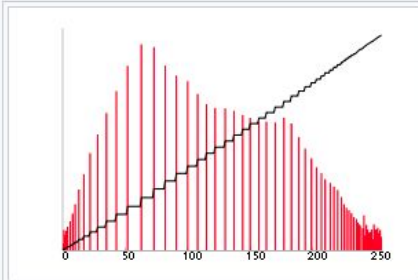
Before Histogram Equalization



After Histogram Equalization



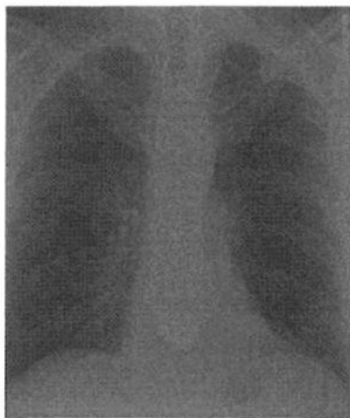
Corresponding histogram (red) and cumulative histogram (black)



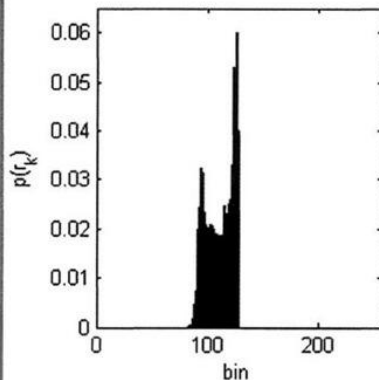
Corresponding histogram (red) and cumulative histogram (black)

Histogram Equalization

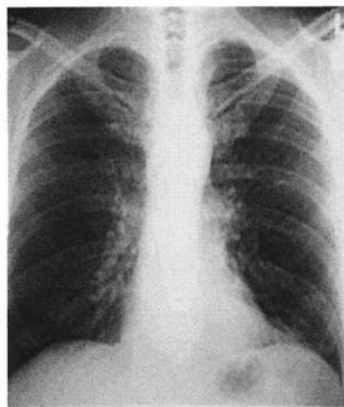
Increases the contrast in an image by adjusting the intensity distribution of an image.



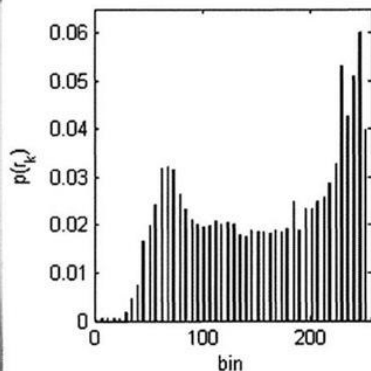
(a)



(b)



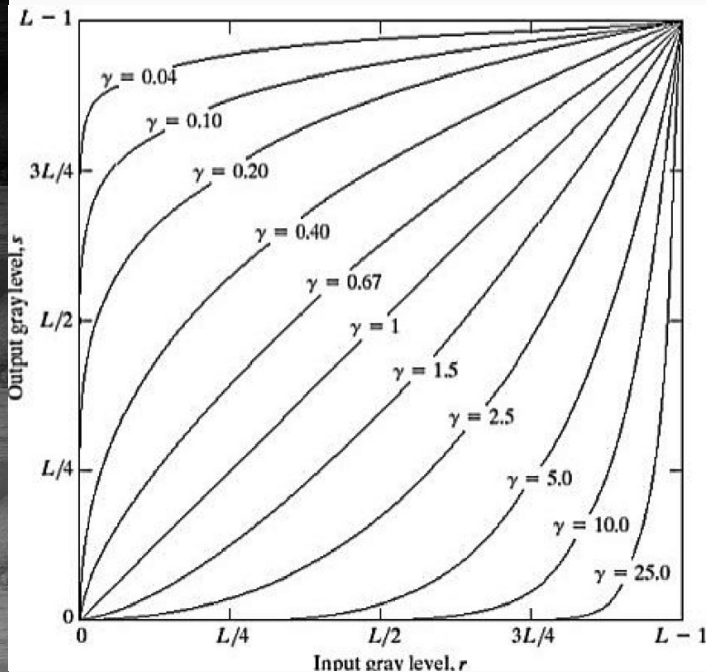
(a)



(b)

Contrast Stretching

Also called “Normalization,” enhances image contrasts by stretching the range of intensity values. Works best on skewed histogram or histogram that’s not well-distributed such as Figure (b).



