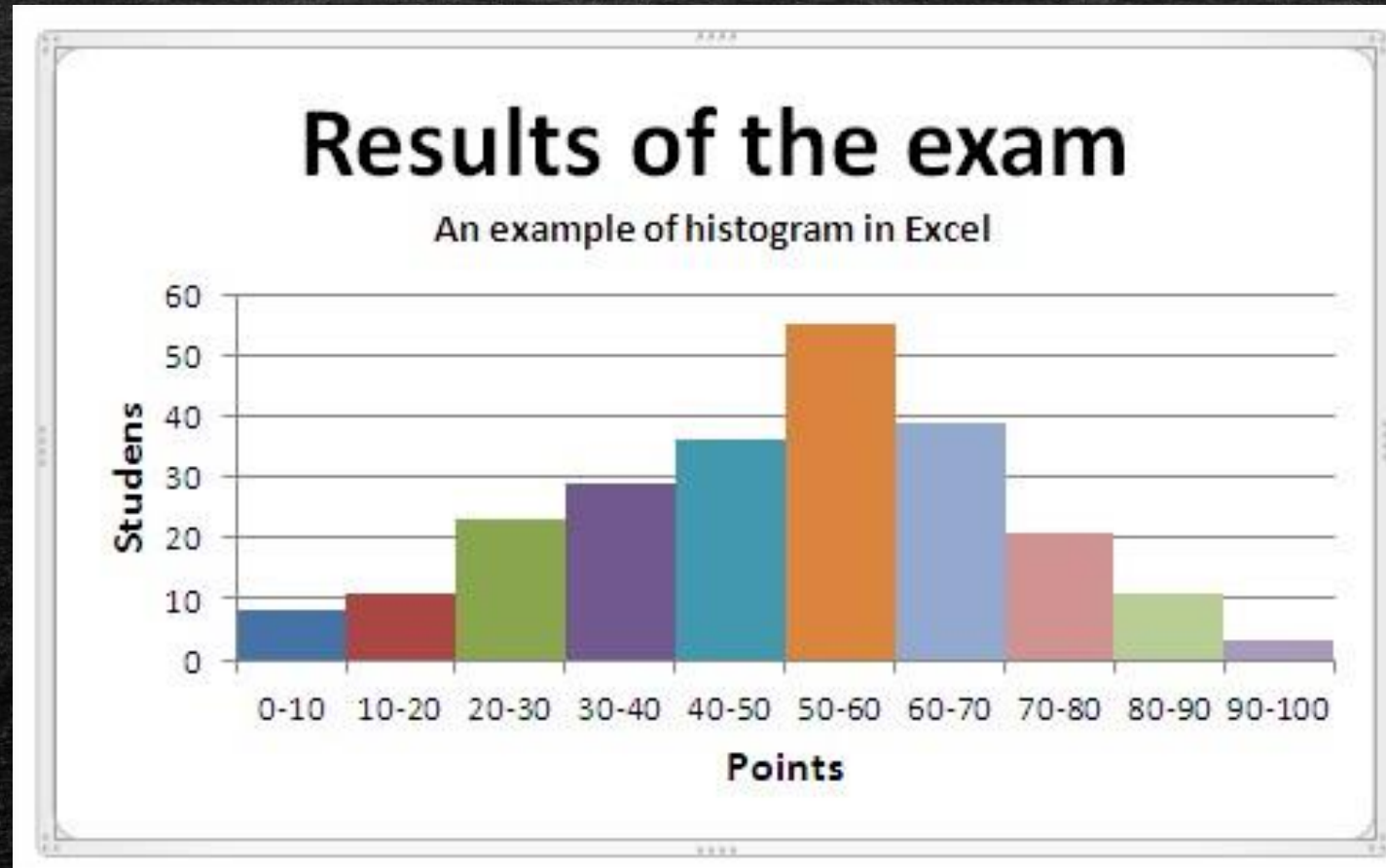

Histograms

What is it?

