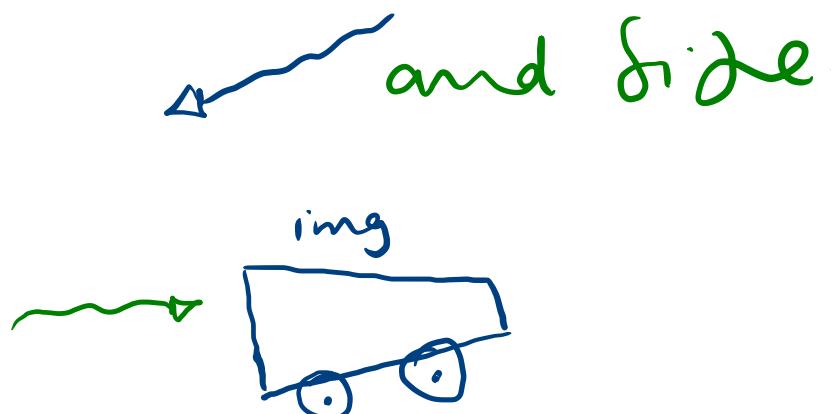
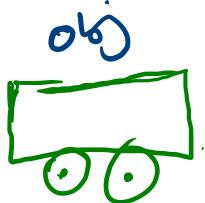
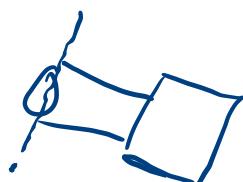


Image Enhancement

problems

Captured Image → {

- noisy
- poor contrast
- wrong shape

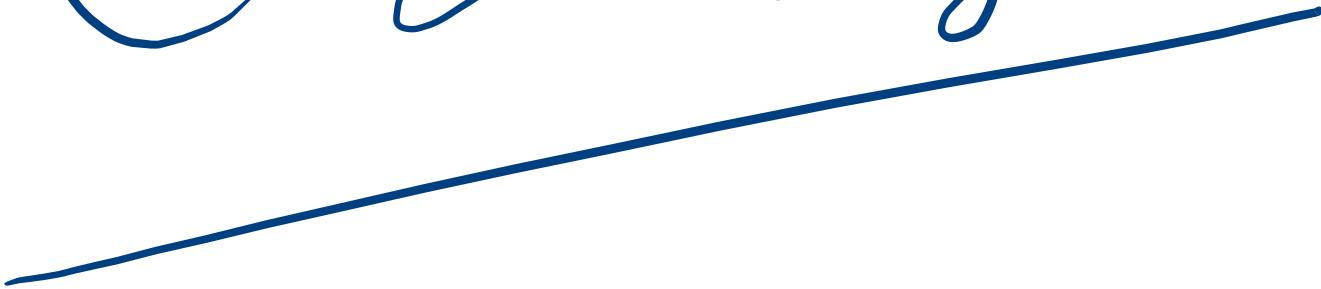


and size

default  
enhancements

- Denoising.
- Contrast enhancement
- Resampling.

Contract



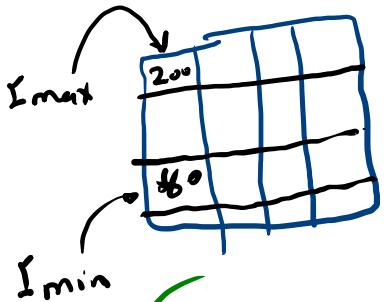
رسالة → Contrast → General (today)

صيغة (255 - intensity)  
كتاب المنهج

رسالة → رسائل

رسالة → رسائل

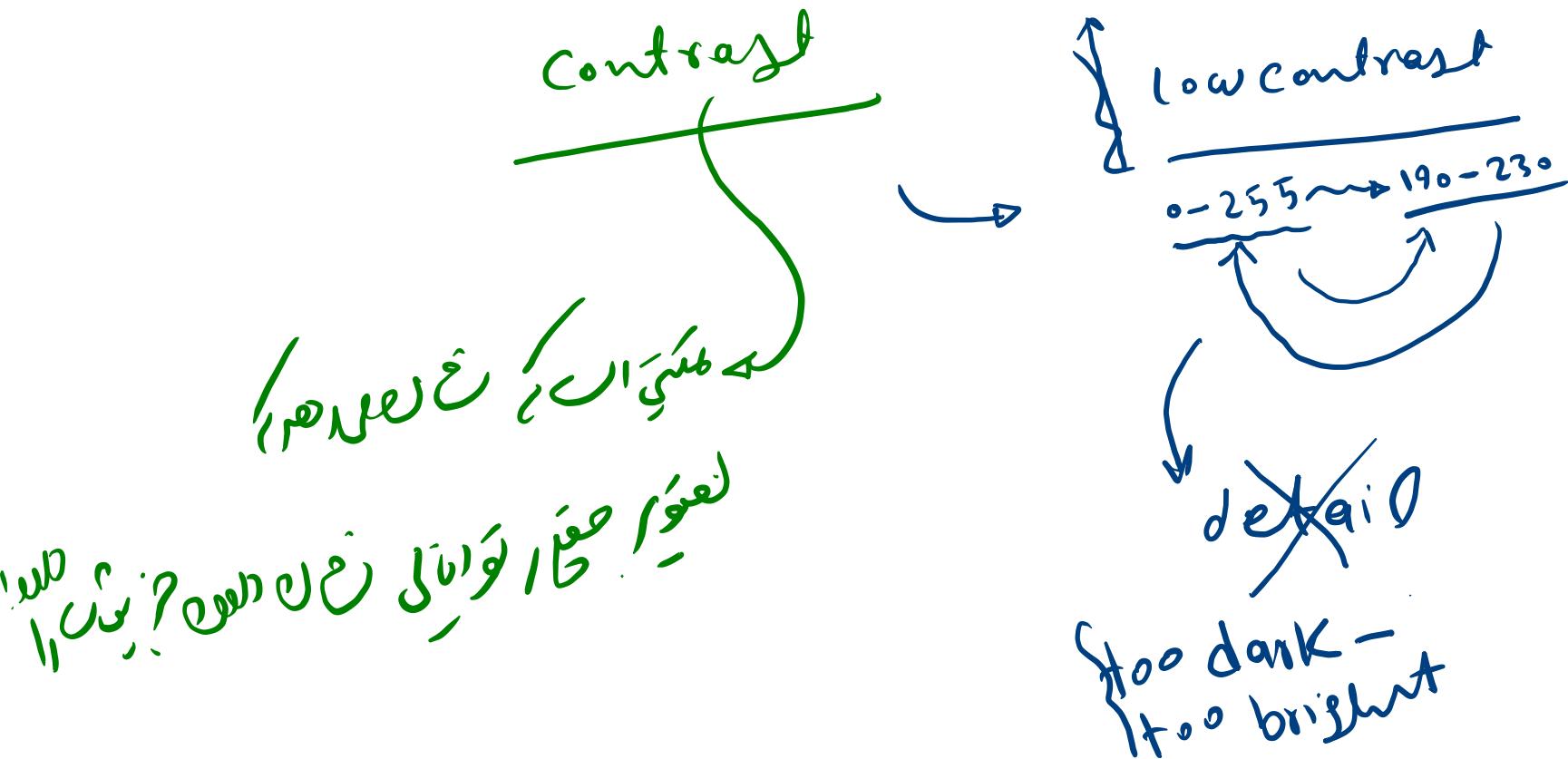
کنڑاٹ: قدرت میں نہ سرخ (پورے کام)



