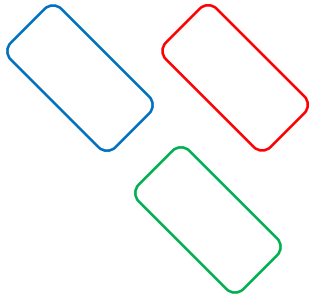


Intensity Transformation

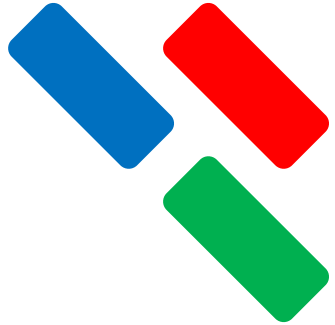
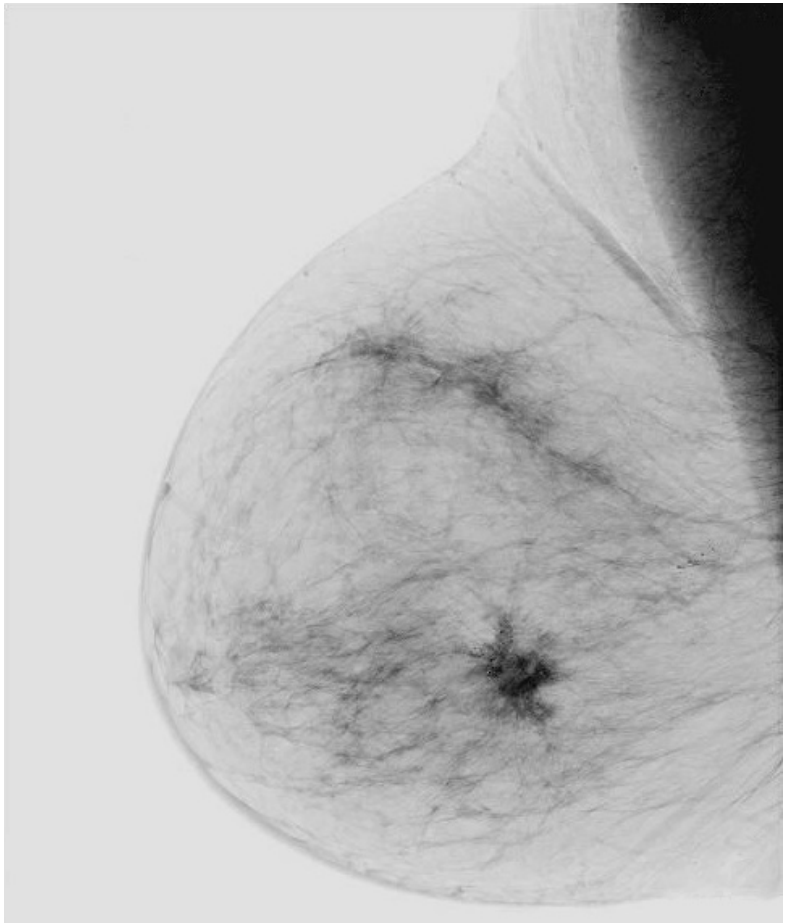