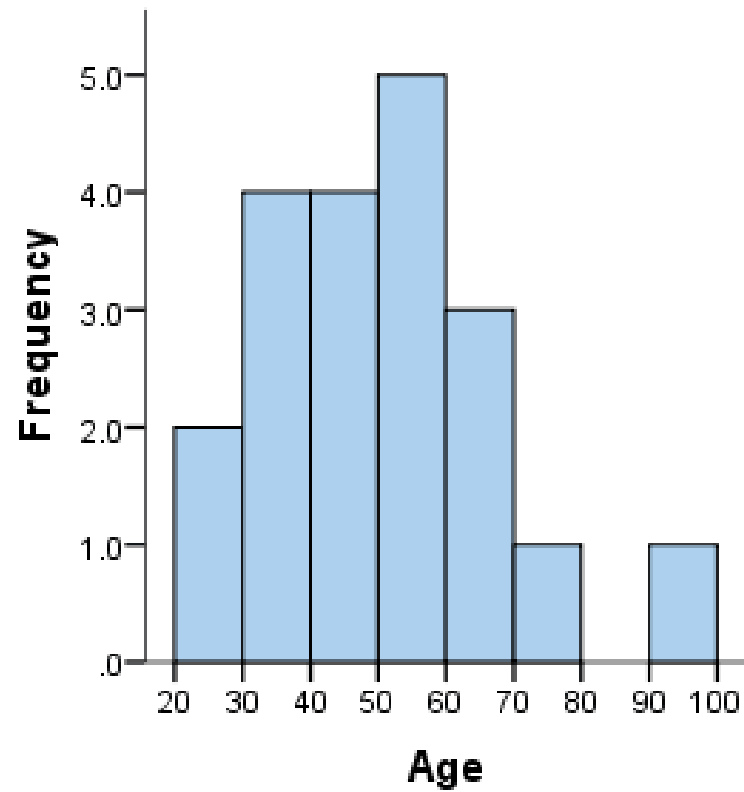
A **histogram** is a plot that lets you discover, and show, the underlying frequency distribution (shape) of a set of continuous data.

This allows the inspection of the data for its underlying distribution (e.g., normal distribution), outliers, skewness, etc.

Example



Example



36	25	38	46	55	68	72	55	36	38
67	45	22	48	91	46	52	61	58	55

Image Histograms

- An **image histogram** is a type of histogram that acts as a graphical representation of the brightness distribution in a digital image.
- The horizontal axis of the graph represents the tonal variations, while the vertical axis represents the number of pixels in that particular tone.
- Thus, the histogram for a very dark image will have most of its data points on the left side and center of the graph. Conversely, the histogram for a very bright image with few dark areas and/or shadows will have most of its data points on the right side and center of the graph.

