Project Proposal

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Intensity Transformation

Topic and Objective(s)

What is the topic:

Intensity Transformations:

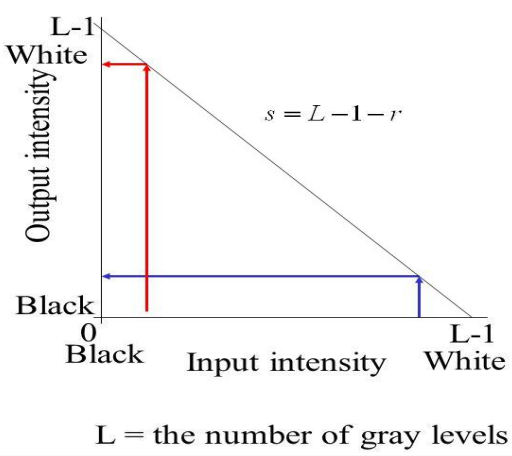
Manipulation of image pixels to achieve a enhanced image that is more suitable than the original for analysis.

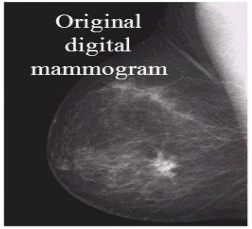
What subtopics do we plan to implement:

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.





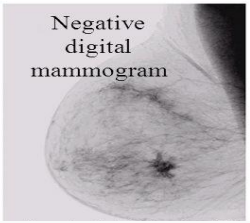
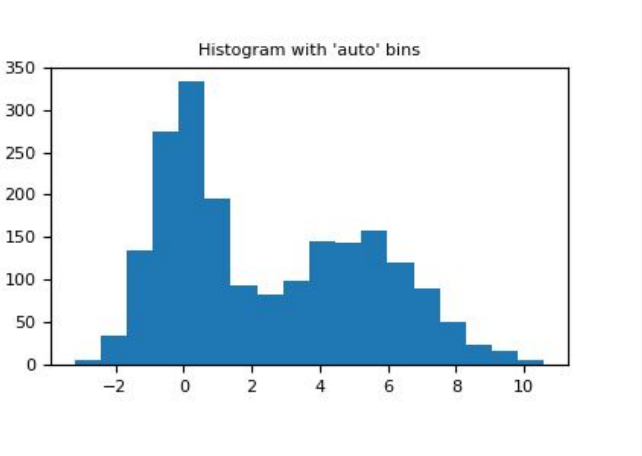


Image from MATLAB Works: Basic Intensity Trans.

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.



Histogram example from SciPy.org

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.

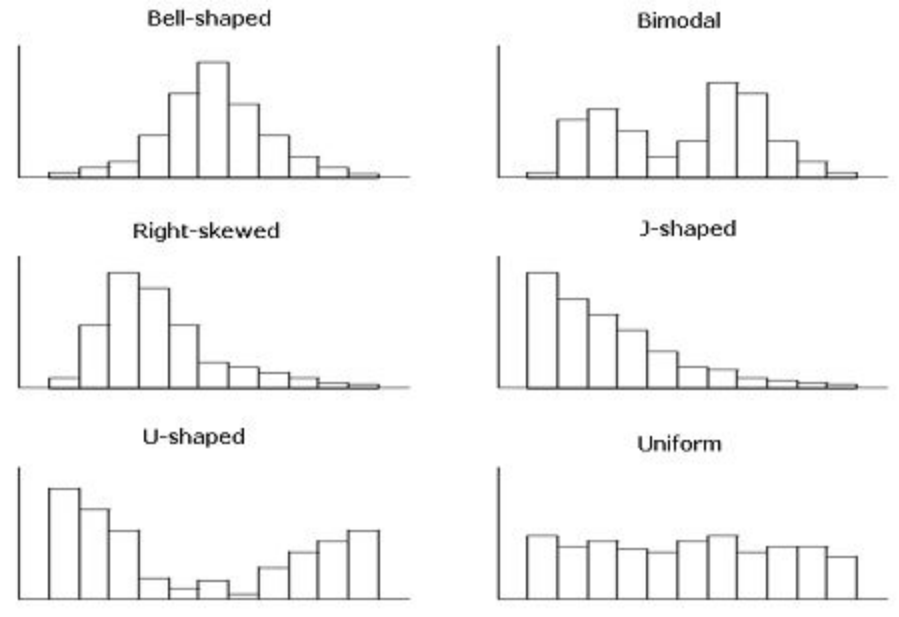


Image from depaul.edu

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.