Image Negatives

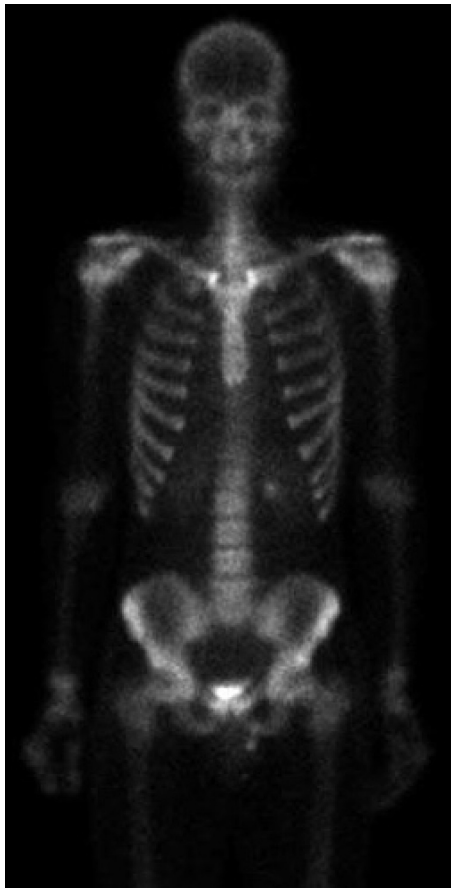
$$S = L - 1 - r$$

Image Negatives



Set Operation

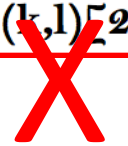
Set Operation



$$A \xrightarrow{3\overline{\sum f(x,y)}} B$$

Error Correction

```
for (int k=0; k<rows; k++) {
    for (int l =0; l<cols; l++) {
        sum.val[0]+=inimage.at<Vec3b>(k,l)[0];
        sum.val[1]+=inimage.at<Vec3b>(k,l)[1];
        sum.val[2]+=inimage.at<Vec3b>(k,l)[2];
        mul.val[0]=3*sum.val[0]/(rows*cols);
        mul.val[1]=3*sum.val[1]/(rows*cols);
        mul.val[2]=3*sum.val[2]/(rows*cols);
        sumimage.at<Vec3b>(k,l)[0]=mul.val[0];
        sumimage.at<Vec3b>(k,l)[1]=mul.val[1];
        sumimage.at<Vec3b>(k,l)[2]=mul.val[2];
    }
}
```

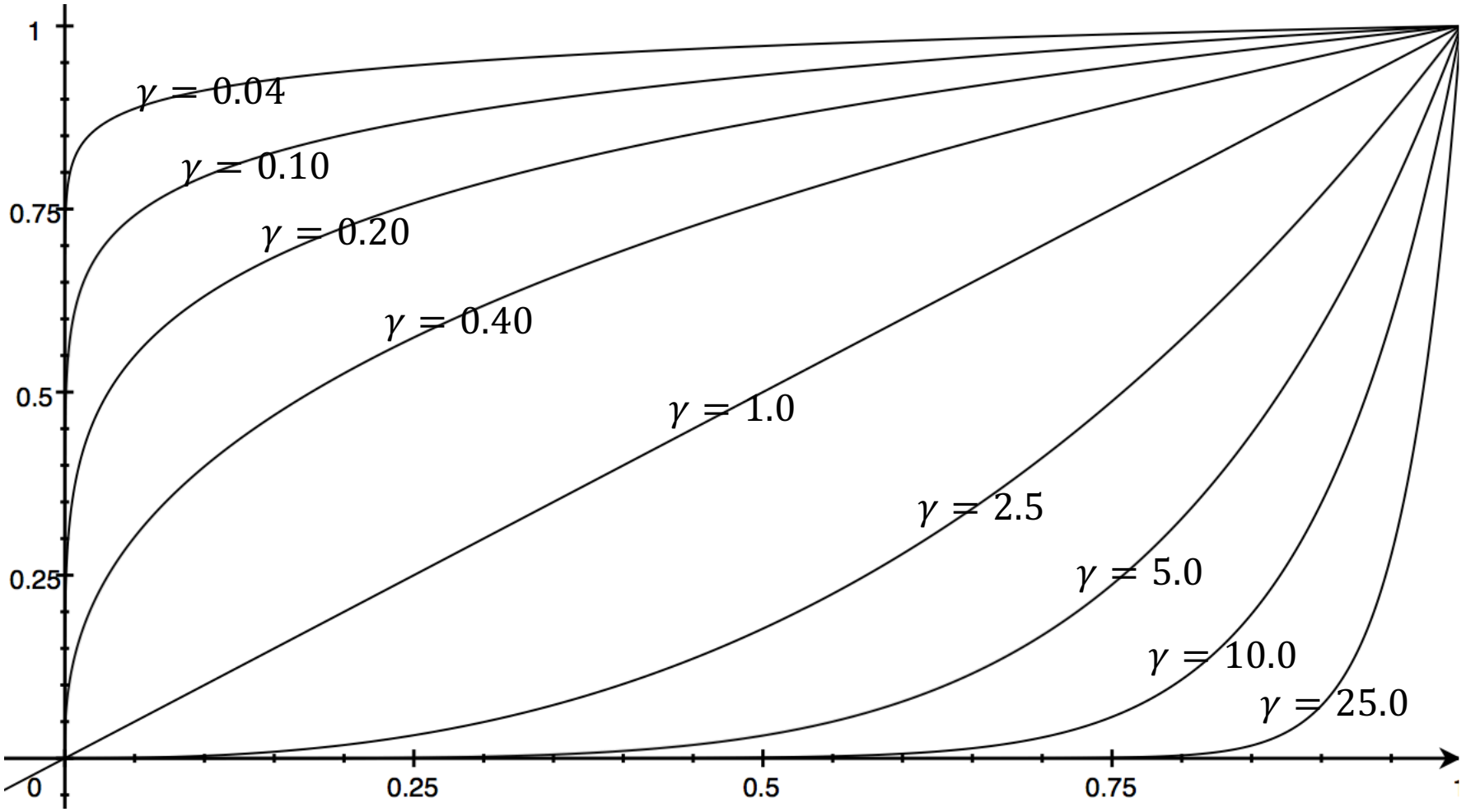


```
for (int k=0; k<rows; k++) {
    for (int l =0; l<cols; l++) {
        sum.val[0]+=inimage.at<Vec3b>(k,l)[0];
        sum.val[1]+=inimage.at<Vec3b>(k,l)[1];
        sum.val[2]+=inimage.at<Vec3b>(k,l)[2];
    }
}
for(int m=0;m<rows;m++){
    for (int n=0; n<cols; n++) {
        mul.val[0]=3*sum.val[0]/(rows*cols);
        mul.val[1]=3*sum.val[1]/(rows*cols);
        mul.val[2]=3*sum.val[2]/(rows*cols);
        sumimage.at<Vec3b>(m,n)[0]=mul.val[0];
        sumimage.at<Vec3b>(m,n)[1]=mul.val[1];
        sumimage.at<Vec3b>(m,n)[2]=mul.val[2];
    }
}
```

