Week - 3

Pixel transformation

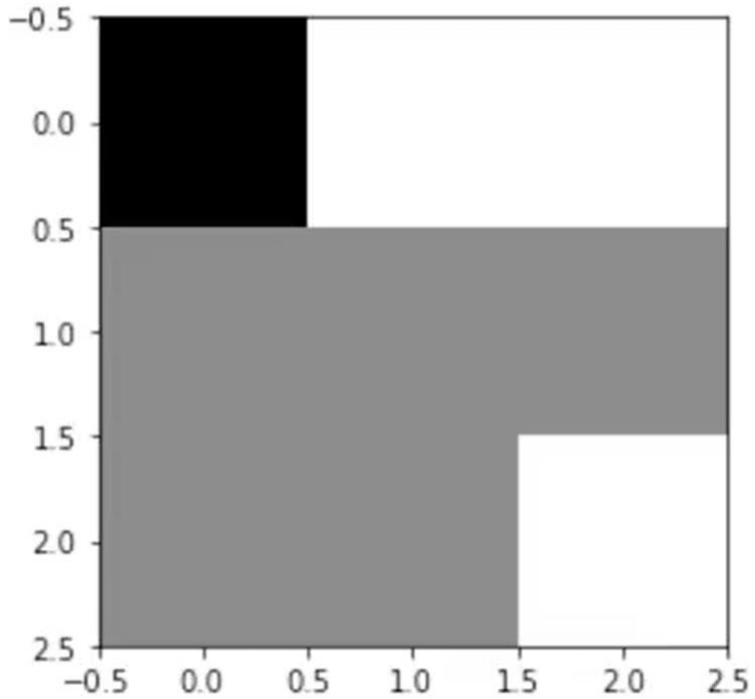
Outline

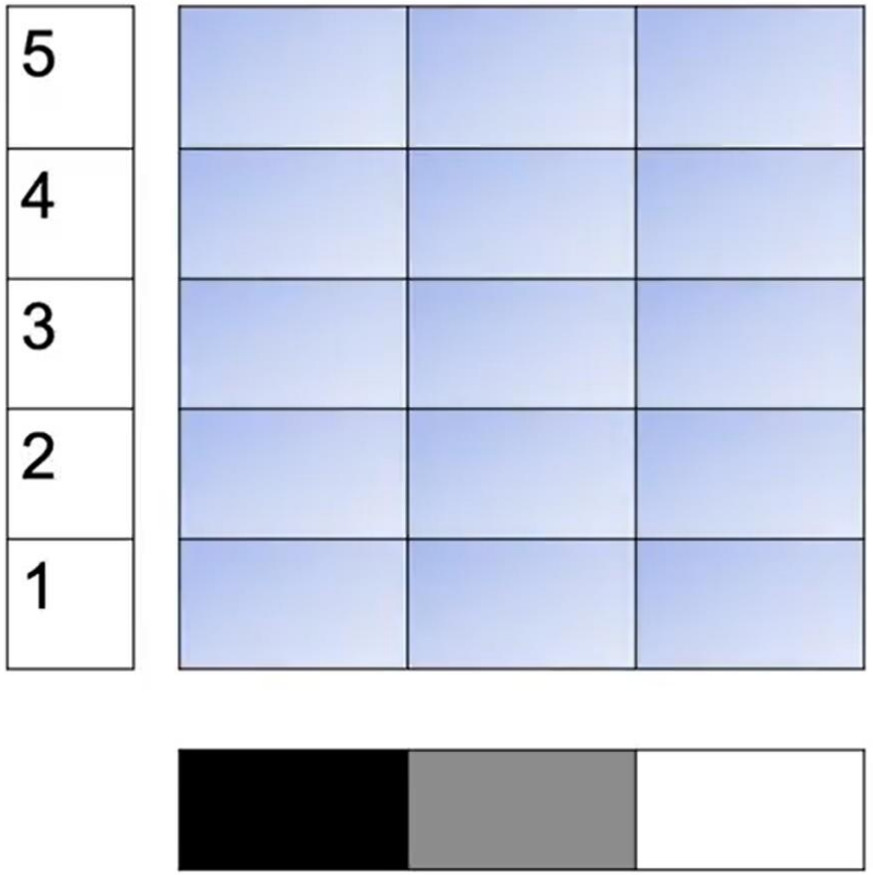
- Histograms
- Intensity transformations
- Thresholding and Simple Segmentation

Histogams

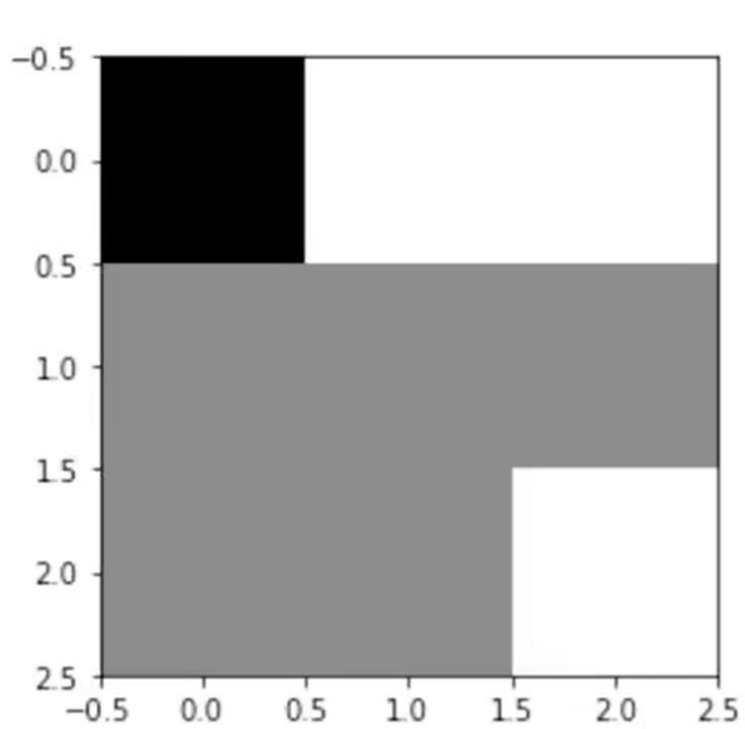
- Biểu đồ đếm số lần xuất hiện của pixel và đây là công cụ hữu ích để hiểu và xử lý hình ảnh.