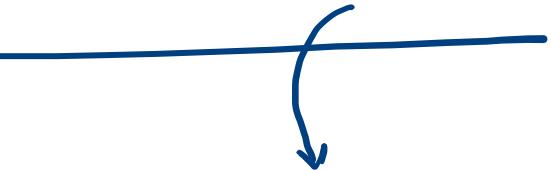
$$\text{Contrast} = I_{\max} - I_{\min}$$

better

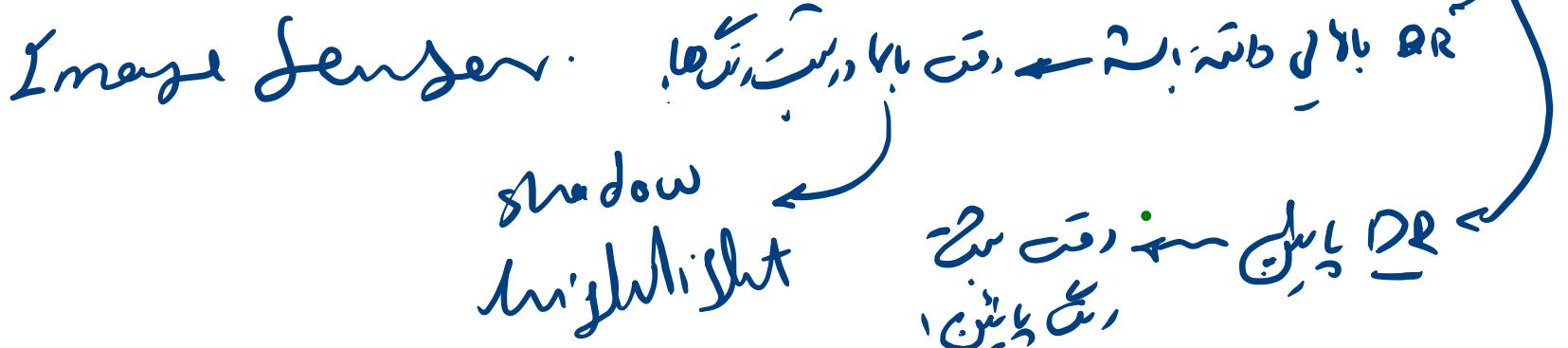
$$\text{Contrast} = \frac{I_{\max} - I_{\min}}{I_{\max} + I_{\min}}$$
$$\text{Contrast} = \frac{200 - 80}{200 + 80} = \frac{120}{280} = 0,4$$



# Dynamic range.(DR)



عفروت گریزه را



$$DR = 20 \log \frac{V_{max}}{V_{min}} \text{ ev}$$

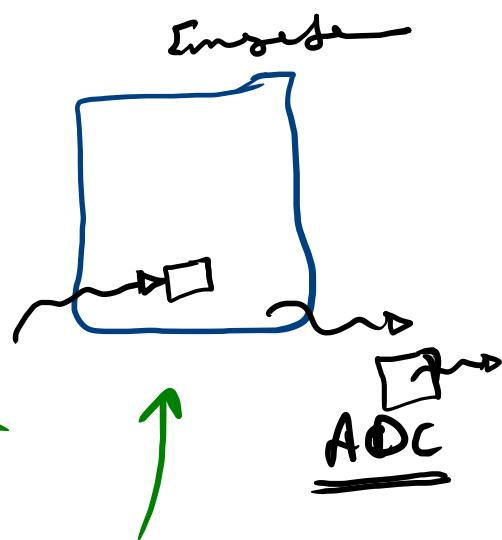
جیوگیو چوچو چوچو  
کوکی کوکی کوکی  
کوکی کوکی کوکی

IS

photon

~~target~~ tunneling

p-type ← Semiconductor



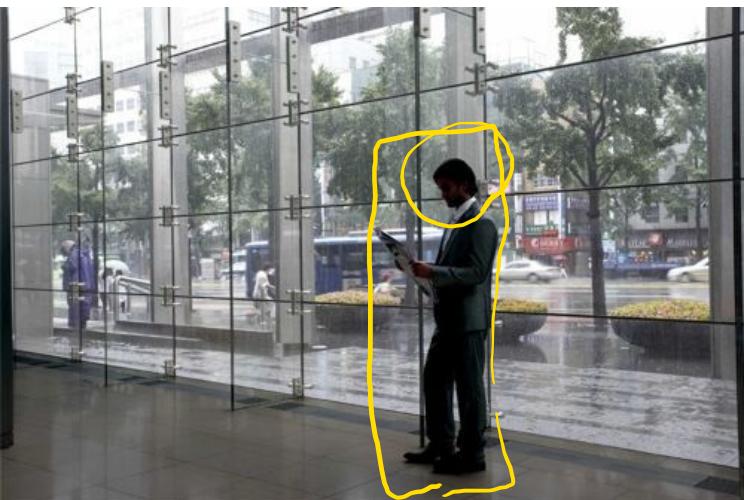
HDR

0 - 255  
on

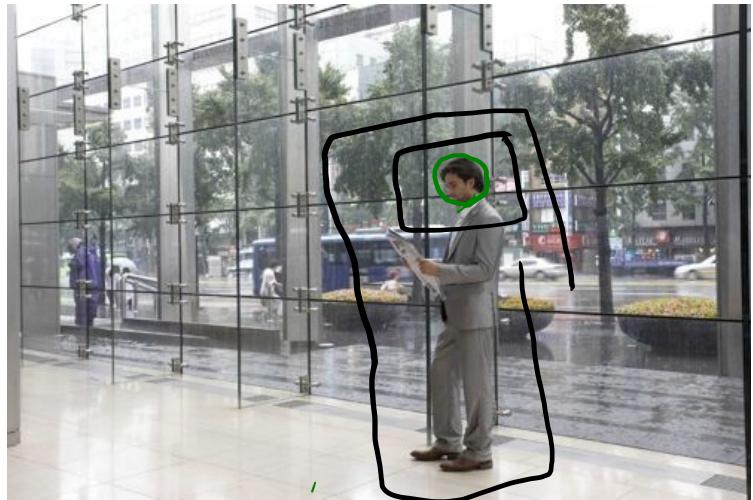
65535

High Dynamic Range.

wide Dynamic Range.



low DR



HDR

HDR



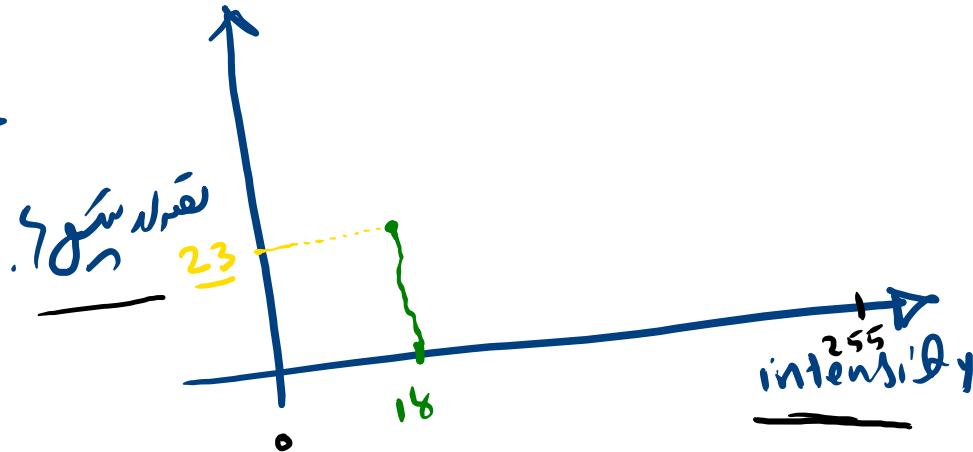
Sensor +  
post processor

[multiple  
Aperture.]