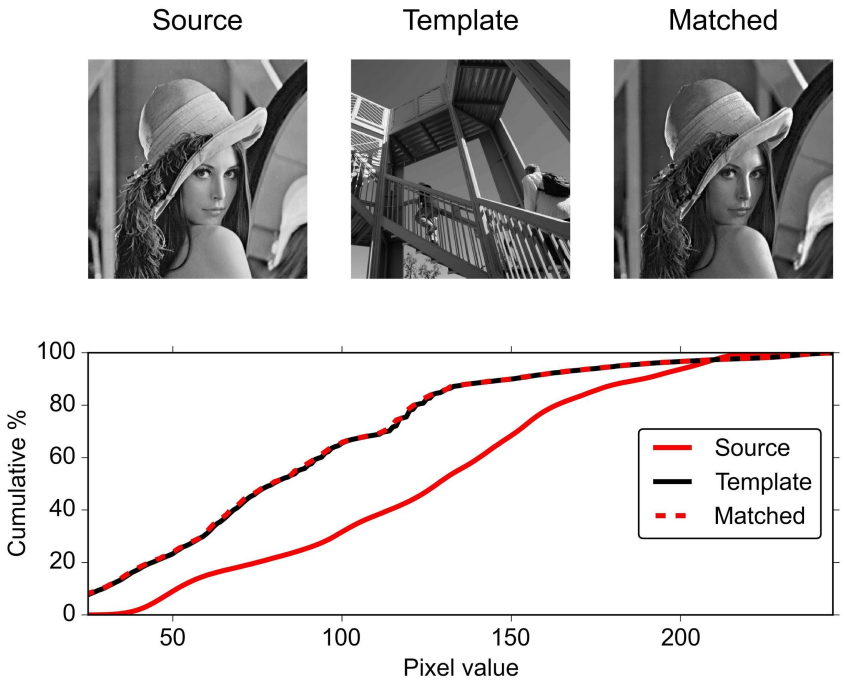


Image from Stack Overflow

Histogram Matching

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

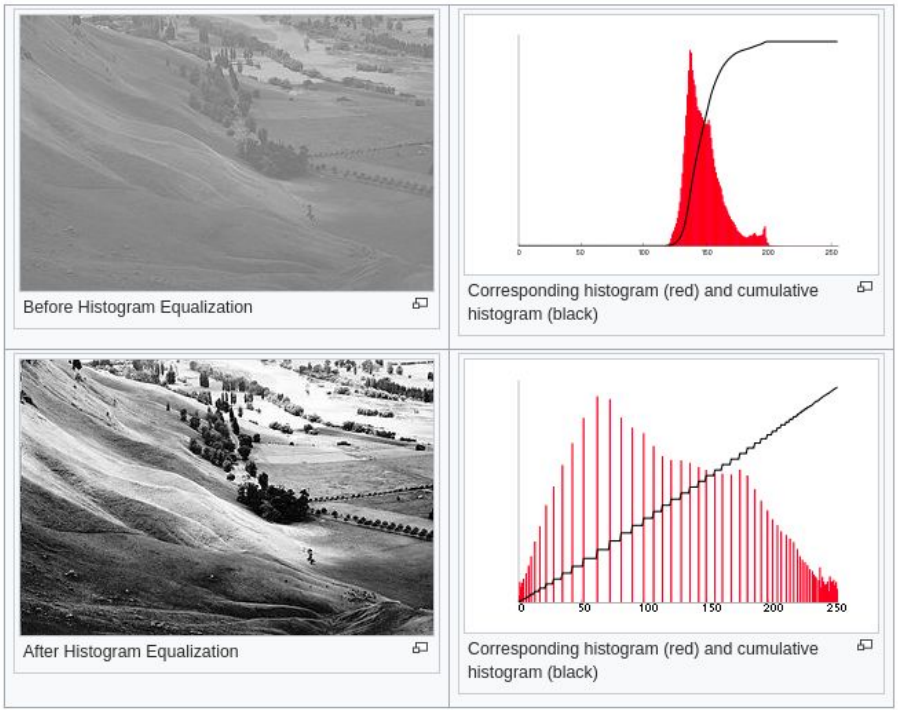
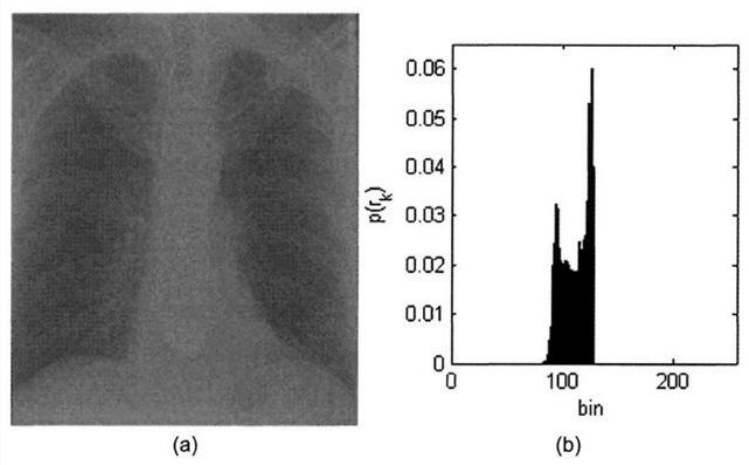
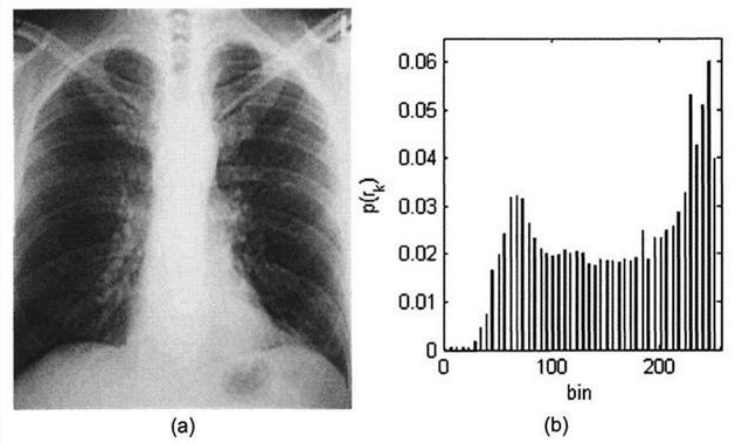