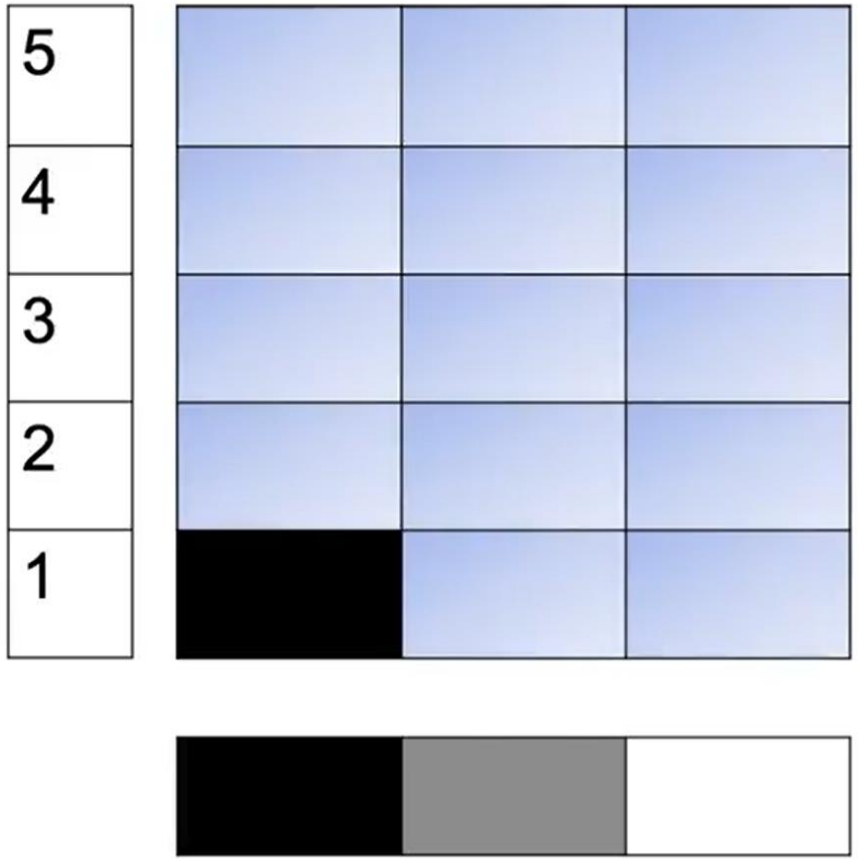
Histograms



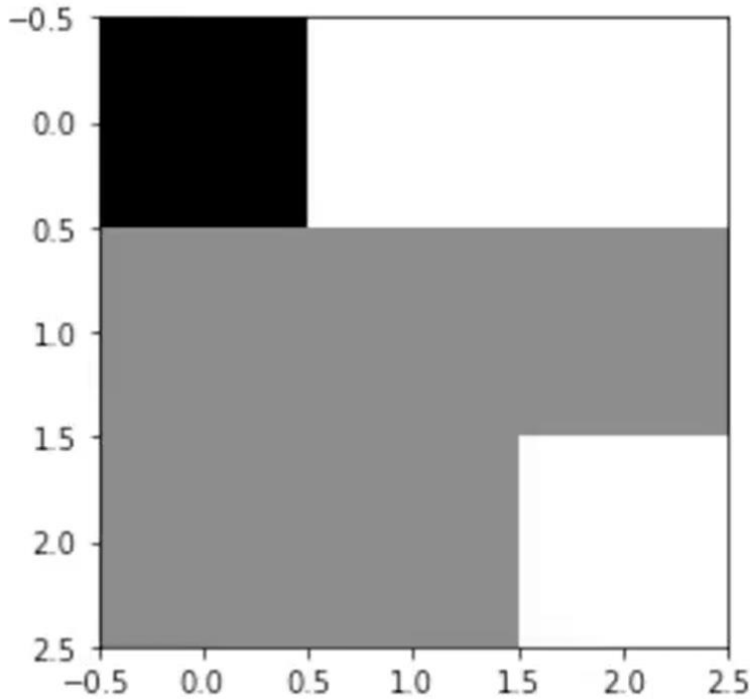


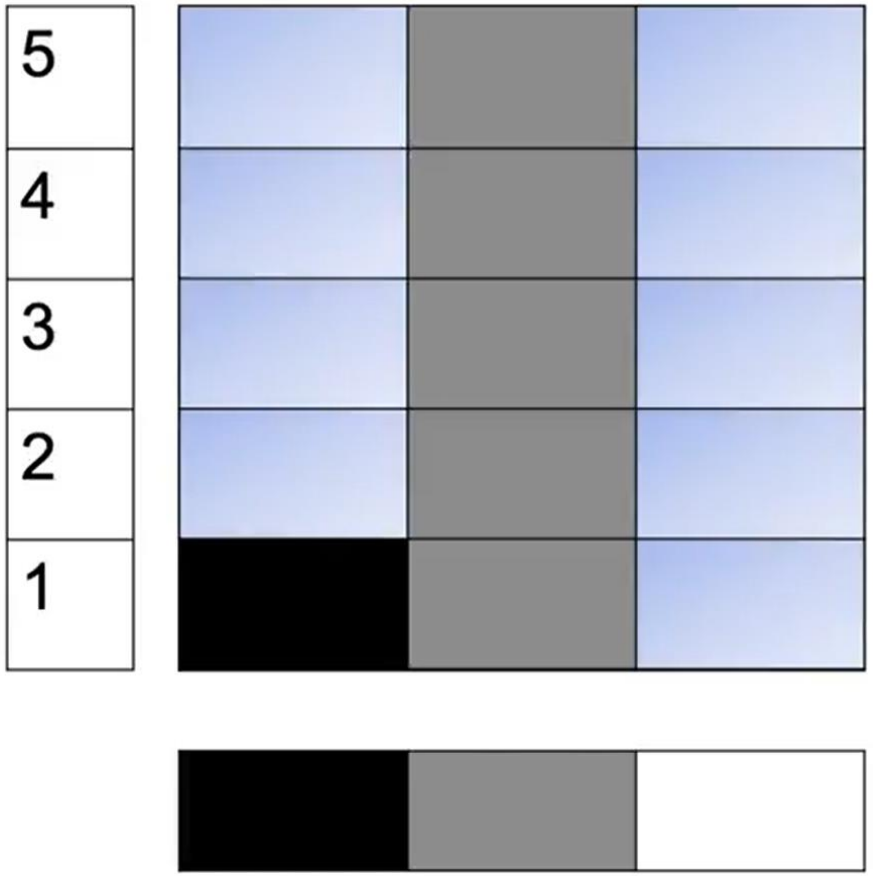
Histograms



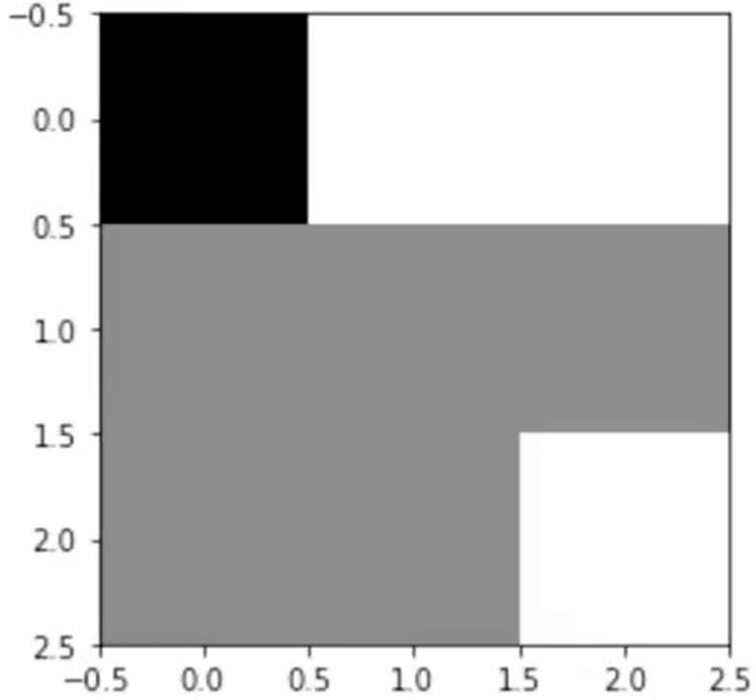


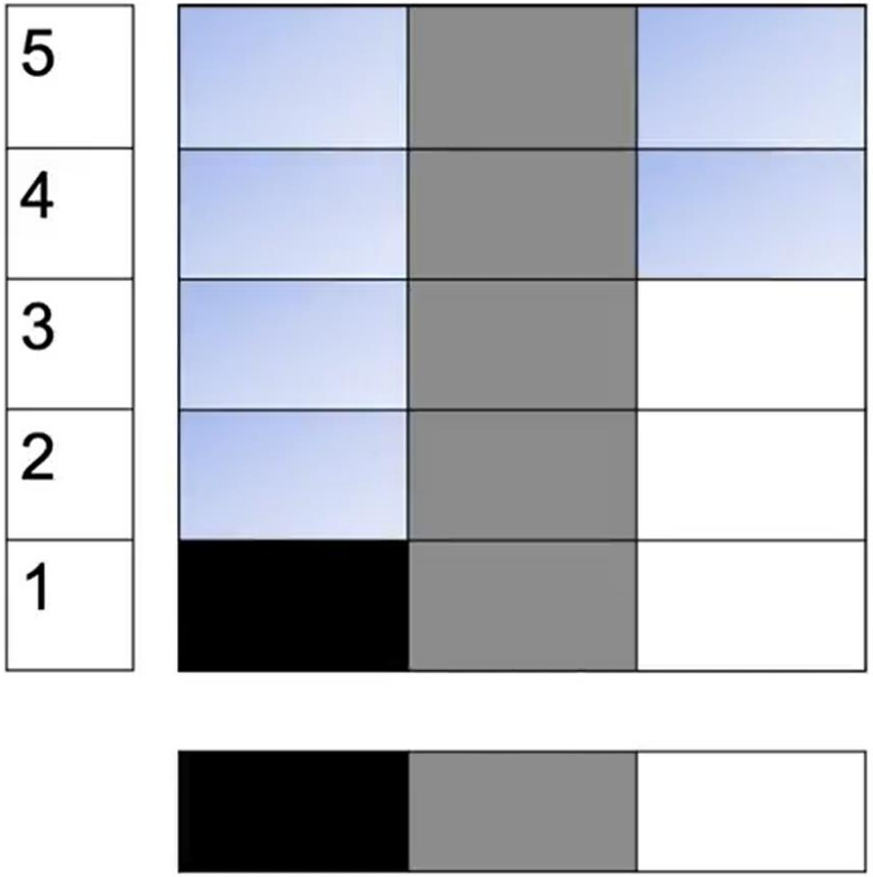
Histograms



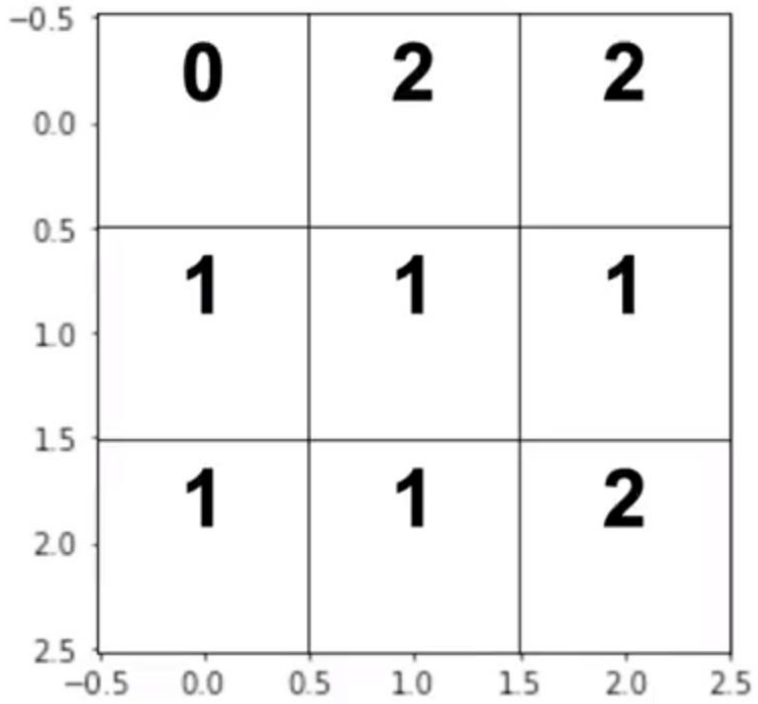


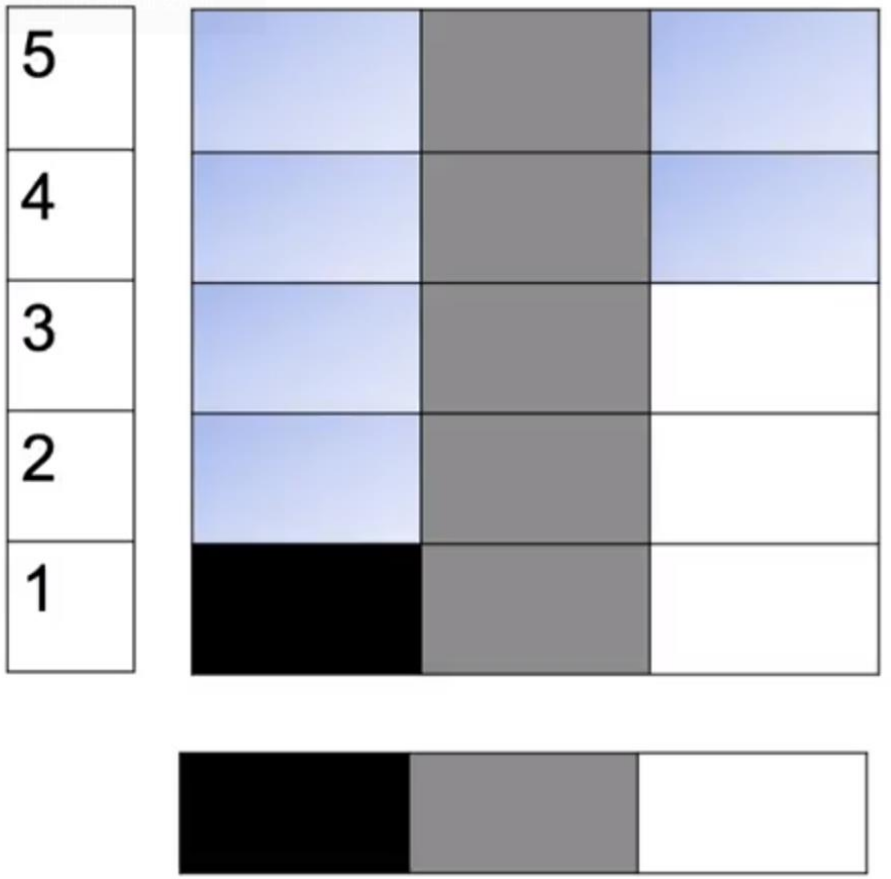
Histograms



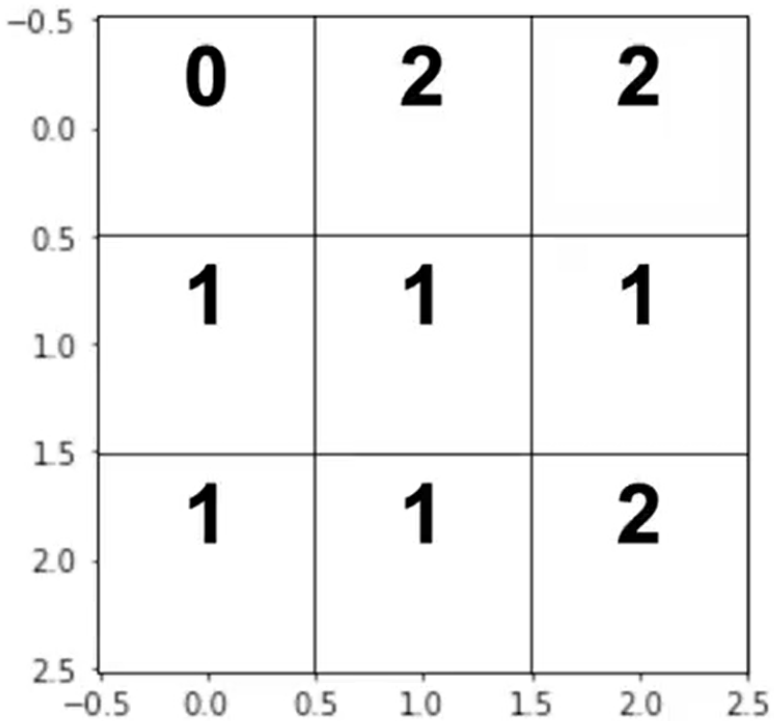


Histograms





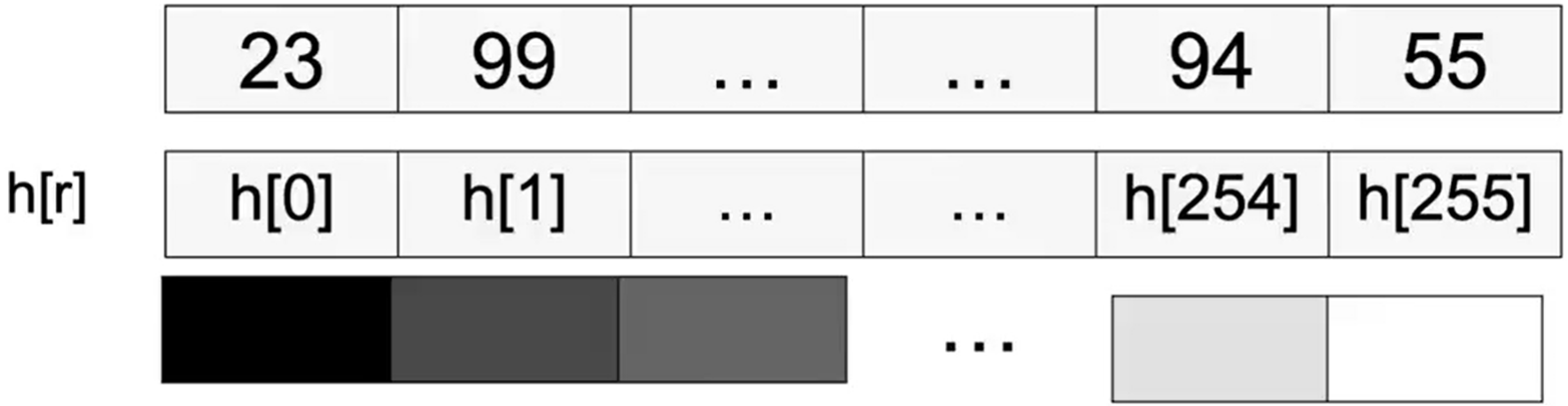