Power-Law or Gamma Transformation

- Formula: $s = c \cdot (r^\gamma)$ where c and γ are constants and s = output gray level and r = input gray level
- Used to correct the power-law response phenomena found in display and capture devices.
- For example, CRT devices tend to produce dark images.
- $\gamma > 1$ produces a darker image, while $\gamma < 1$ produces brighter images

Log Transformation

One simple technique to enhance images.

Formula: $o = c \log(i + 1)$.

C = arbitrary constant, o = output pixel, i = input pixel

Purpose: Increase the detail (or contrast) of lower intensity values. Higher the c value, brighter the image.

ORIGINAL



C = 1



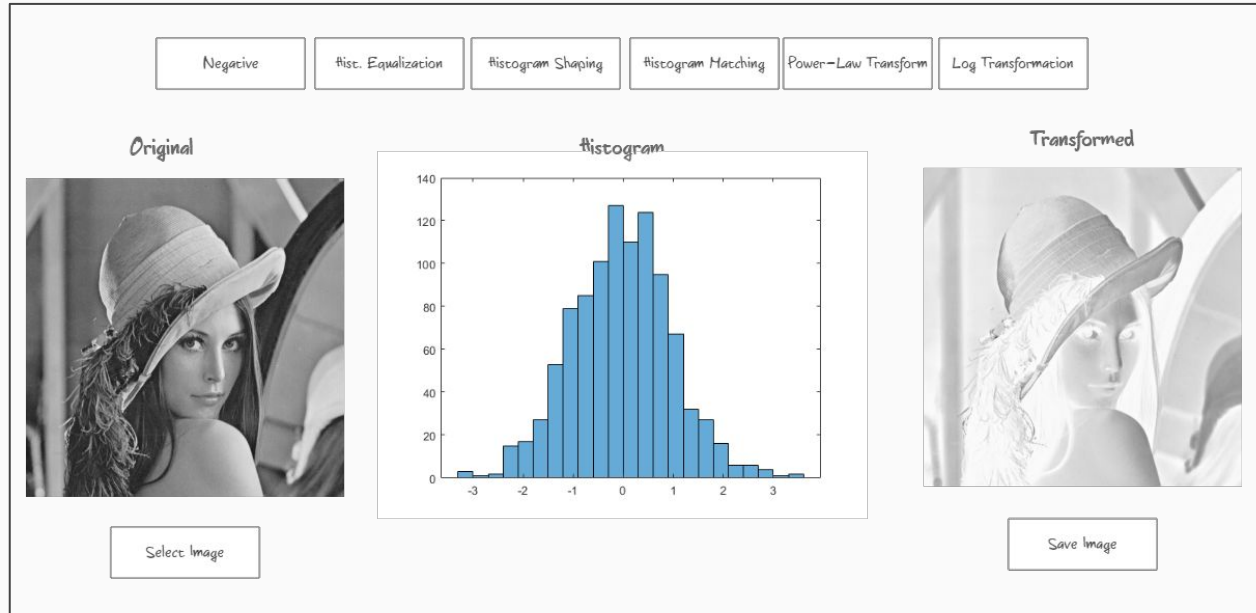
C = 2



C = 5



GUI Prototype



Member Responsibility

1	Task	Status	Member(s) working on task
2	GUI	In progress	Duong, Zhao
3	REPORT	In progress	Zhao
4	PROPOSAL	In progress	Austin
5	IMAGE NEGATIVE	In progress	Austin
6	HIST. EQUALIZATION	In progress	Jason
7	HIST. MATCHING	In progress	Jason
8	CONTRAST STRETCH	In progress	Amanjit
9	LOG TRAN.	In progress	Duong
10	POWER-LAW GAMMA TRAN.	In progress	Tym
11	HISTOGRAM	In progress	Amanjit
12	HISTOGRAM SHAPING	In progress	Amanjit

Libraries and Functions

Libraries that will be used:

- OpenCV
 - needed to read images
- Math
 - log and power functions
- Numpy
 - Matrix manipulation
- TKinter
 - GUI

We will not be using the various transformation functions of OpenCV. Transformation algorithms will be implemented ourselves.