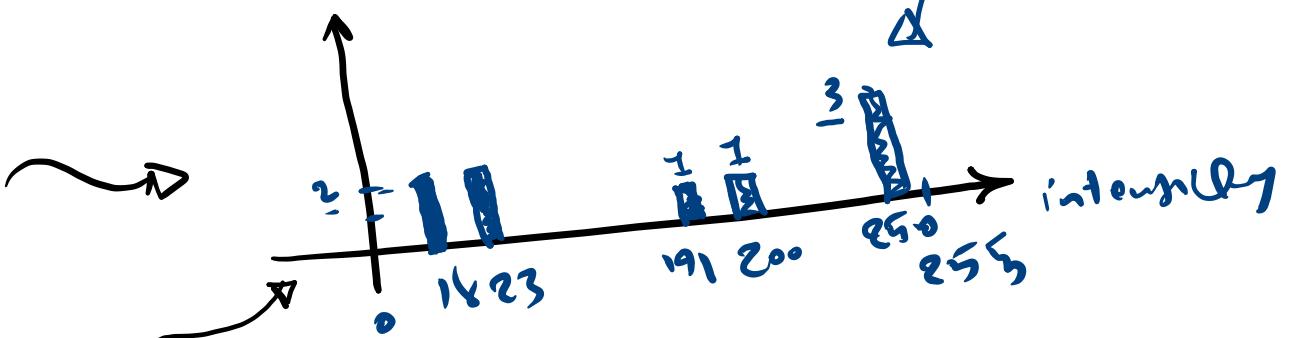
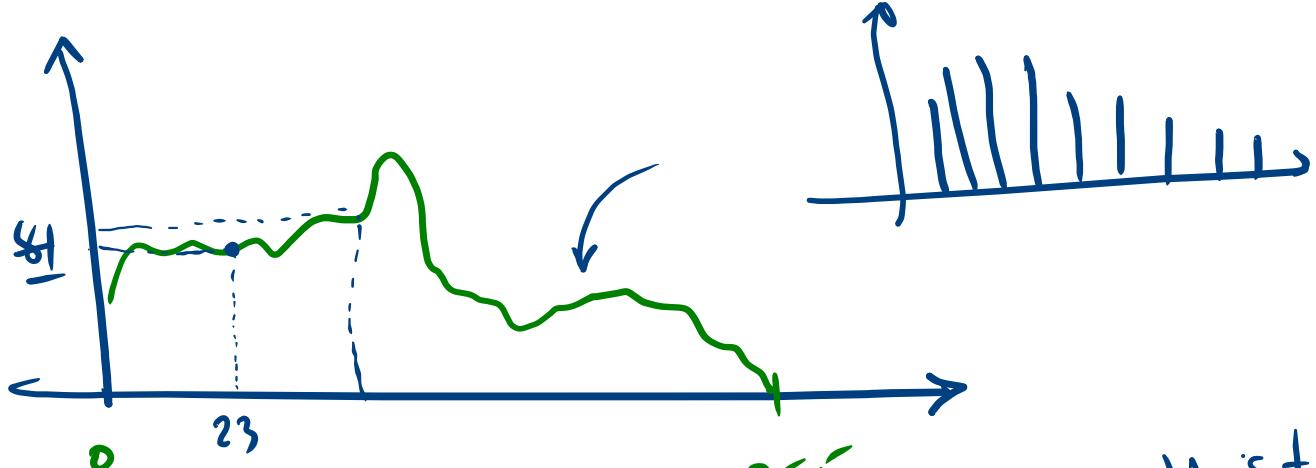
Sony ~ IS → HDR

# Histogram :

8-bit  $\rightarrow$  256



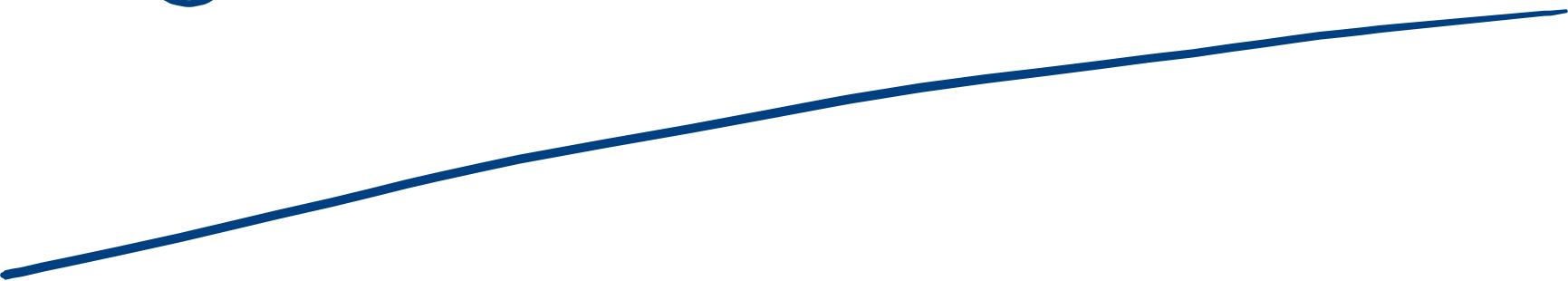
وَلُعْرَلَه سُكُونٍ 23 مَسْكُونٌ بِالنِّيَامِ!