Histograms



h[r]	1	5	3
r	0	1	2

Histograms

- Hầu hết các ảnh đều có tối đa 256 mức độ biểu thị cho 256 mức xám



Histograms

```
import cv2

goldhill = cv2.imread("goldhill.bmp")
```

Histograms

```
goldhill = cv2.imread("goldhill.bmp")

hist = cv2.calcHist([goldhill],[0],None,[256],[0,255])
```

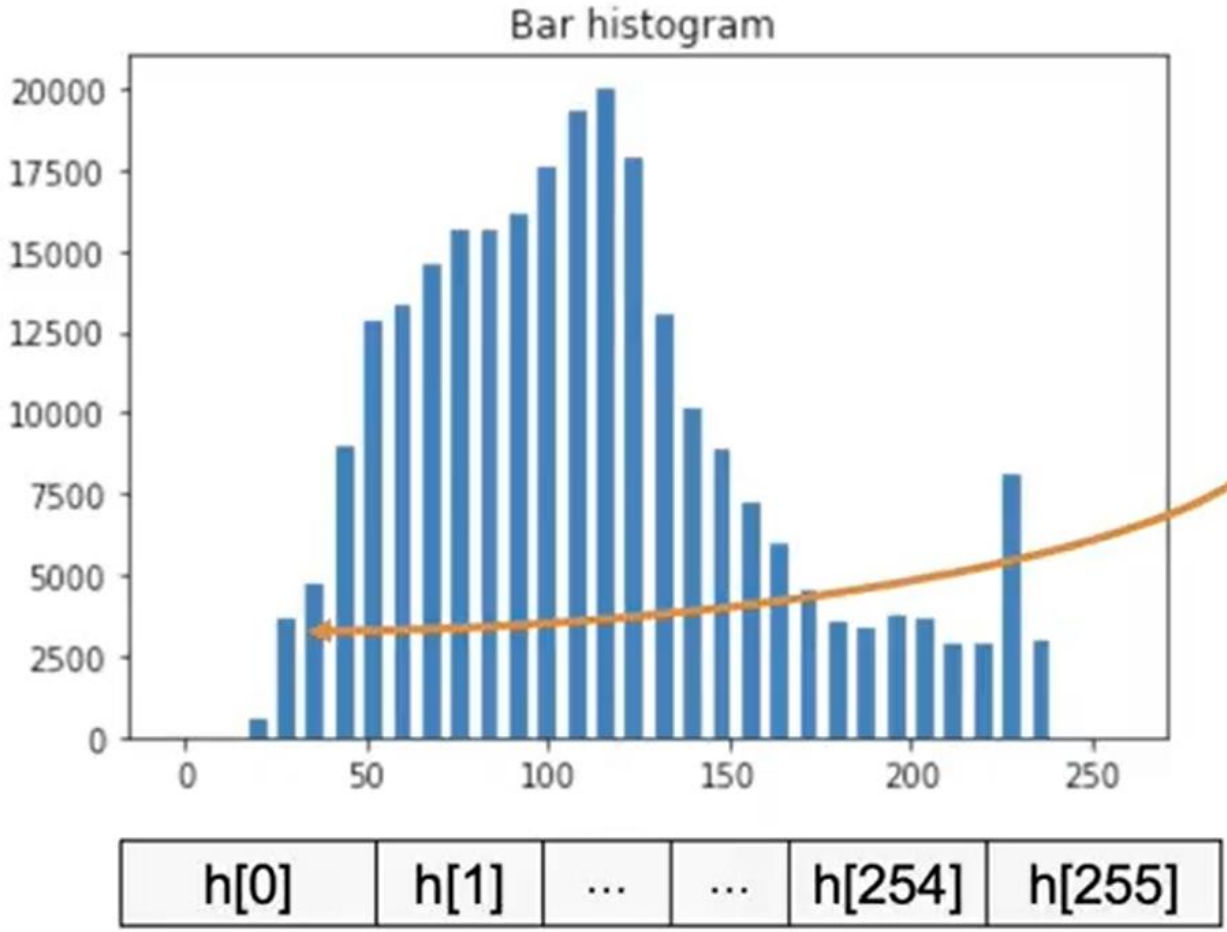
```
goldhill = cv2.imread("goldhill.bmp")

hist = cv2.calcHist([goldhill],[0],None,[256],[0,255])
```