Image Histograms

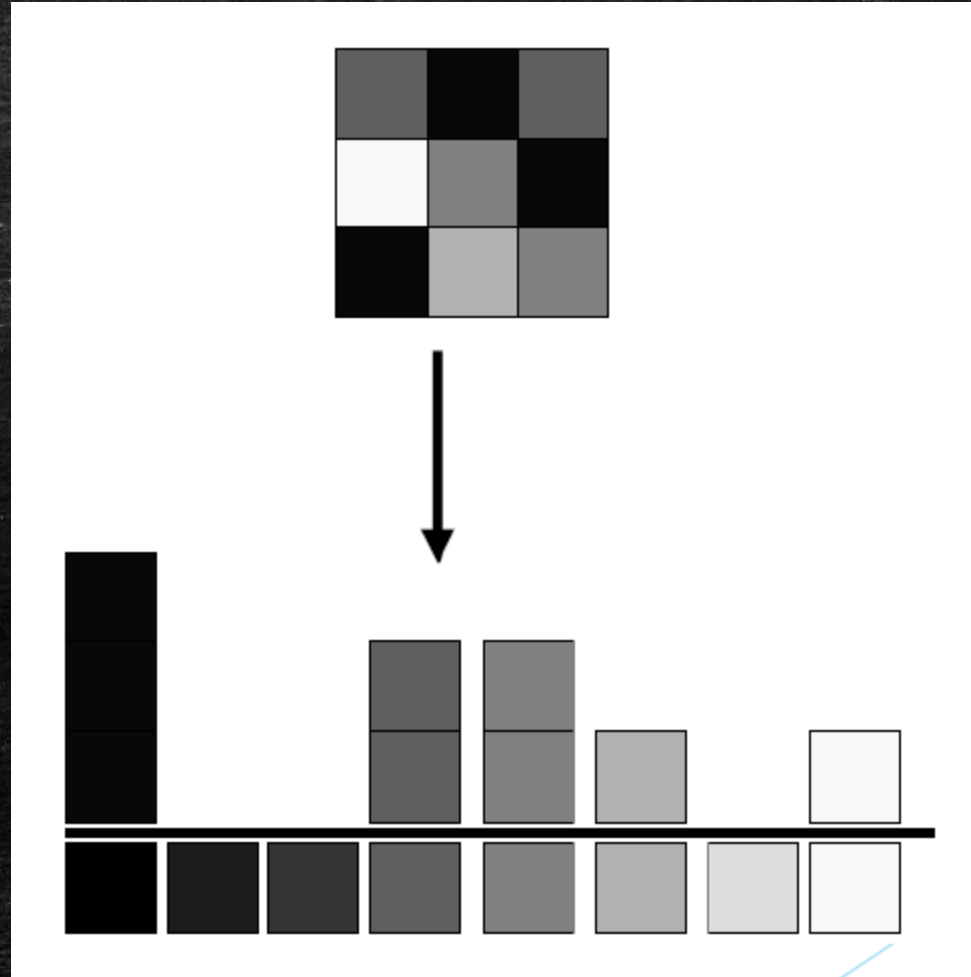