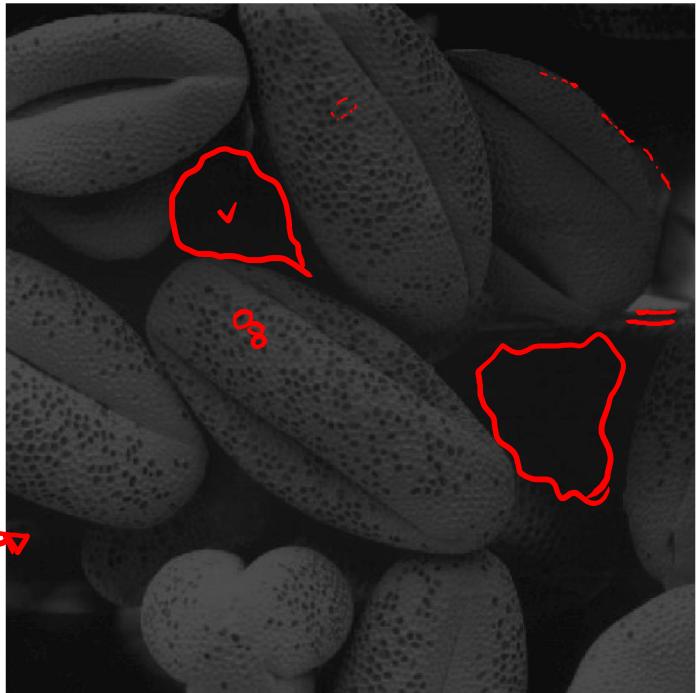


Histogram

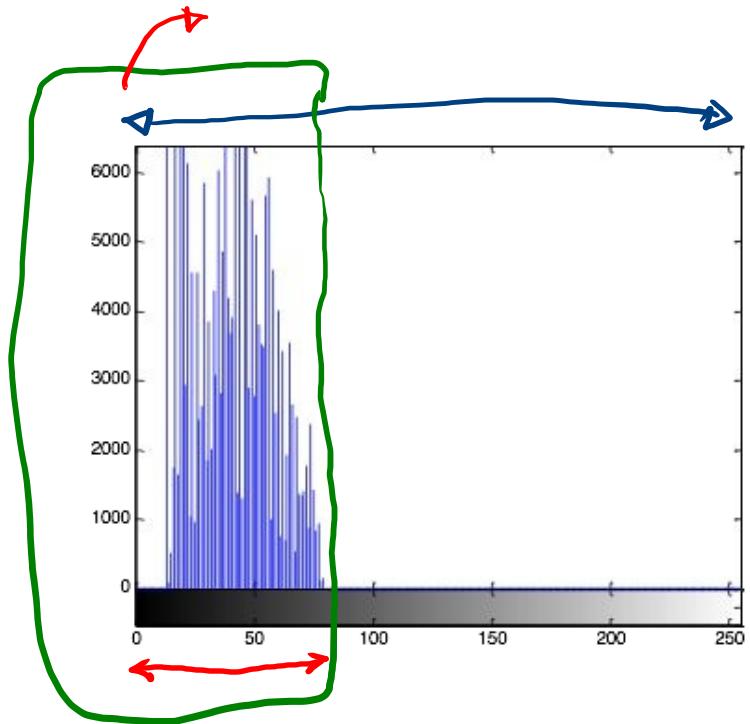
intensity

Contrast enhancement

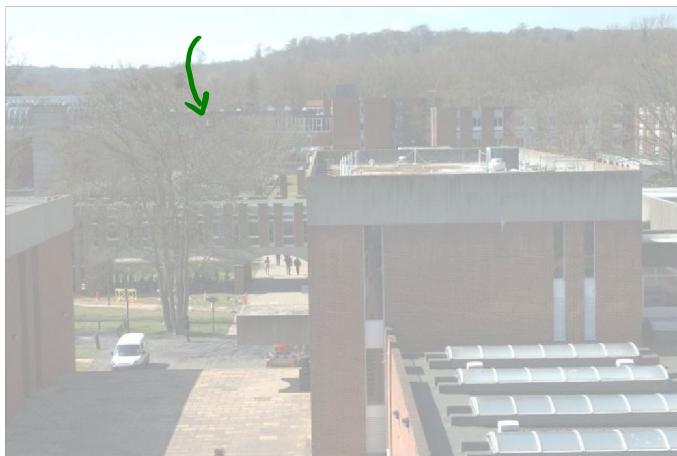




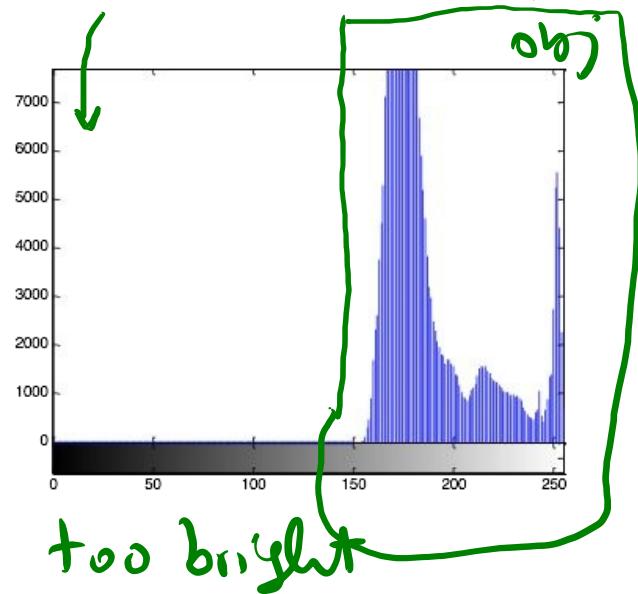
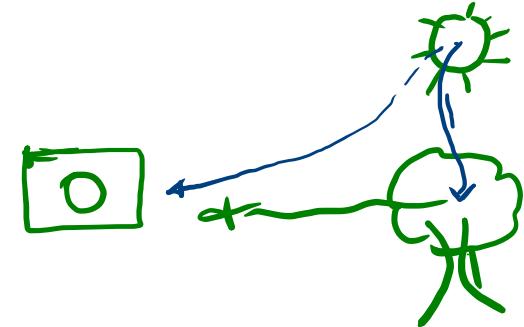
low contrast  
poor contrast

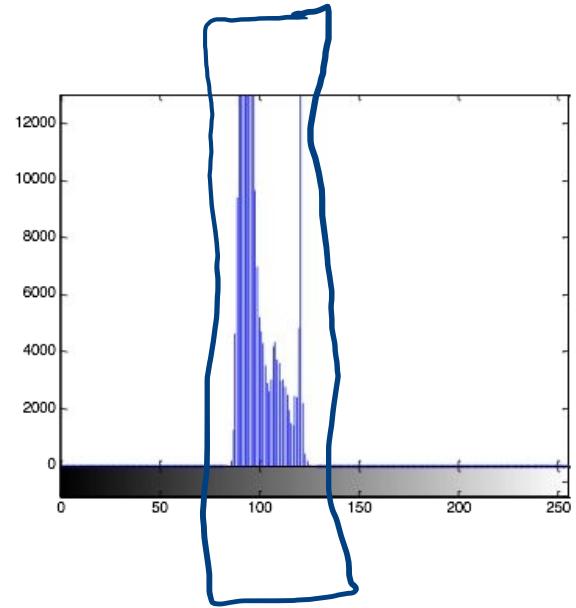


too dark



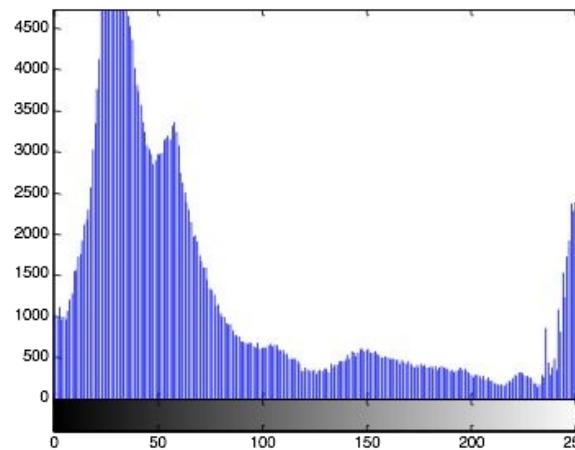
low (or poor) contrast





poor contrast  $\alpha$

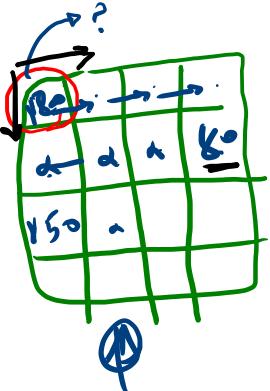
$DR \rightarrow \text{good}$



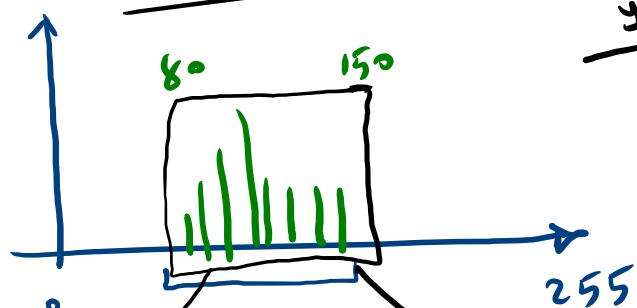
Good contrast

Contrast Stretching

متضاد! مترافق!



*very quick*



$$g(x,y) = \frac{I - I_{min}}{I_{max} - I_{min}} (Max - Min) + Min$$

$$g(0,0) = \frac{120 - 80}{150 - 80} (255 - 0) + 0 =$$

$$g(0,0) = \frac{40}{70} (255)$$

$$= \frac{140}{70} \approx \underline{\underline{200}}$$

→ 147

$$I: 120$$

$$I_{min}: 80$$

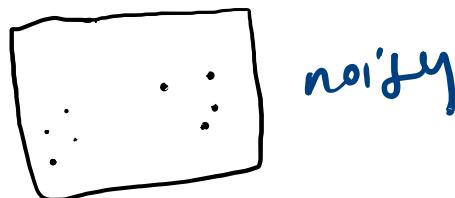
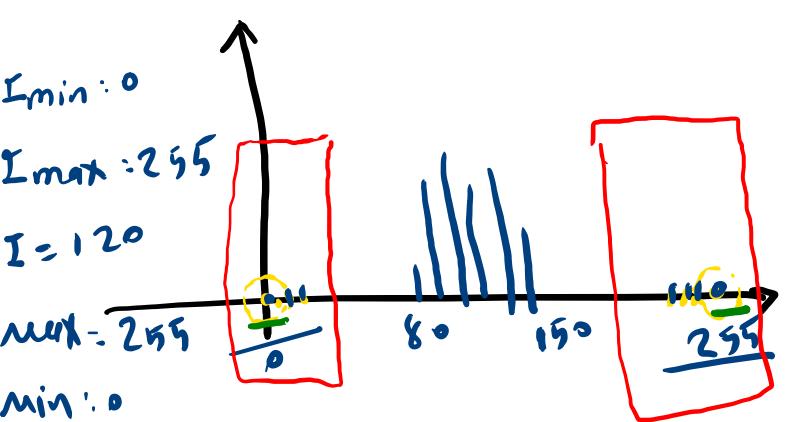
$$I_{max}: 150$$