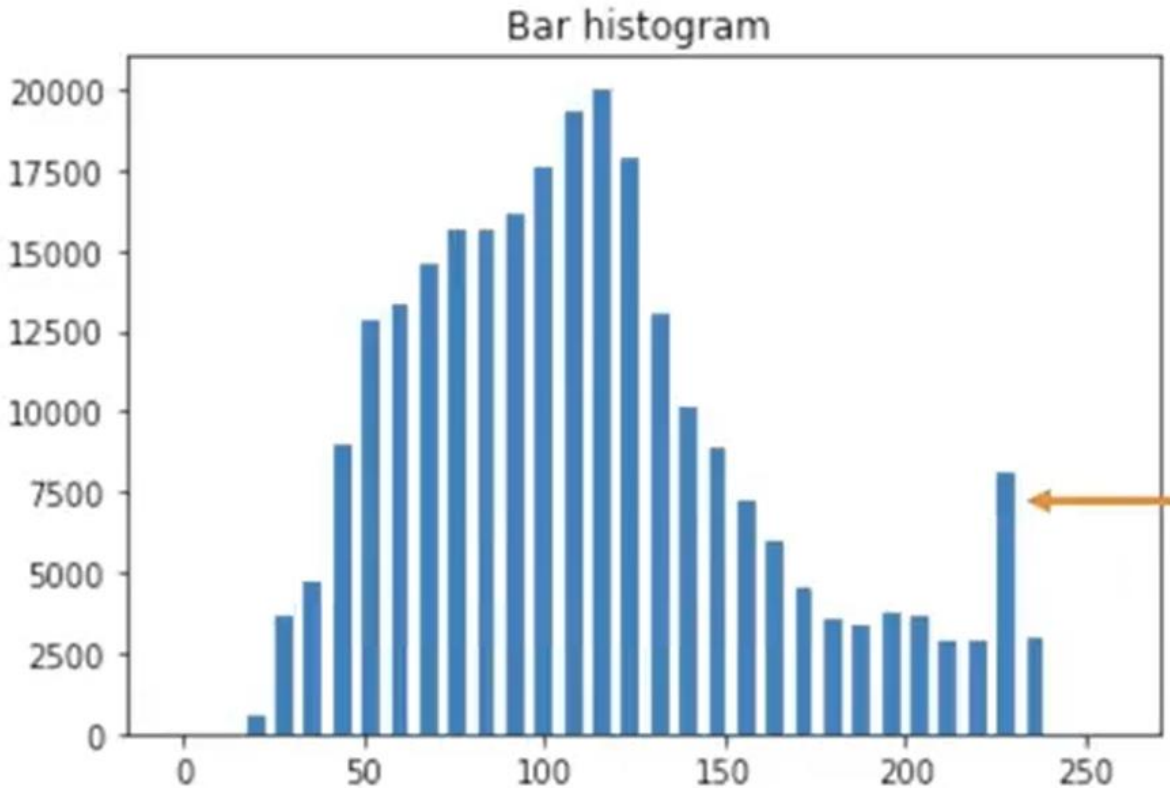
```
goldhill = cv2.imread("goldhill.bmp")

hist = cv2.calcHist([goldhill],[0],None,[256],[0,255])
```

34	1	…	…	94	0
0	1	2	…	254	255



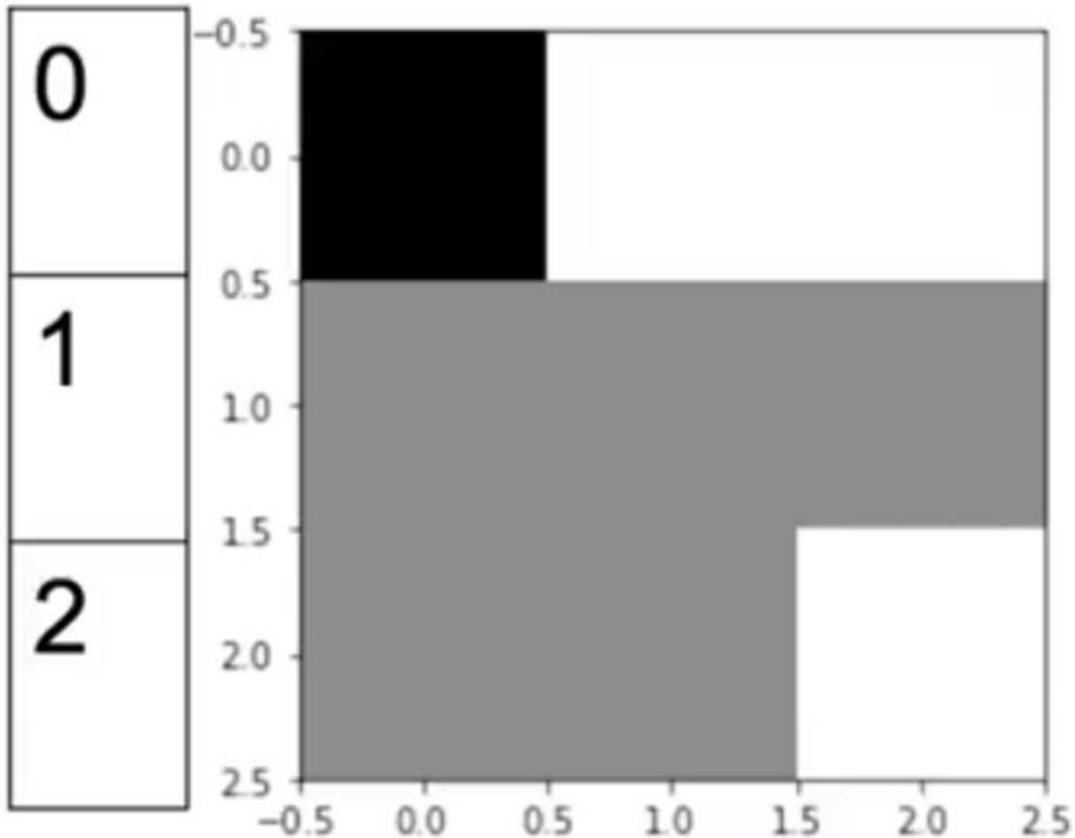
h[0]	h[1]	…	…	h[254]	h[255]



h[0]	h[1]	…	…	h[254]	h[255]