Gamma Transformation

$$S = cr^{\gamma}$$

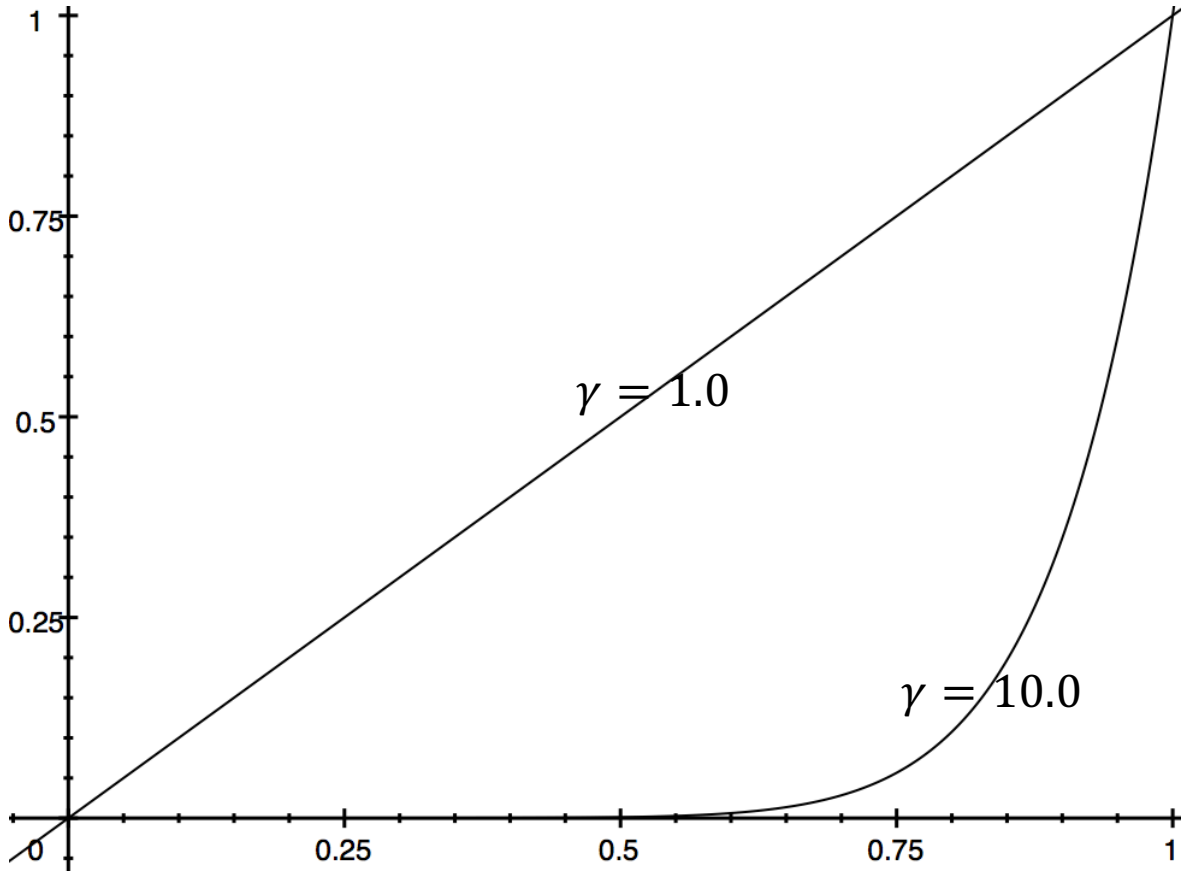
Gamma Transformation



$$c = 1 \longrightarrow s = r^{\gamma}$$