$$Max: 255$$

$$Min: 0$$

## 2. Contrast stretching.

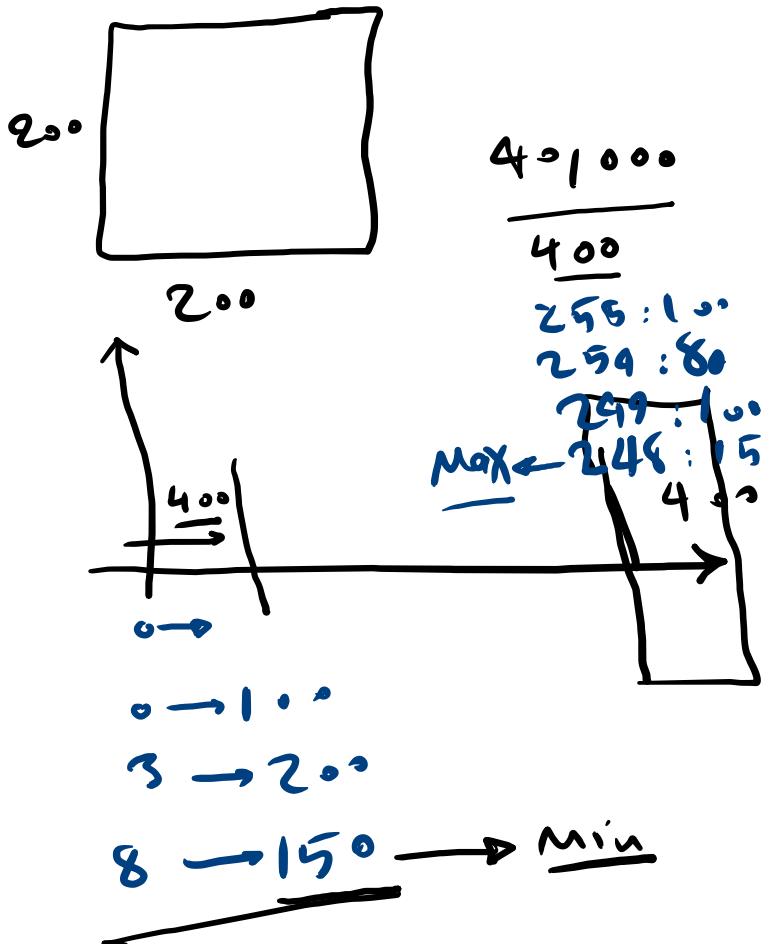
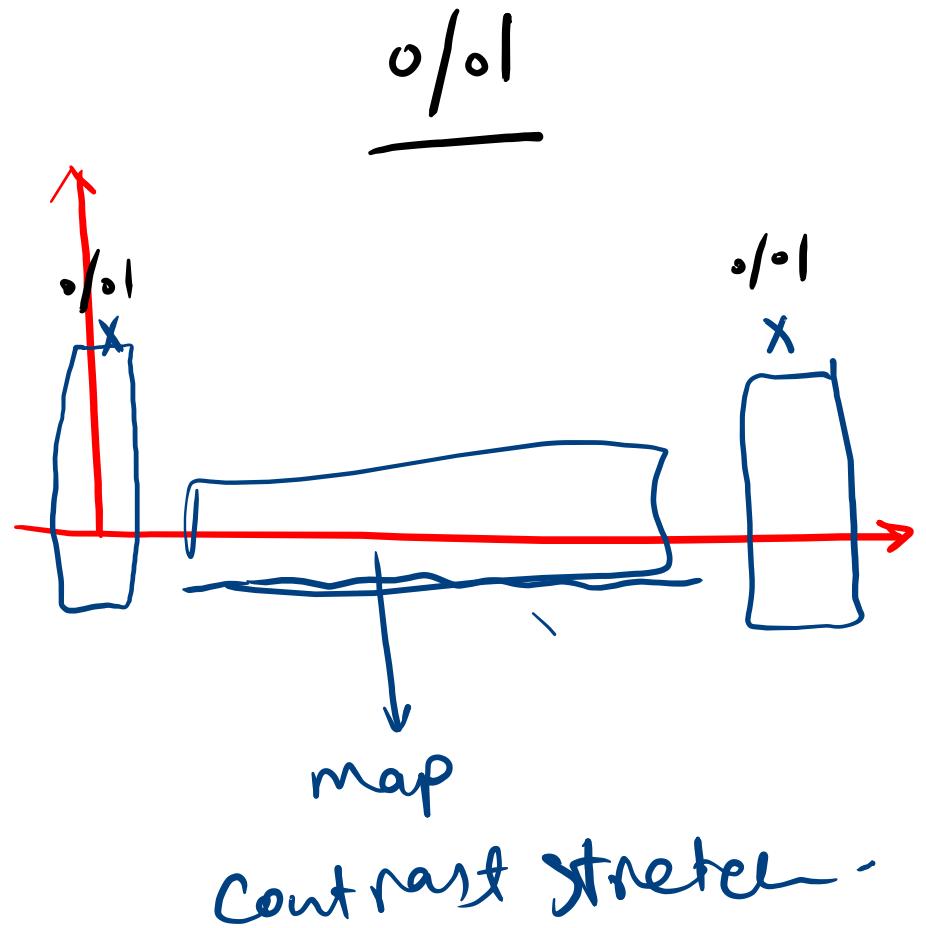
$$g(x,y) = \frac{I - I_{\min}}{I_{\max} - I_{\min}} (Max - min) + min$$



$$g(0,0) = \frac{120 - 0}{255 - 0} (255 - 0) + 0 = 120$$

Contrast

clipping.



مُعْصِلَةُ الْمَوَازِينِ  
مُعْصِلَةُ الْمَوَازِينِ

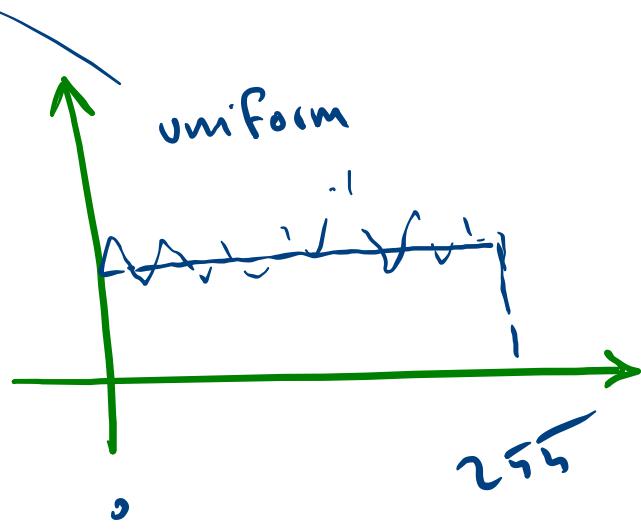
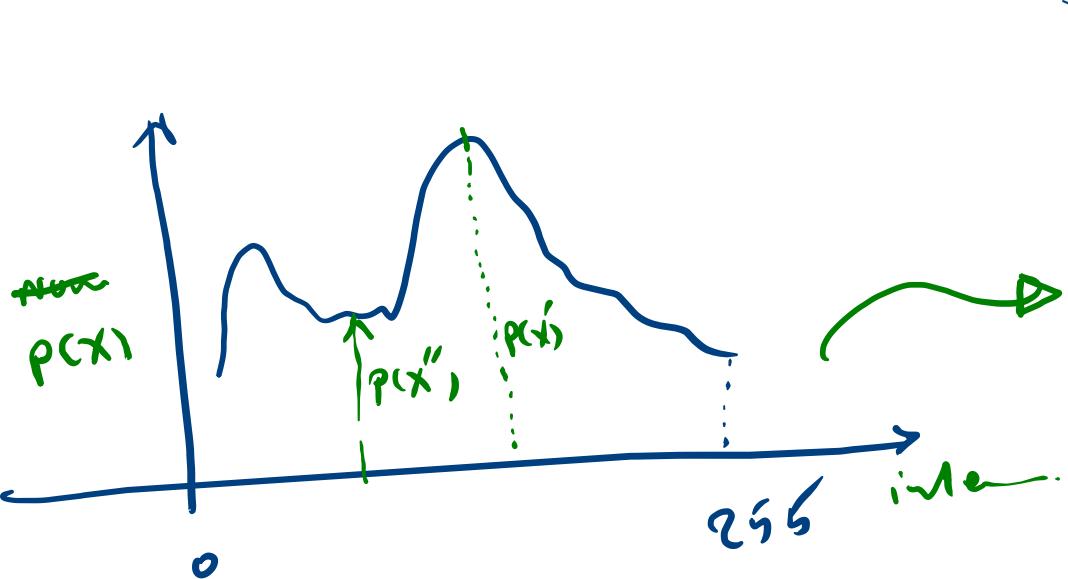
Stretch