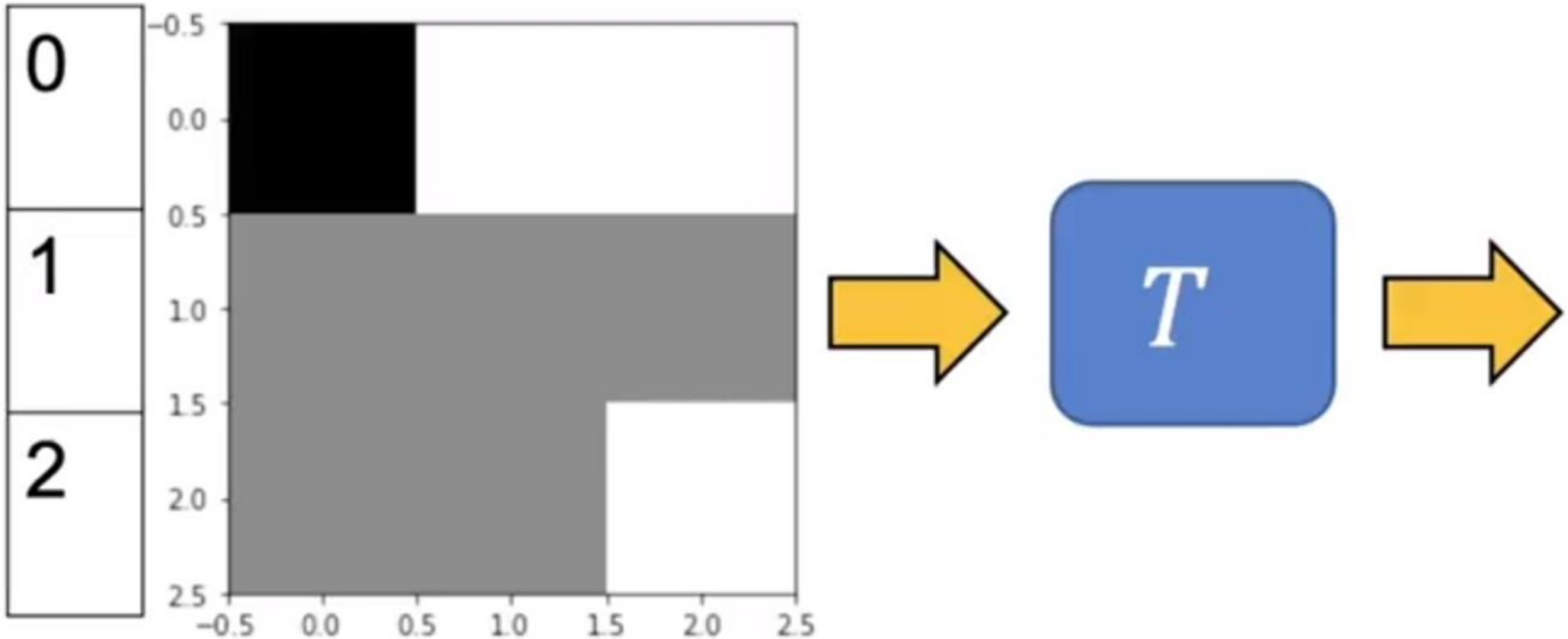
Intensity Transformations

$f[i, j]$



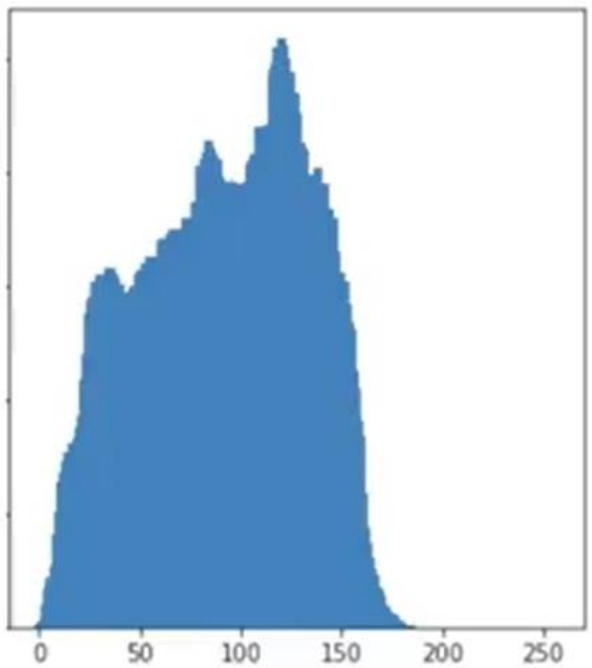
i, j	0	1	2

$f[i,j]$ $g[i,j] = T\{f[i,j]\}$



i,j	0	1	2

h_r

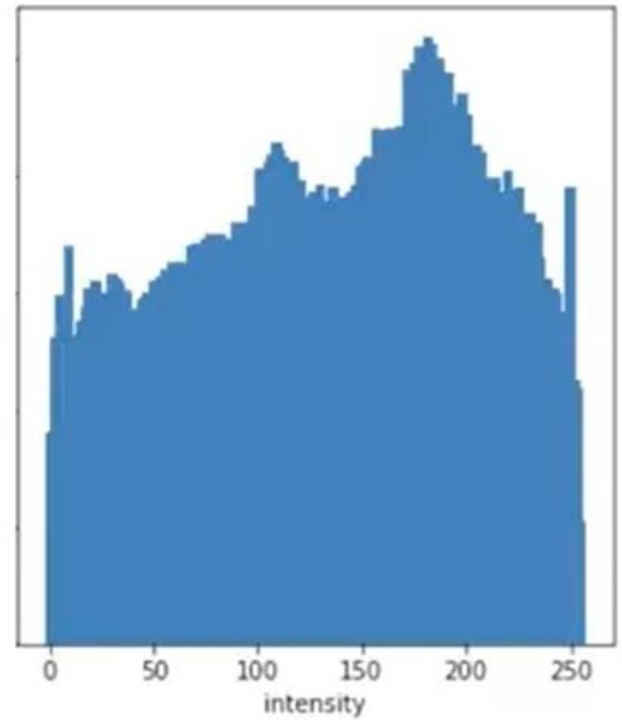


r

$s = T\{r\}$

T

h_s



s

$f[i,j]$ $g[i,j] = 2f[i,j] + 1$ $g[i,j]$

0	2	2
1	1	1
1	1	2

$f[i,j]$ $g[i,j] = 2f[i,j] + 1$ $g[i,j]$

0	2	2
1	1	1
1	1	2

$0 + 1$

1		

$f[i,j]$

$$g[i,j] = 2f[i,j] + 1$$

$g[i,j]$

0	2	2
1	1	1
1	1	2

$2(1) + 1$

1		
3		

$f[i,j]$

$$g[i,j] = 2f[i,j] + 1$$

$g[i,j]$

0	2	2
1	1	1
1	1	2

1	5	5
3	3	3
3	3	5

r	h_r
0	1
1	5
2	3
3	0
4	0
5	0
6	0

$$s = 2r + 1$$

$$= 2(0) + 1$$

$$= 1$$

s	h_s
0	0
1	1
2	0
3	5
4	0
5	3
6	0

r	h_r
0	1
1	5
2	3
3	0
4	0
5	0
6	0

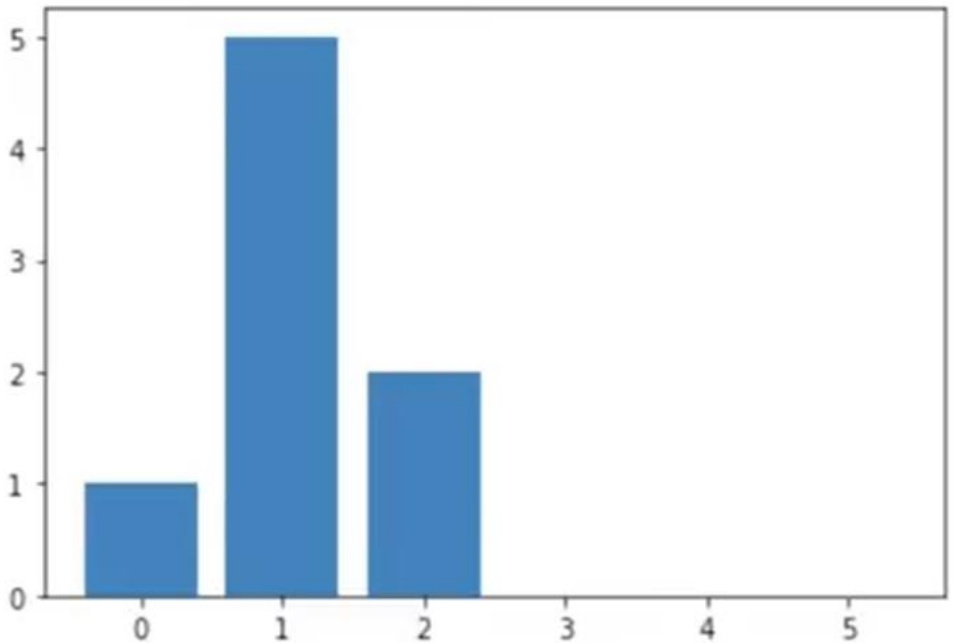
$$s = 2r + 1$$