Gamma Transformation

γ



Gamma Transformation

$\gamma = 1.0$

Original image

$\gamma = 3.0$

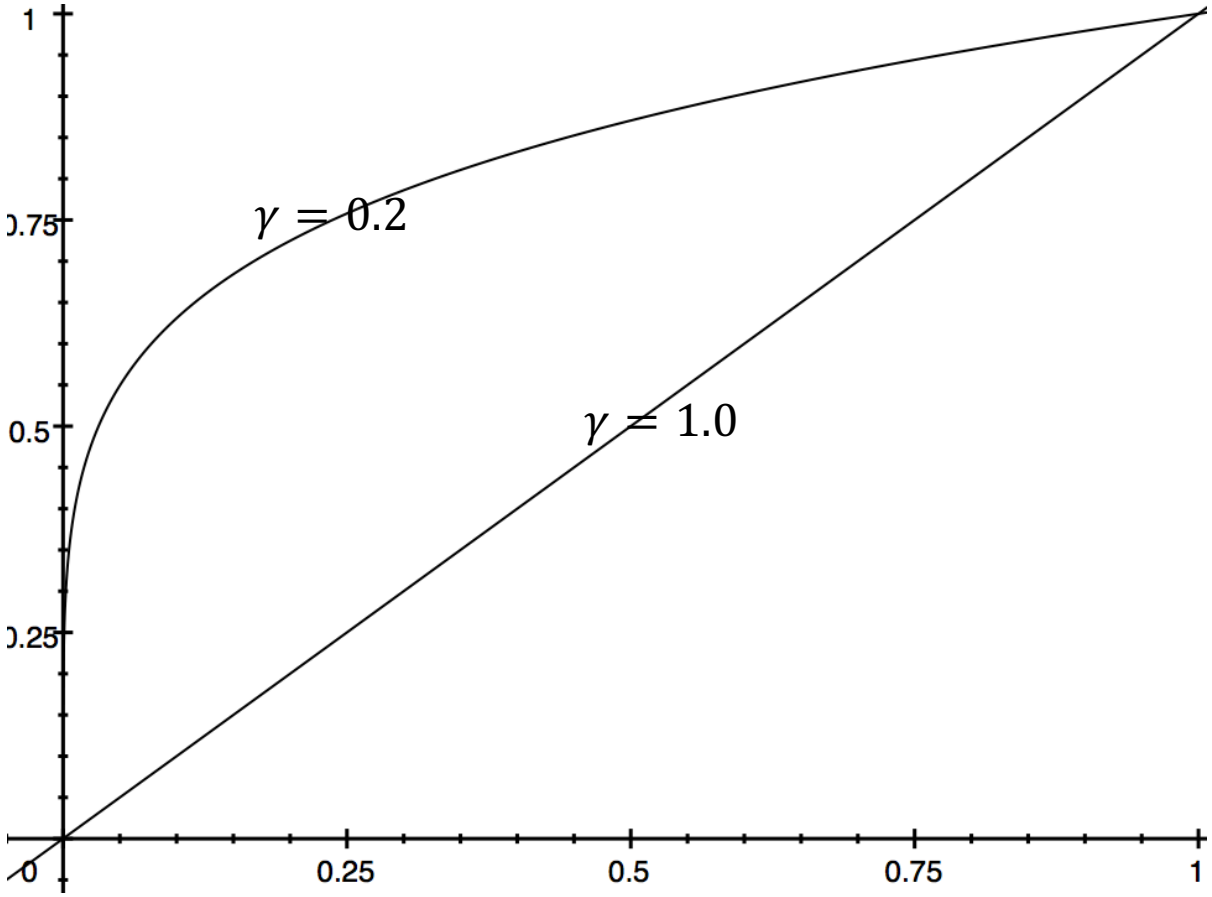
$\gamma = 4.0$