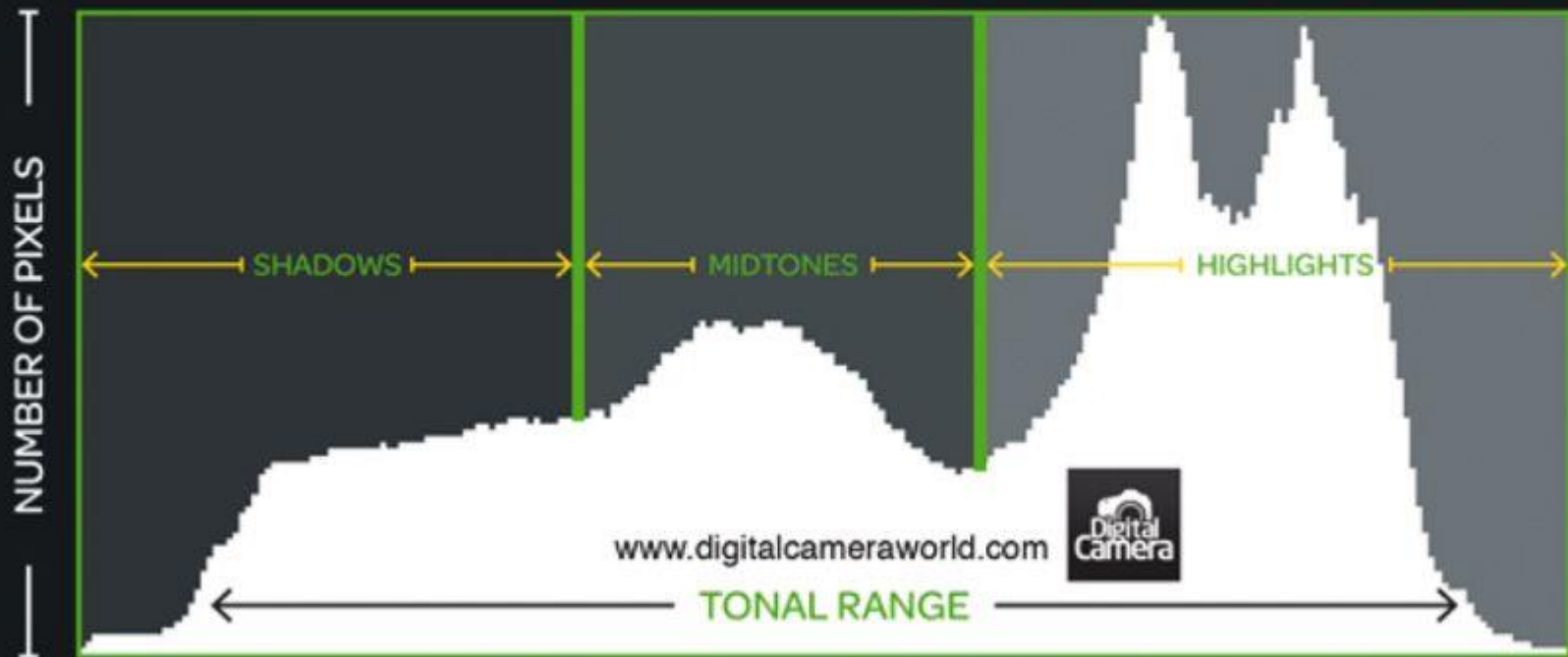