$$= 2(2) + 1$$

$$= 3$$

s	h_s
0	0
1	1
2	0
3	5
4	0
5	3
6	0

h_r



h_s

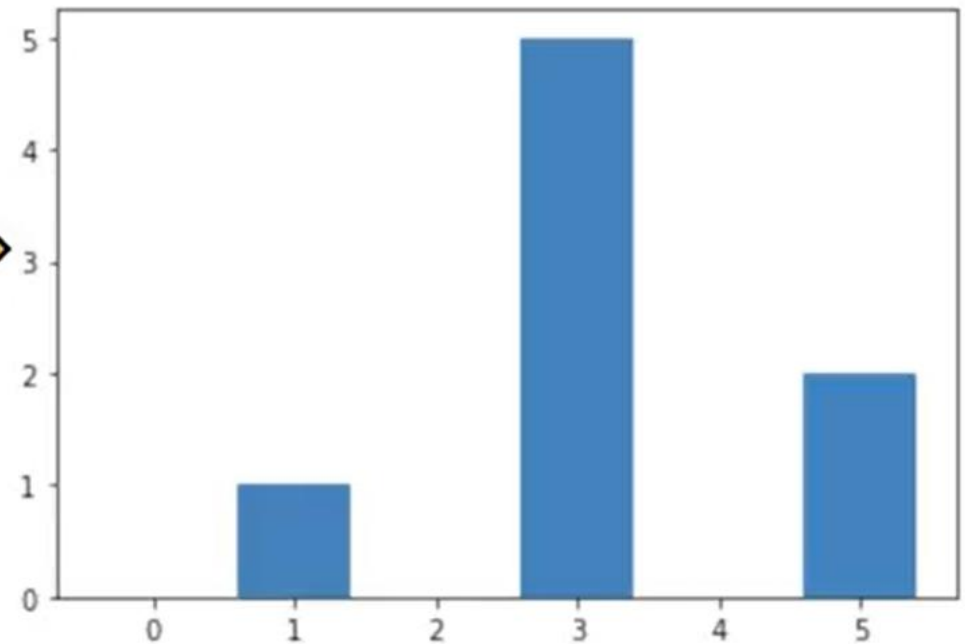


Image negative

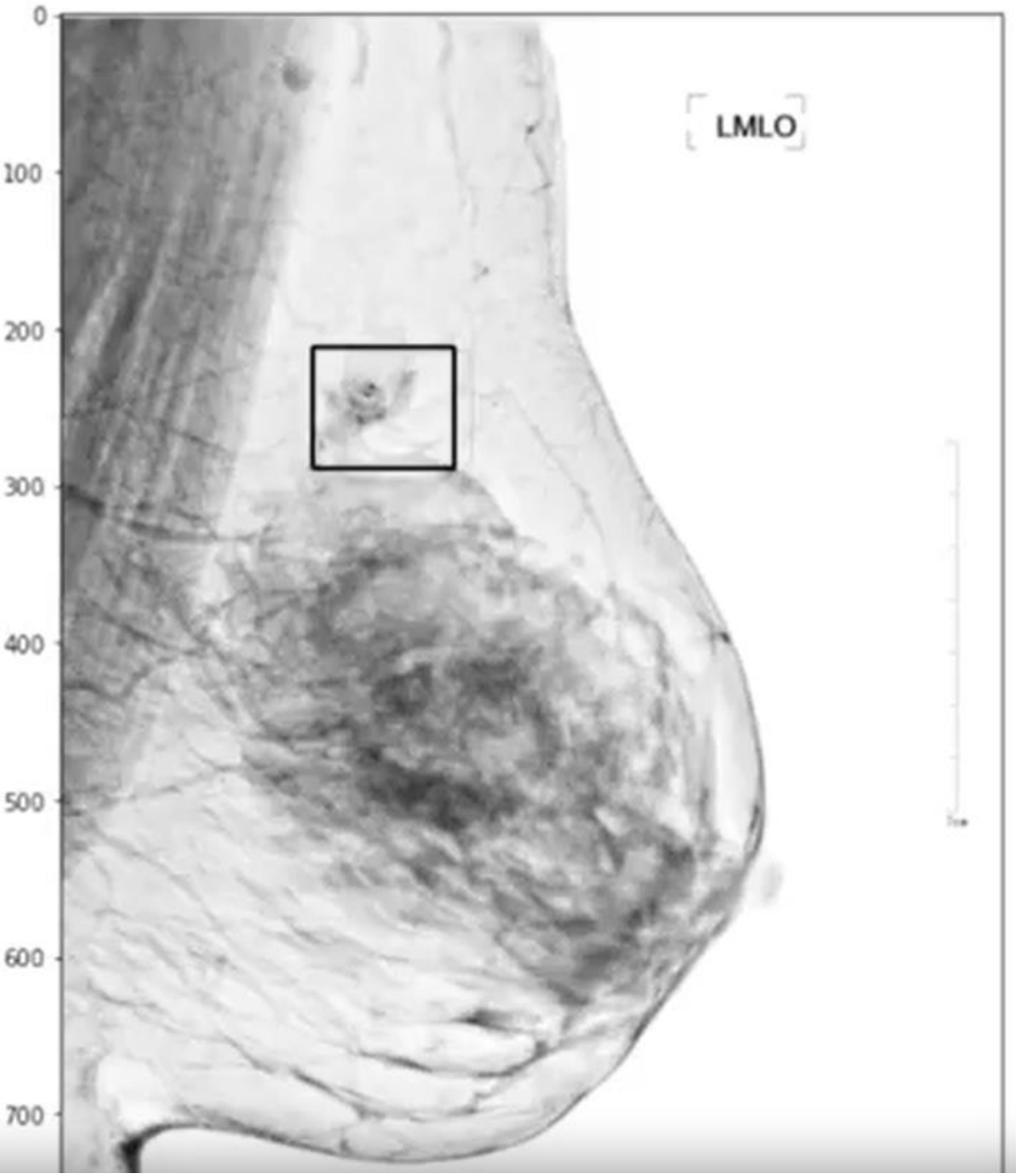
Ảnh âm bản

```
image= cv2.imread("mammogram.png",cv2.IMREAD_GRAYSCALE)
```

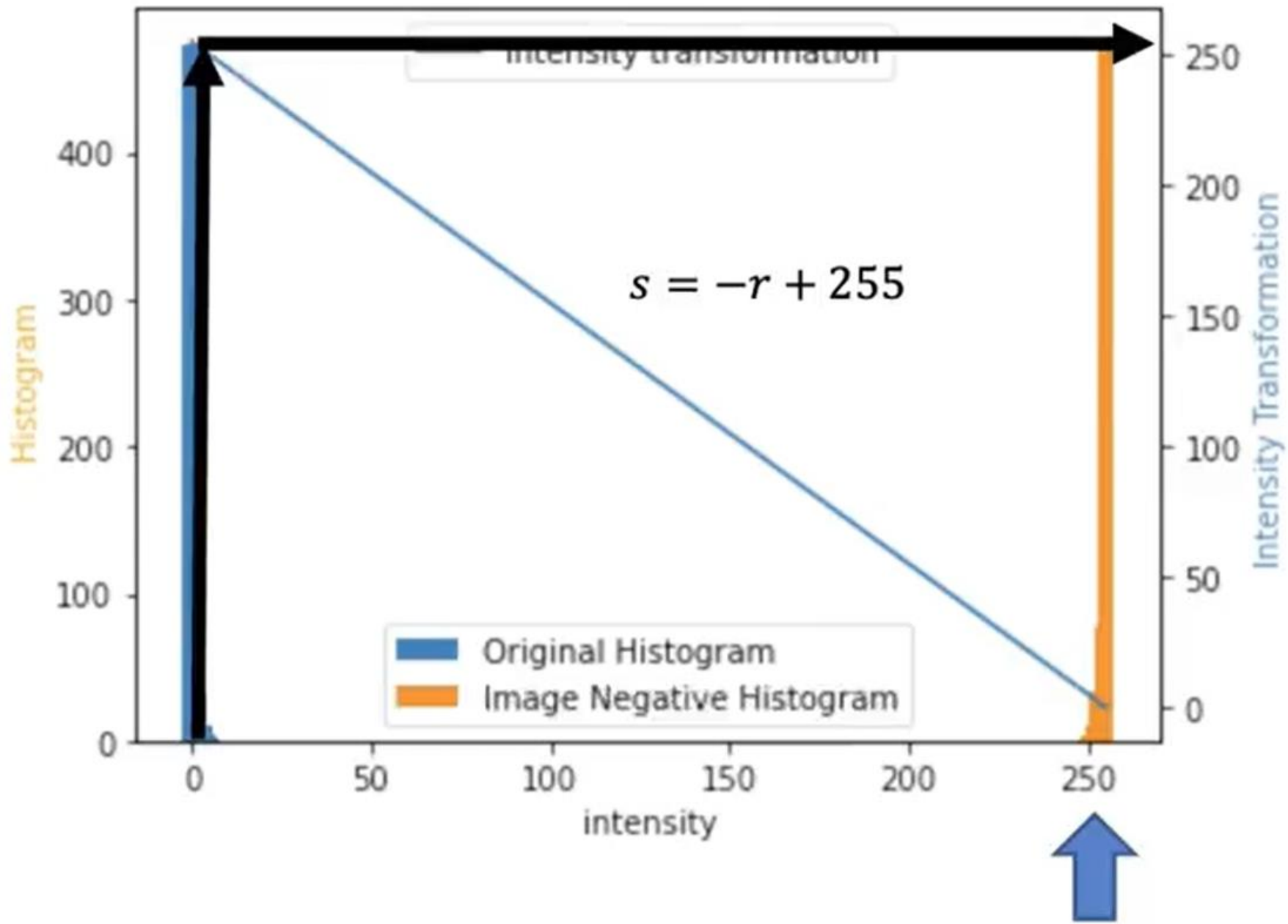
$$g[i,j] = -1f[i,j] + 255$$

Jian, Wushuai, Xueyan Sun, and Shuqian Luo. "Computer-aided diagnosis of breast microcalcifications based on dual-tree complex wavelet transform." Biomedical engineering online 11.1 (2012): 1-12.

img_neg=-1* image+255



$$g[i,j] = -1f[i,j] + 255$$


Intensity transformation
$s = -r + 255$
Original Histogram
Image Negative Histogram
Histogram
Intensity Transformation
intensity
0
100
200
300
400
0
50
100
150
200
250
0
50
100
150
200
250