$\gamma = 5.0$

Gamma-corrected image

Gamma Transformation

γ



Gamma Transformation

$\gamma = 1.0$

Original image

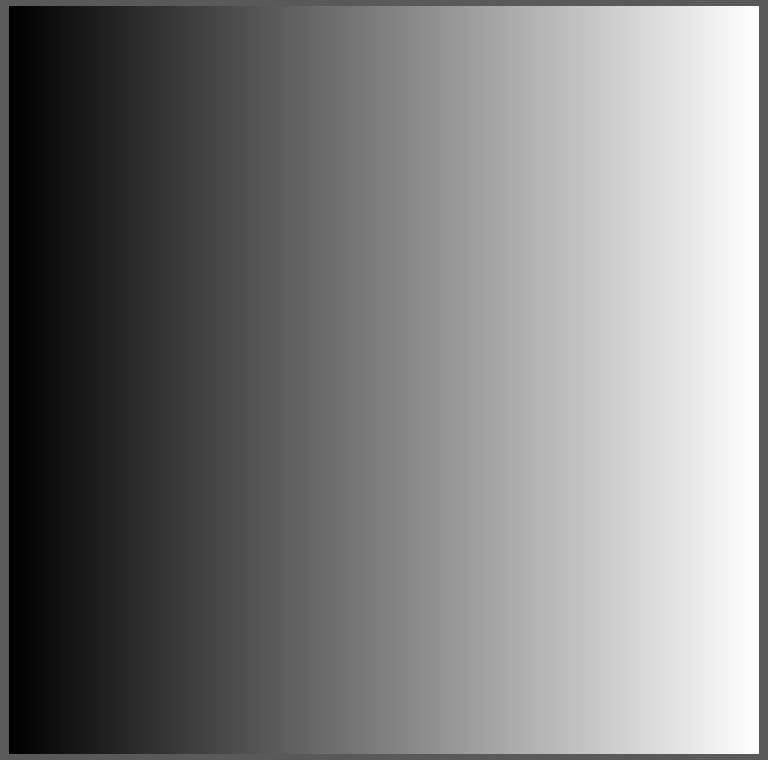