Image Histograms

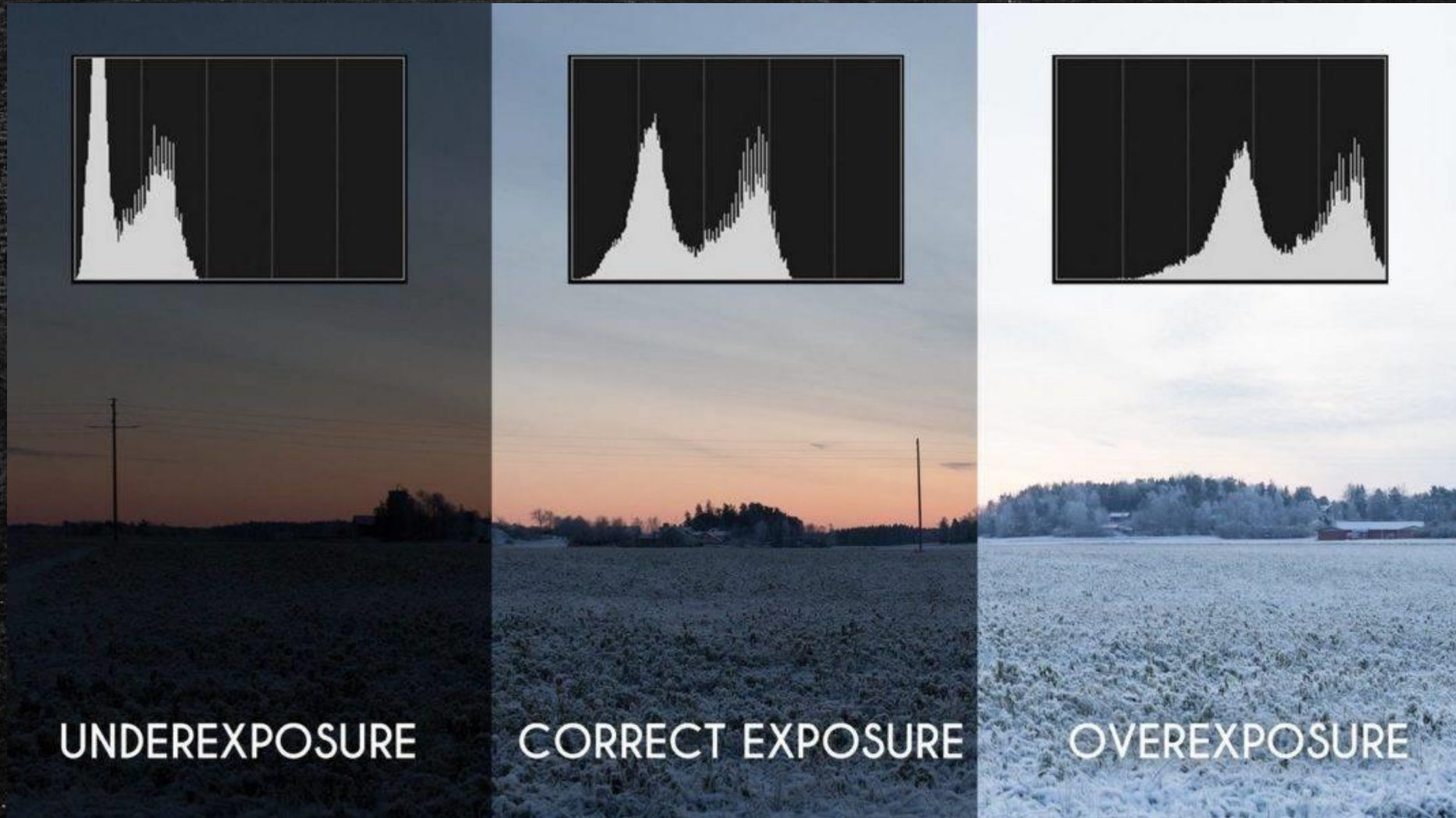
EXPLAINED HOW TO READ A HISTOGRAM

A camera's histogram is an accurate guide to exposure, as it illustrates the range of tones, or brightness levels, present in an image. You

should review the histogram each time you take a picture, so that you can assess if you need to make any exposure adjustments.



Example 1



Example 2

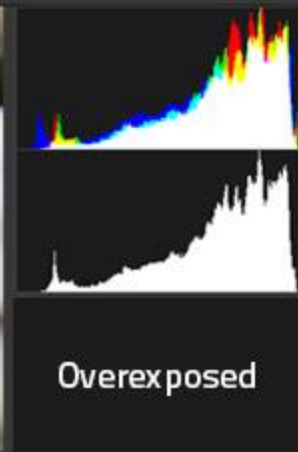
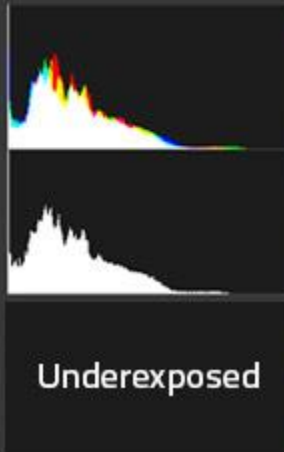
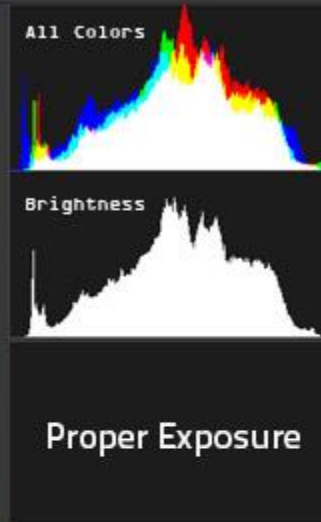