Brightness and Contrast

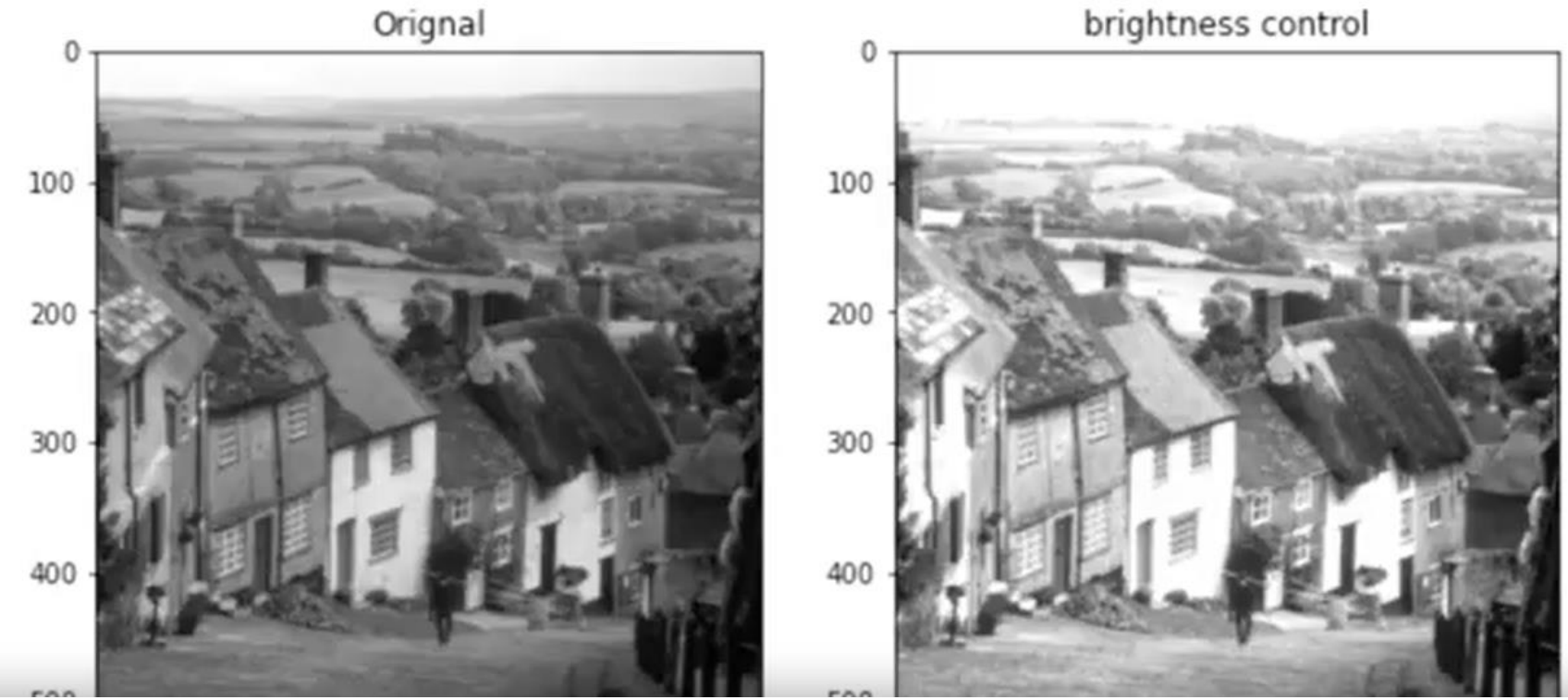
Ánh sáng và độ tương phản

$$g[i,j] = \alpha f[i,j] + \beta$$

```
alpha = 1 # Simple contrast control
beta = 100   # Simple brightness control
```

$$g[i,j] = 1f[i,j] + 100$$

```
new_image = cv2.convertScaleAbs(goldhill, alpha=alpha, beta=beta)
```

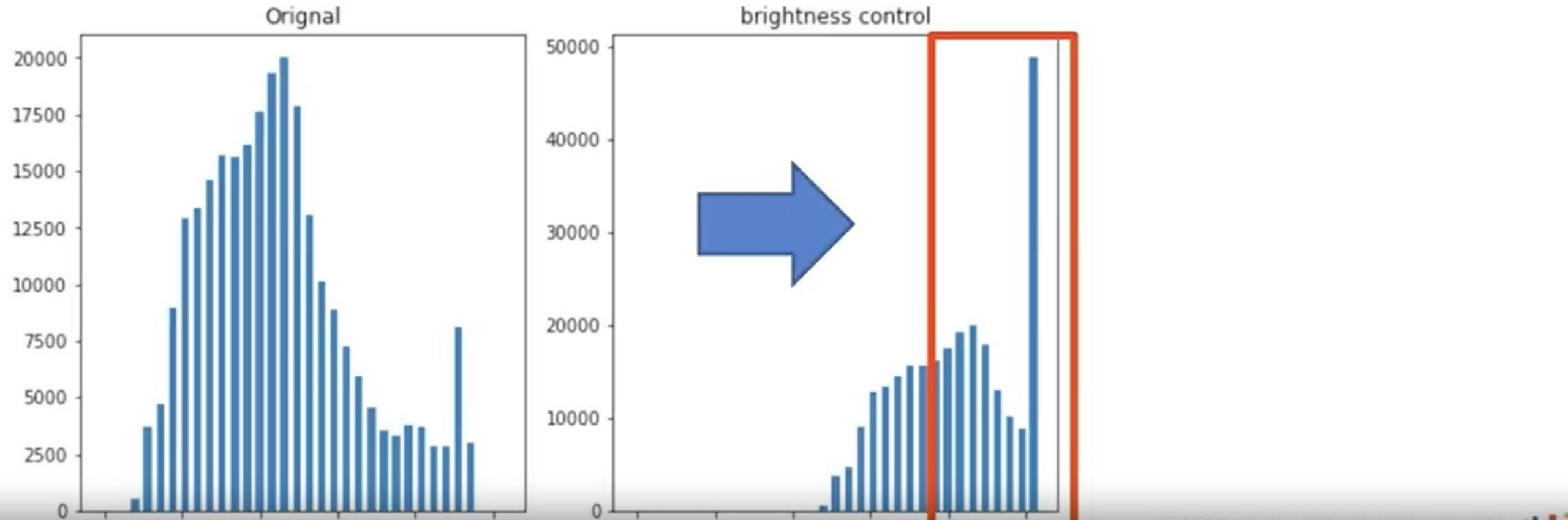


```
alpha = 1
beta = 100   # Simple brightness control
```

$$g[i,j] = \alpha f[i,j] + \beta$$

$$g[i,j] = 1f[i,j] + 100$$

```
new_image = cv2.convertScaleAbs(goldhill, alpha=alpha, beta=beta)
```