$\gamma = 0.6$

$\gamma = 0.4$

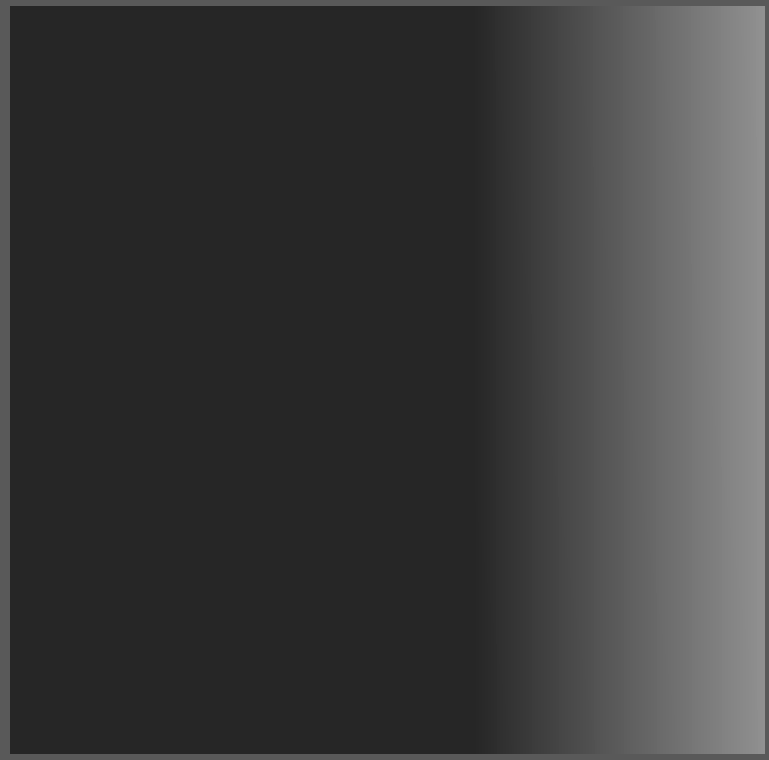
$\gamma = 0.3$

Gamma-corrected image

Gamma Transformation