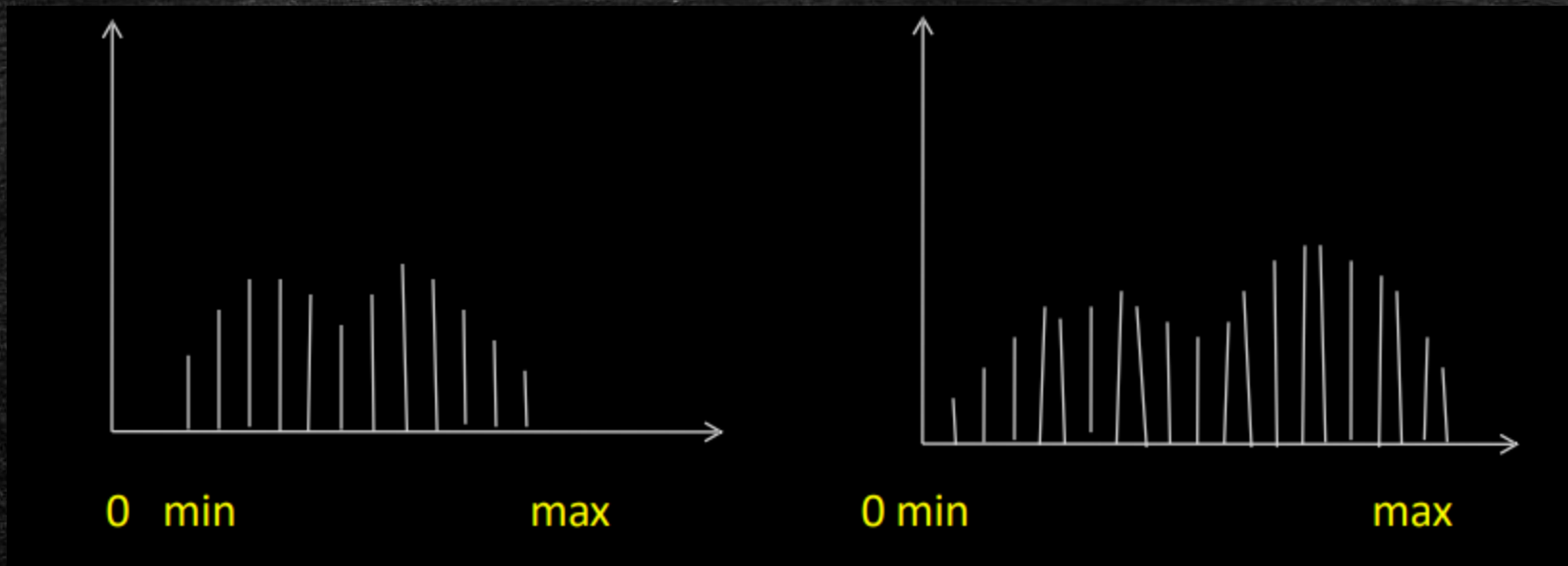
Image Histograms

By looking at a histogram you can:

- Tell whether image detail has been lost to blown-out highlights or blacked-out shadows
- Stretch or Equalise the histogram (more on this later)
- If you use the histogram display on your camera, you can use it to take better pictures.

Histogram Stretching

Linear stretching is a good technique but not perfect since the shape remains the same. You just increase the distance between minimum and maximum grey values.