Image from Wikipedia: Histogram Equalization

Histogram Equalization

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





Low Contrast Stretch Example from:: what-when-how.com

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).

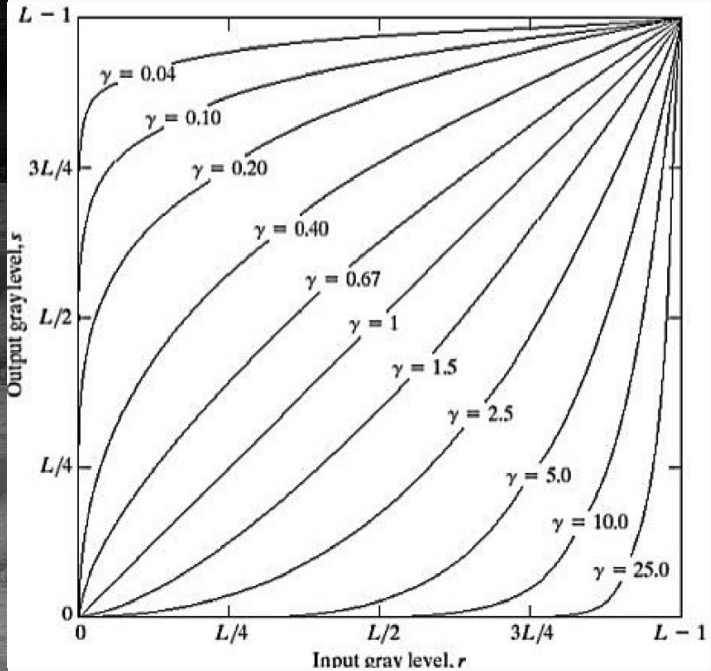


Image from wikipedia.com: gamma correction

Power-Law or Gamma Transformation

- Formula: s = c*(r^gamma) where c and gamma 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