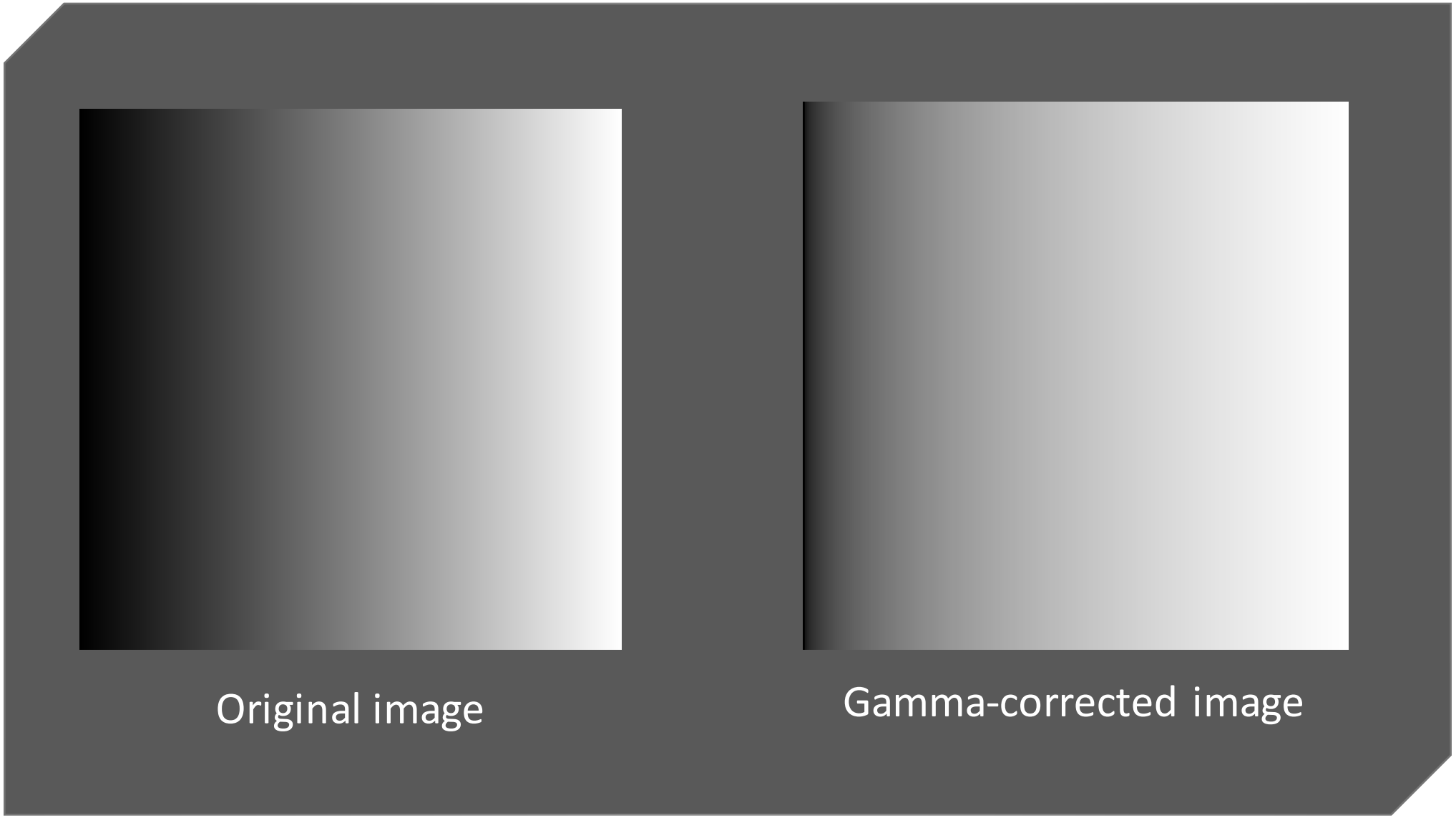


Original image



Original image as viewed on monitor

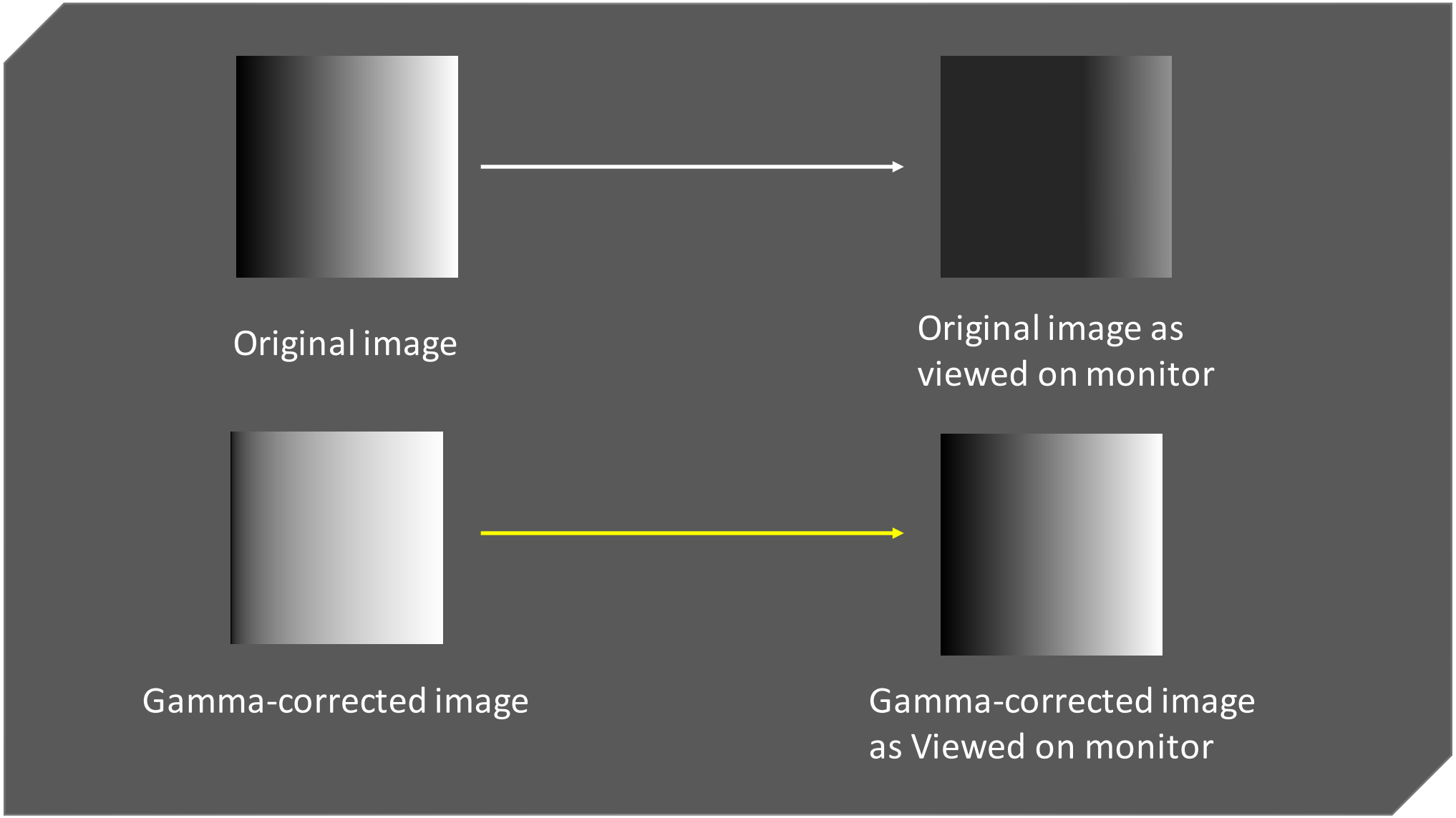
Gamma Transformation