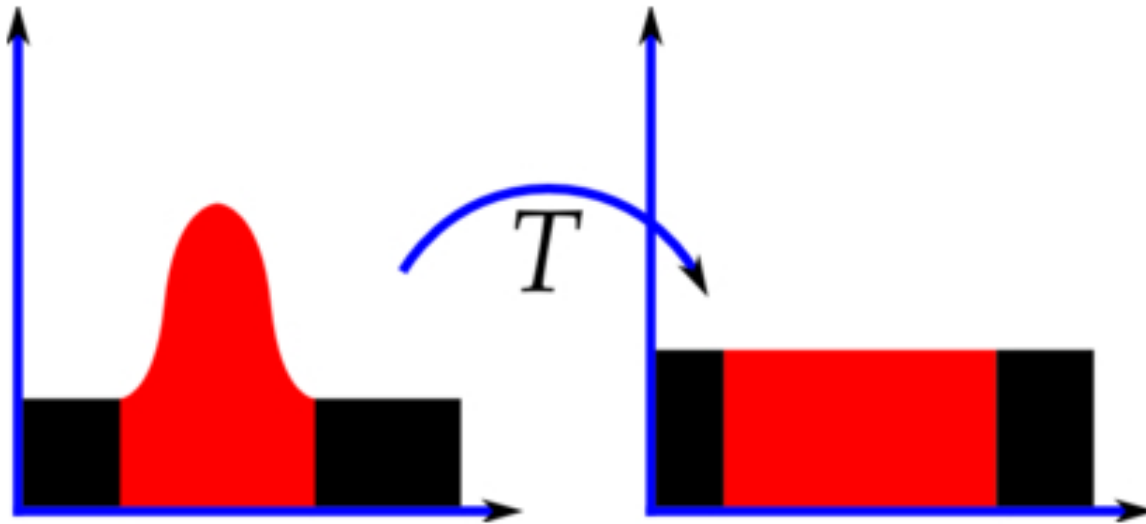
Histogram Equalisation

Histogram Equalization is a computer image processing technique used to improve contrast in images. Perfect image is one where all gray levels have equal or almost equal number of pixels...



Histogram Equalisation

In Histogram equalization, you want to flatten the histogram into a uniform distribution.



Python Histograms

We shall be using histograms to analyse and improve grayscale images.

- **Matplotlib.pyplot: plt.hist()**

- **OpenCV:**

```
img = cv2.imread('home_grayscale.jpg',0)  
hist = cv2.calcHist([img],[0],None,[256],[0,256])
```

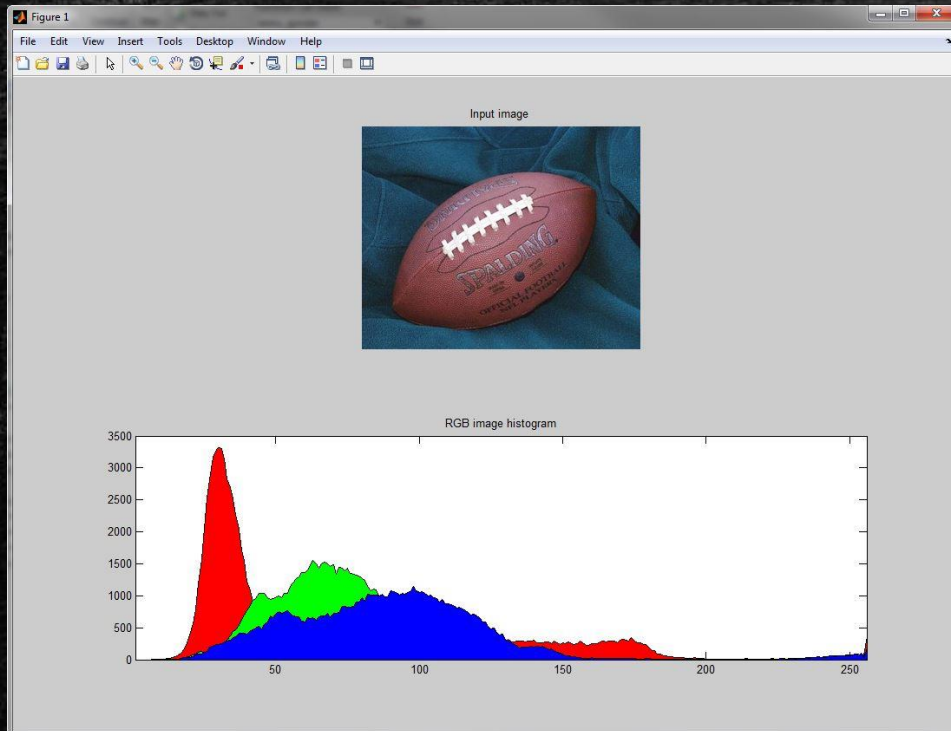

Python Histogram Equalisation

```
img = cv2.imread('wiki.jpg',0)
equ = cv2.equalizeHist(img)
res = np.hstack((img,equ)) #stacking images side-by-side
cv2.imwrite('res.png',res)
```



What about RGB images?

RGB image histogram equalisation has to be done manually in Octave/Matlab. Can you think of how? Hint: we first need to separate colour from luminance information and then equalise the luminance information only...



Equalising the red, green and blue channels individually yields a non-sensible result!

Questions?