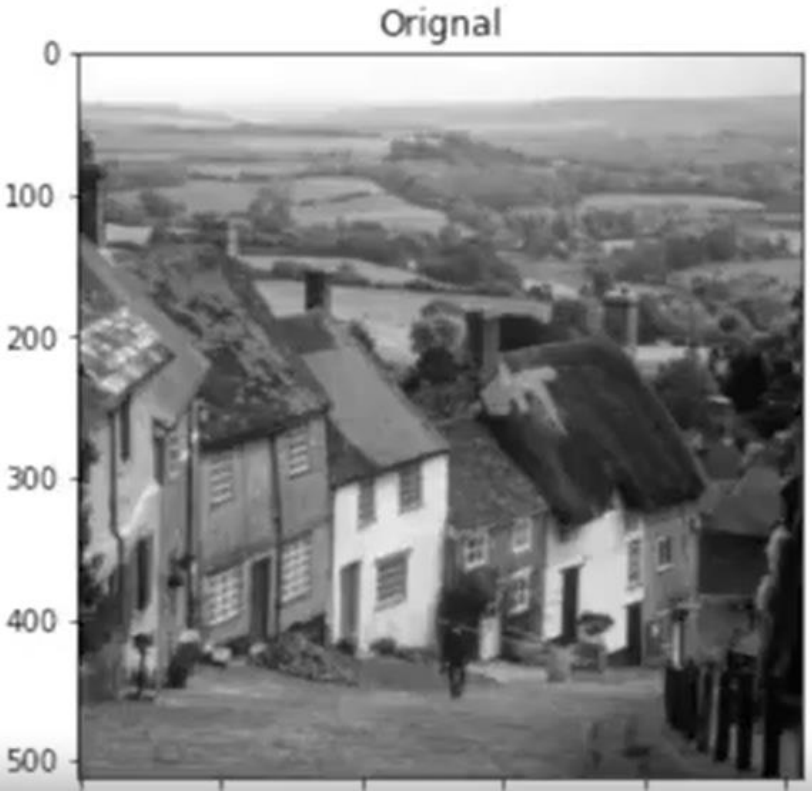


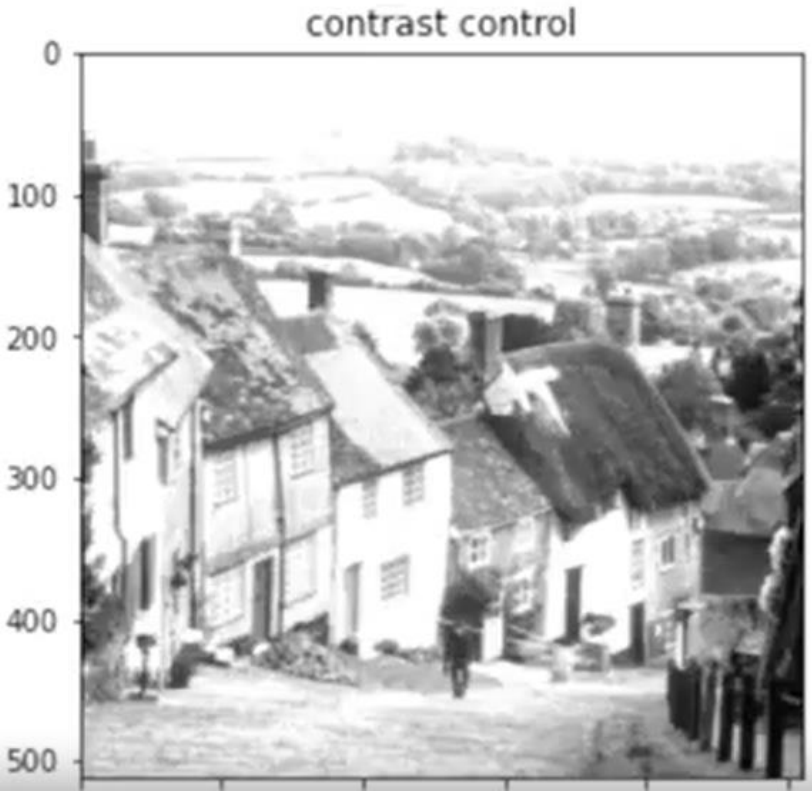
$$g[i,j] = \alpha f[i,j] + \beta$$

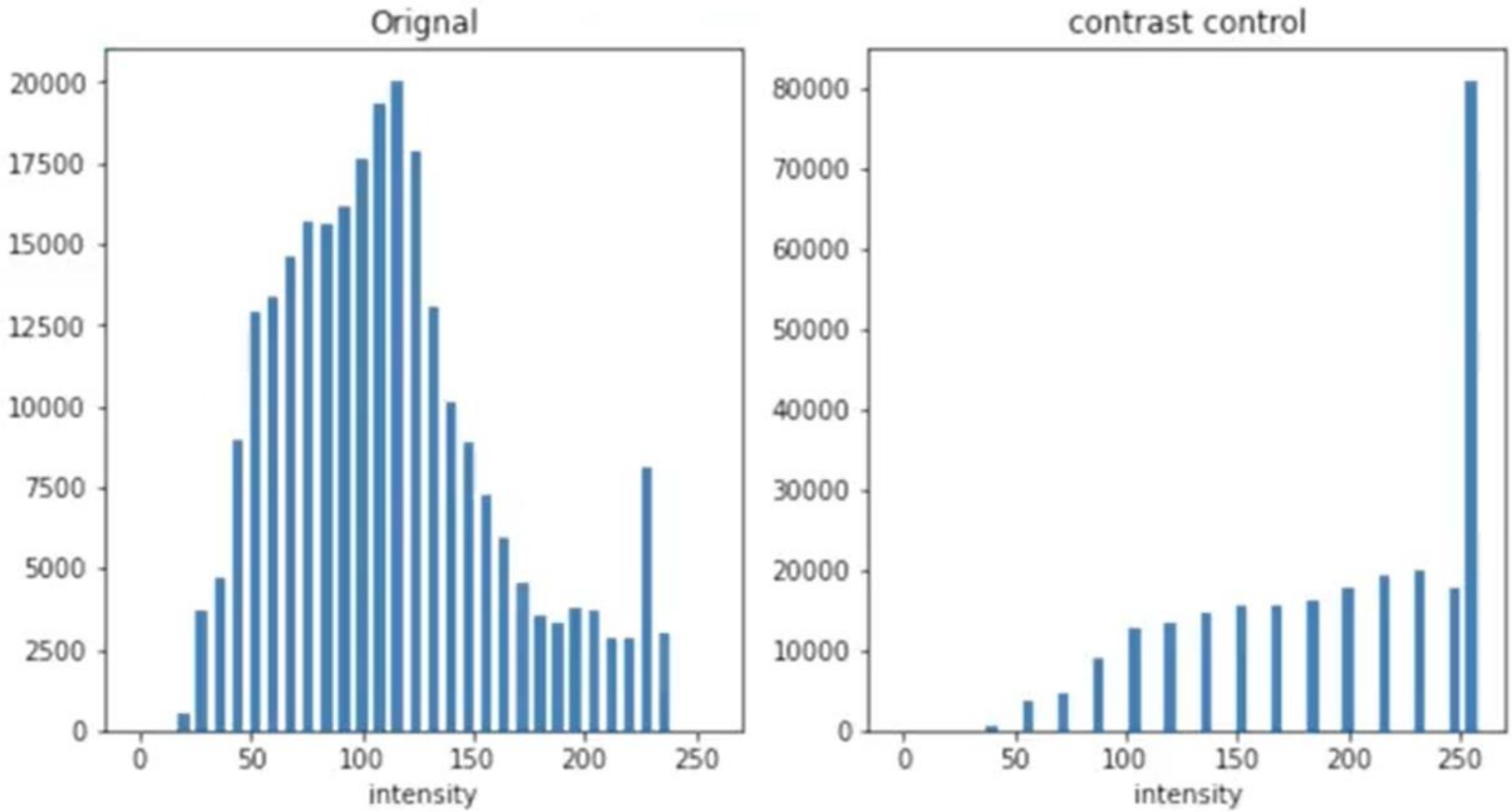
```
alpha = 2 # Simple contrast control
beta = 0 # Simple contrast control
```

$$g[i,j] = 2f[i,j]$$

```
new_image = cv2.convertScaleAbs(goldhill, alpha=alpha, beta=beta)
```





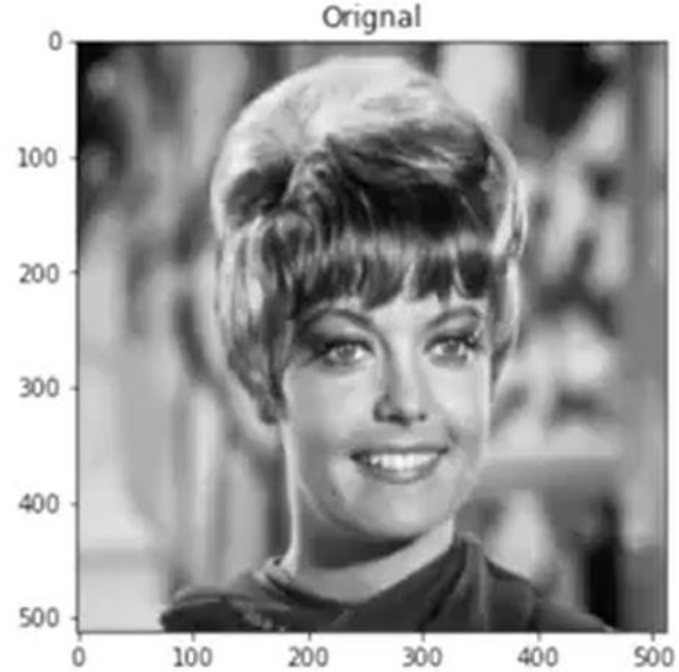

Orignal
20000
17500
15000
12500
10000
7500
5000
2500
0
0
50
100
150
200
250
intensity
contrast control
80000
70000
60000
50000
40000
30000
20000
10000
0
0
50
100
150
200
250
intensity

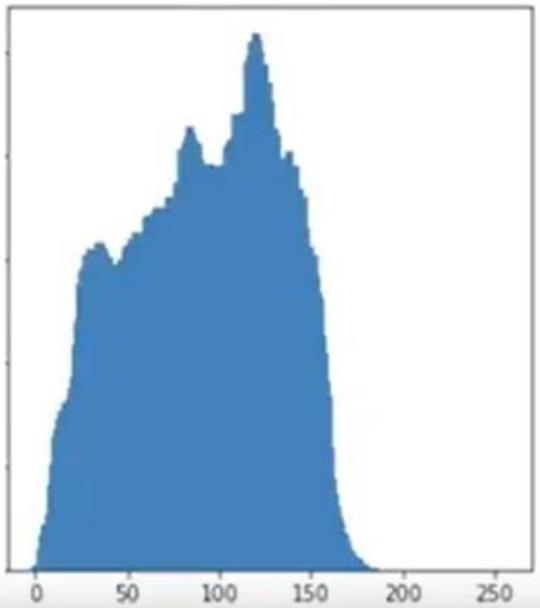
Histogram Equalization

Cân bằng histogram

```
zelda= cv2.imread("zelda.png",cv2.IMREAD_GRAYSCALE)

new_image= cv2.equalizeHist(zelda)
```

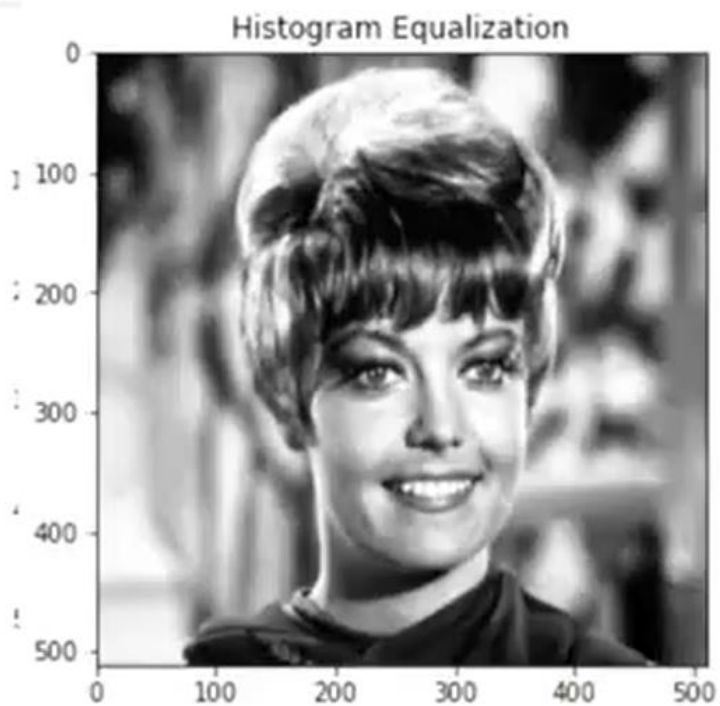




Histogram Equalization

```
zelda= cv2.imread("zelda.png",cv2.IMREAD_GRAYSCALE)

new_image= cv2.equalizeHist(zelda)
```



Histogram Equalization