مُعْصِلَةُ الْمَوَازِينِ

مُعْصِلَةُ الْمَوَازِينِ

clipping

Histogram equalization



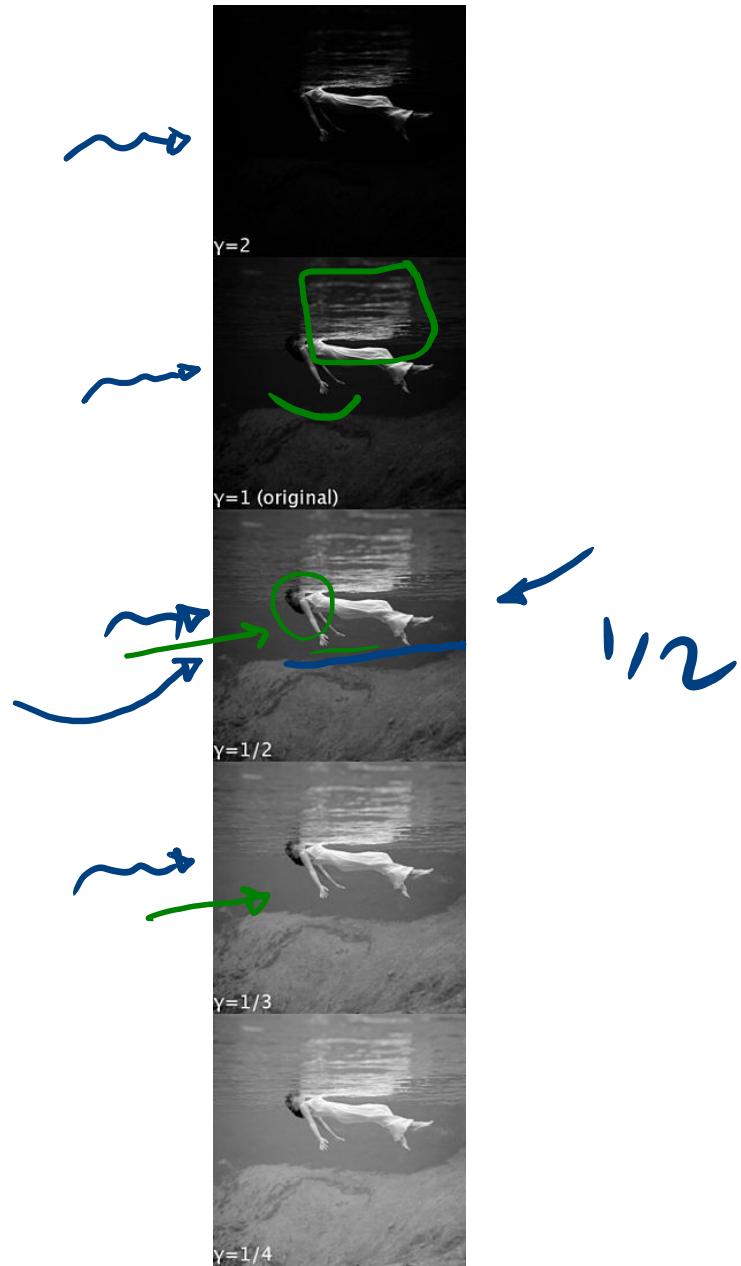
۱. اینکه حسوس کن هر ۱۷ ثوانی میتواند بخواهد  
۲. لغزش بسیار راحت و سریع میباشد!