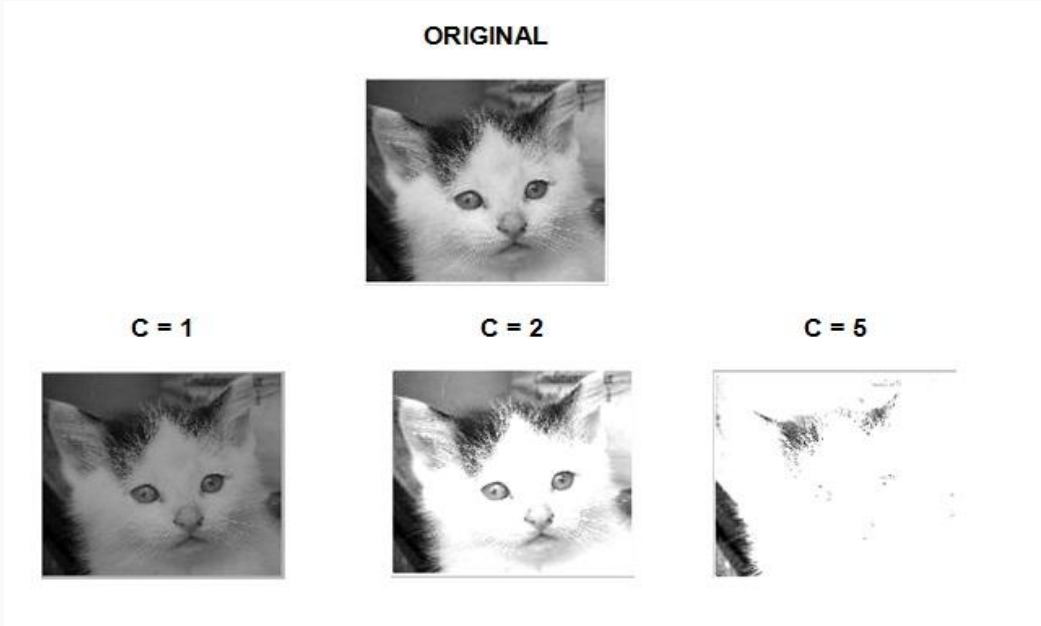
Log Transformation

One simple technique to enhance images.

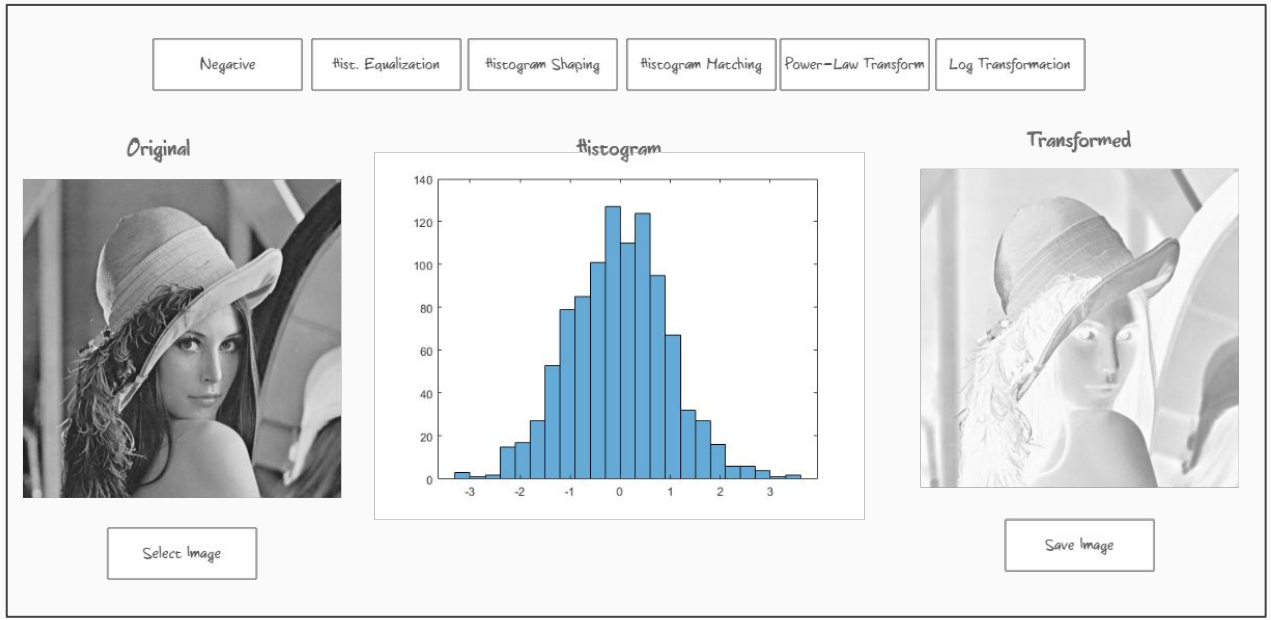
Formula: o = c log(i + 1).

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.



GUI Prototype



Member Responsibility

Task	Status	Member(s) working on task
GUI	In progress	Duong, Zhao
REPORT	In progress	Zhao, Amanjit
FINAL PRESENTATION SLIDES	Completed	Austin
IMAGE NEGATIVE	Completed	Austin
HIST. EQUALIZATION	Completed	Jason
HIST. MATCHING	Completed	Jason
CONTRAST STRETCH	Completed	Amanjit, Zhuoran Cao
LOG TRAN.	Completed	Duong
POWER-LAW GAMMA TRAN.	Completed	Tym
HISTOGRAM	Completed	Amanjit
HISTOGRAM SHAPING	Completed	Amanjit, Zhuoran Cao

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.