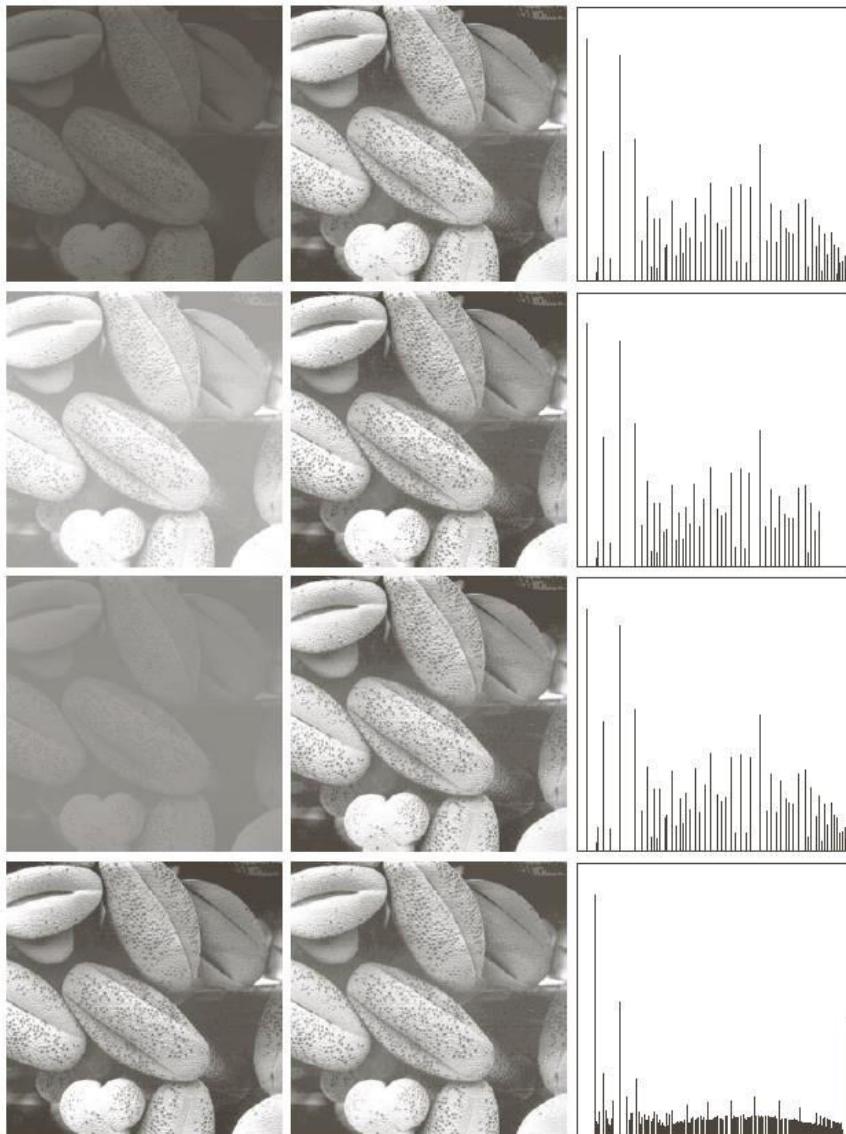
طبیع

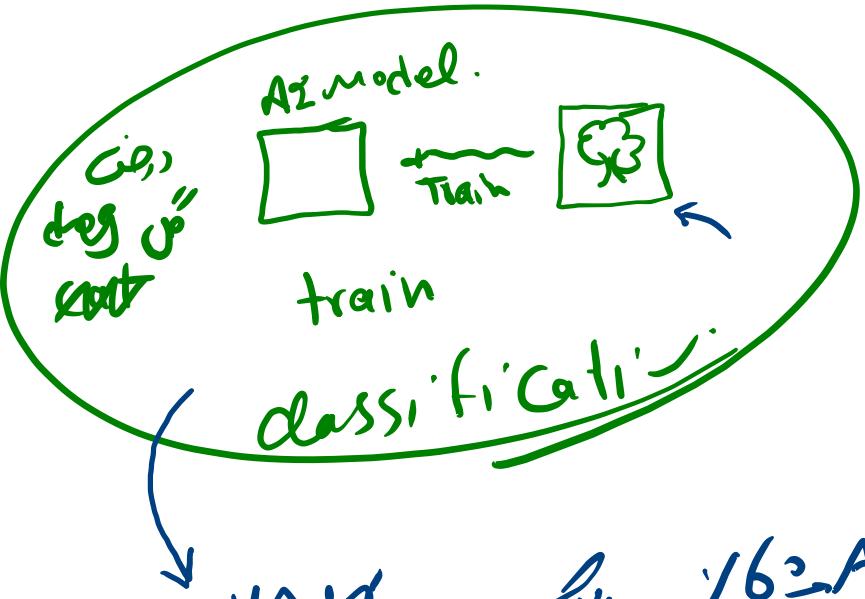
اصح و درست کامل  
لذا خدا

Gamma

$$\gamma = \left( \frac{I - I_{min}}{I_{max} - I_{min}} \right)^8 \left( \frac{I_{max} - I_{min}}{I_{max} - I_{min}} + \frac{I_{min}}{I_{max} - I_{min}} \right)$$







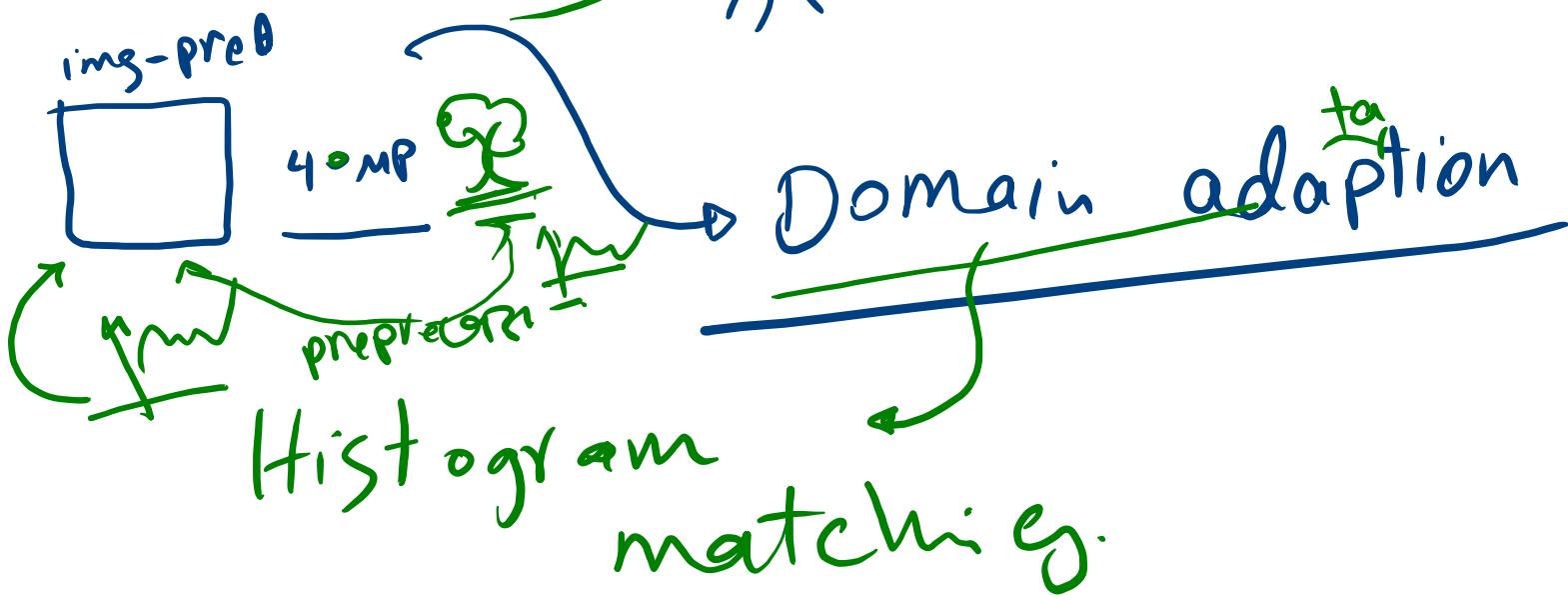
۰.۹۵ → Ace

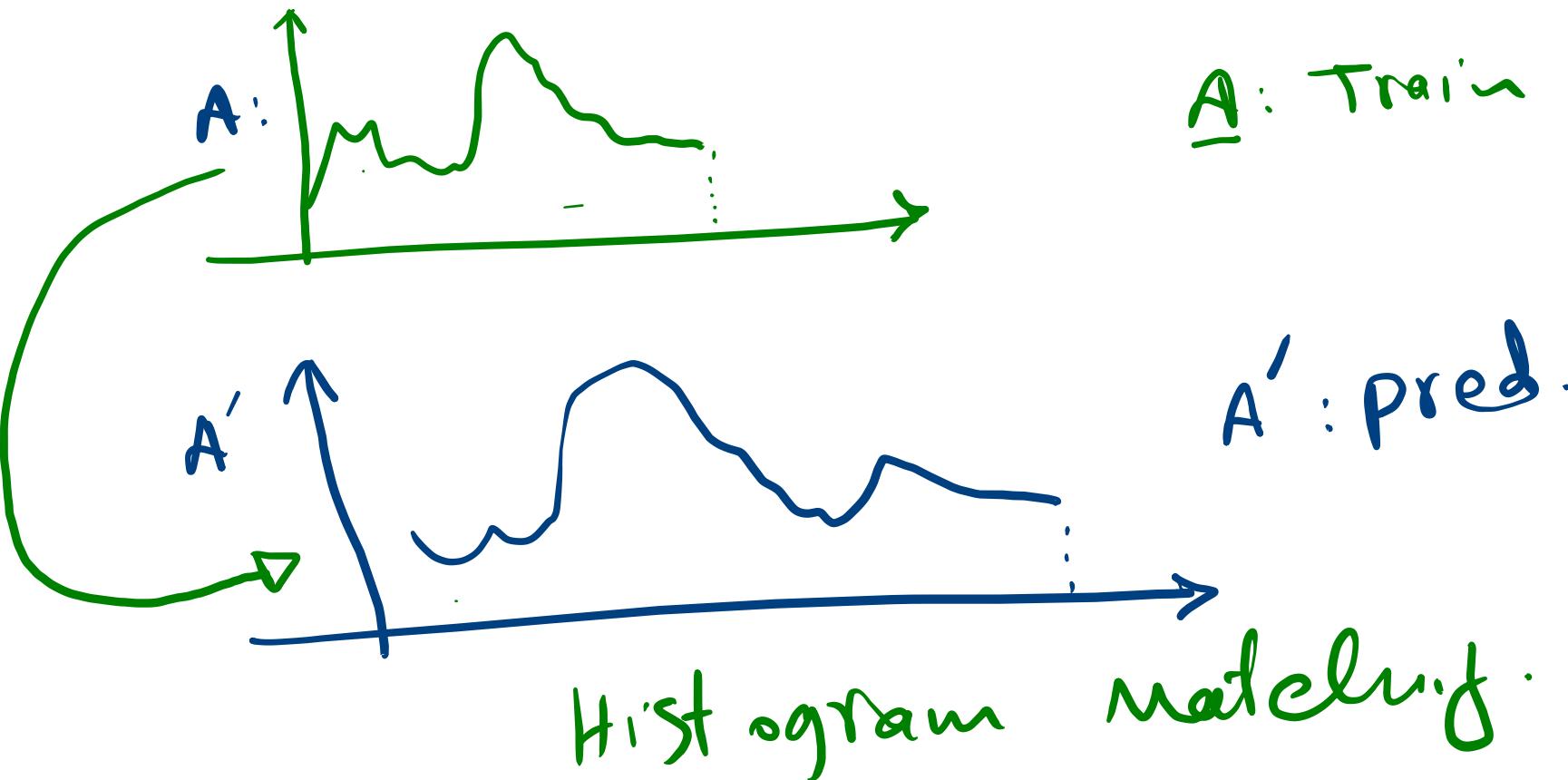
اوپری میل  
نور + پلاکت اسیدی زیداری

A:



B:



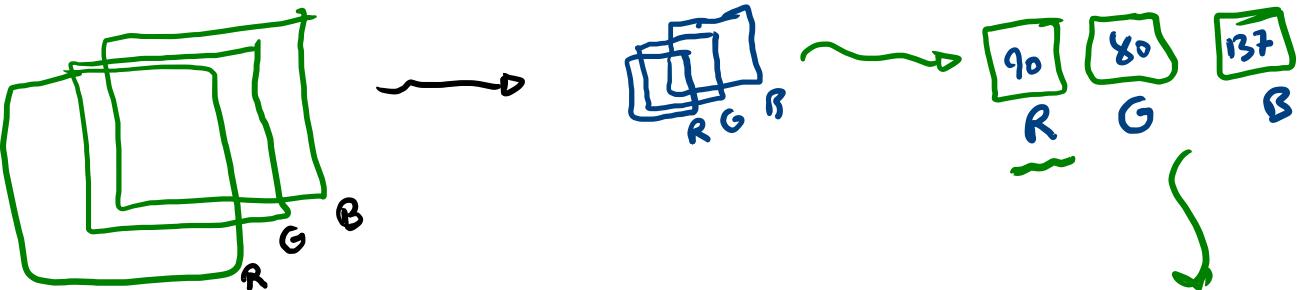




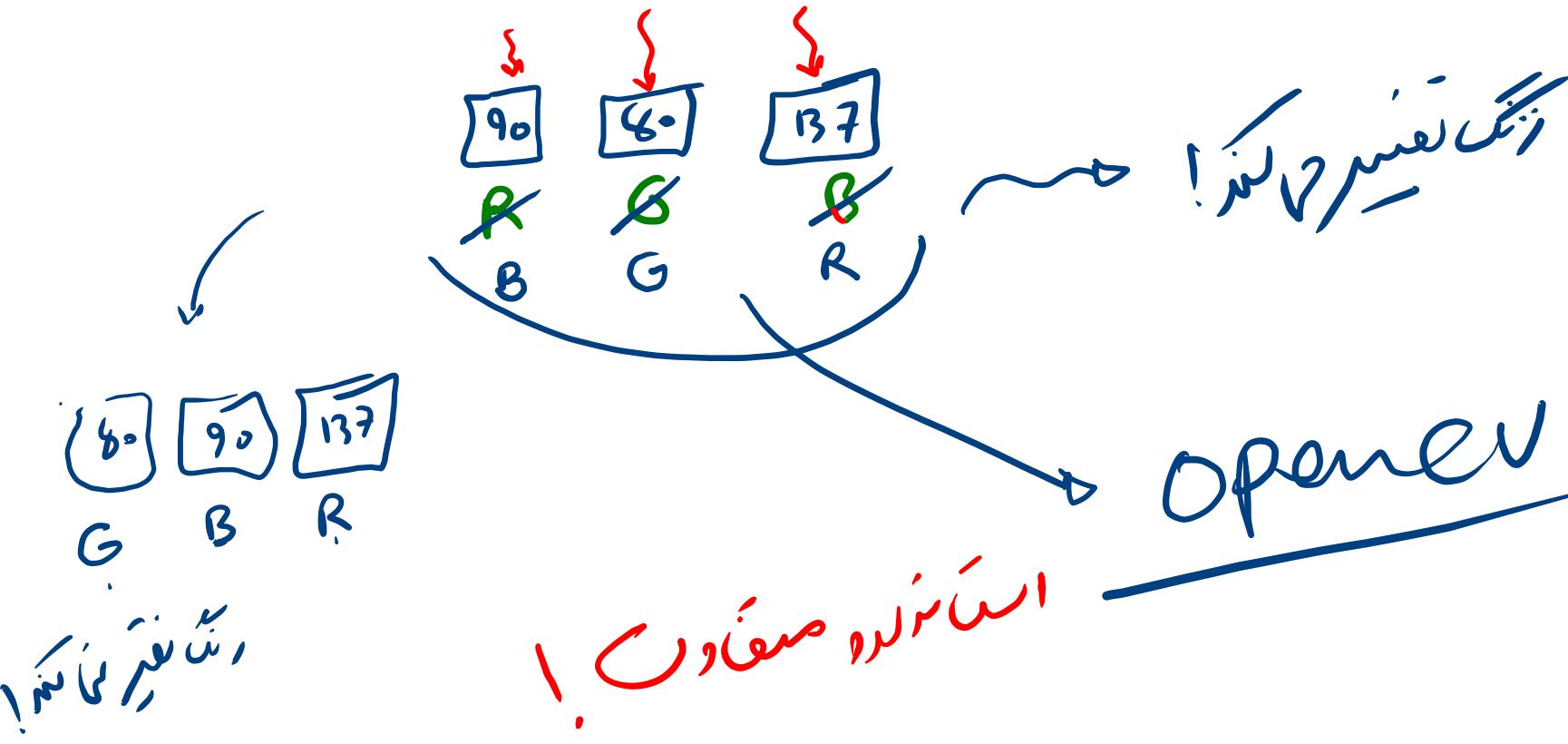
Extra

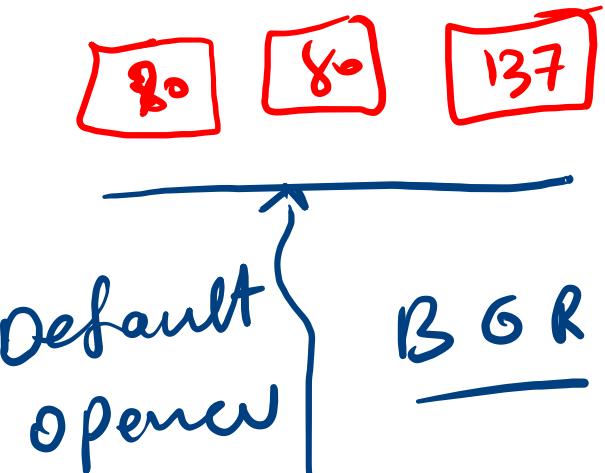
RGB or BGR?

OpenedCV



جذب فرمان من الصورة ثم  
R  $\leftarrow$  Ch1 / ملحوظة  
G  $\leftarrow$  Ch2  
B  $\leftarrow$  Ch3





bise : R GB

BGR 2 RGB

BGR 2 Gray

ch1 ch2 ch3

openCV : RGB 2 Gray

ch1 ch2 ch3

OB + OG + Or

Gray ✓

$$\text{Gray} = \cdot3R + \cdot5G + \cdot2B$$

```

path = r'images/colors.png'

color_image = cv2.imread(path)
gray_image2 = cv2.cvtColor(color_image, cv2.COLOR_RGB2GRAY)
plt.subplot(3, 1, 1)
plt.imshow(gray_image2, cmap='gray')
plt.title('Gray Image using COLOR_RGB2GRAY')
plt.axis('off')

color_image = cv2.imread(path)
color_image3 = cv2.cvtColor(color_image, cv2.COLOR_BGR2GRAY)
plt.subplot(3, 1, 2)
plt.imshow(color_image3, cmap='gray')
plt.title('Gray Image using COLOR_BGR2GRAY')
plt.axis('off')

gray_image1 = cv2.imread(path, 0)
plt.subplot(3, 1, 3)
plt.imshow(gray_image1, cmap='gray')
plt.title('Gray Image using IMREAD_GRAYSCALE')
plt.axis('off')

```

Gray Image using COLOR\_RGB2GRAY



Gray Image using COLOR\_BGR2GRAY



Gray Image using IMREAD\_GRAYSCALE



~~$$\text{Gray} = \cdot3R + \cdot5G + \cdot2B$$~~