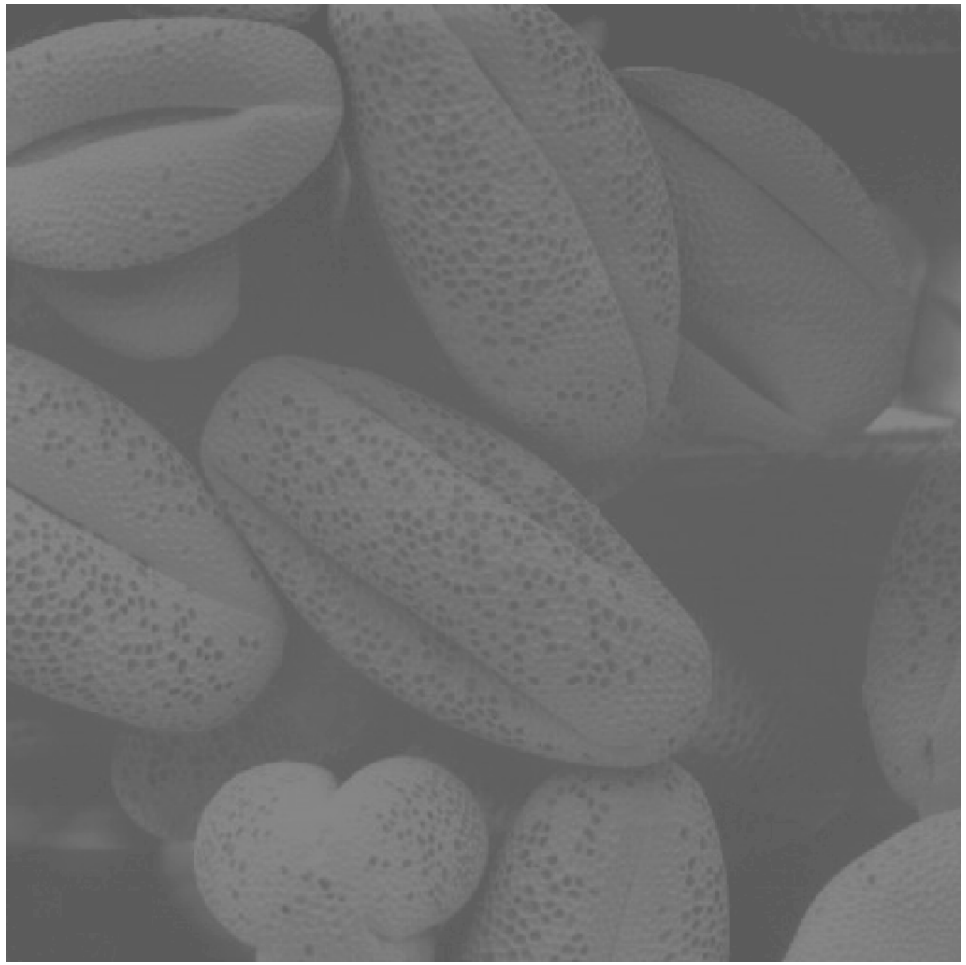
Original image

Gamma-corrected image

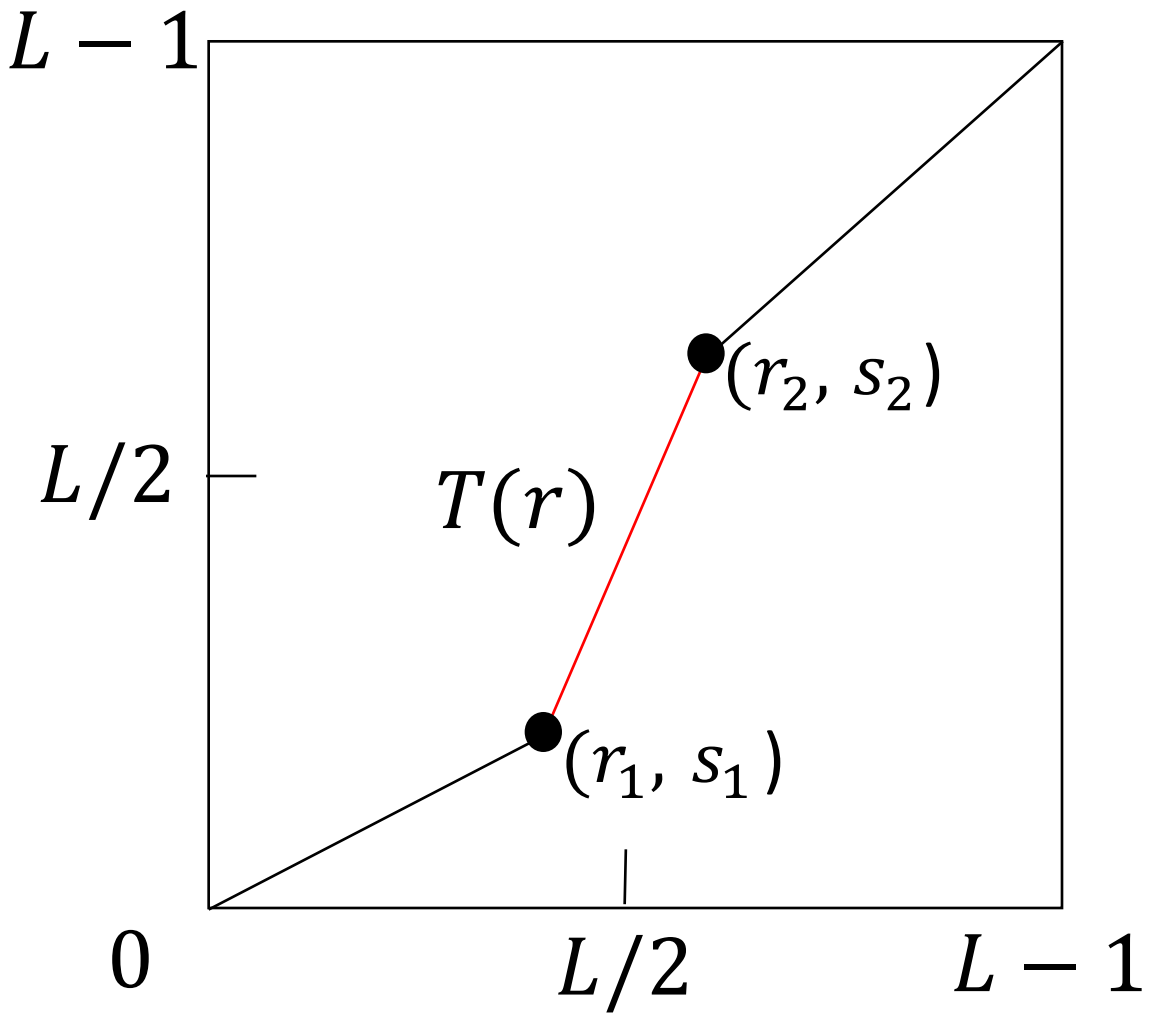
Gamma Transformation



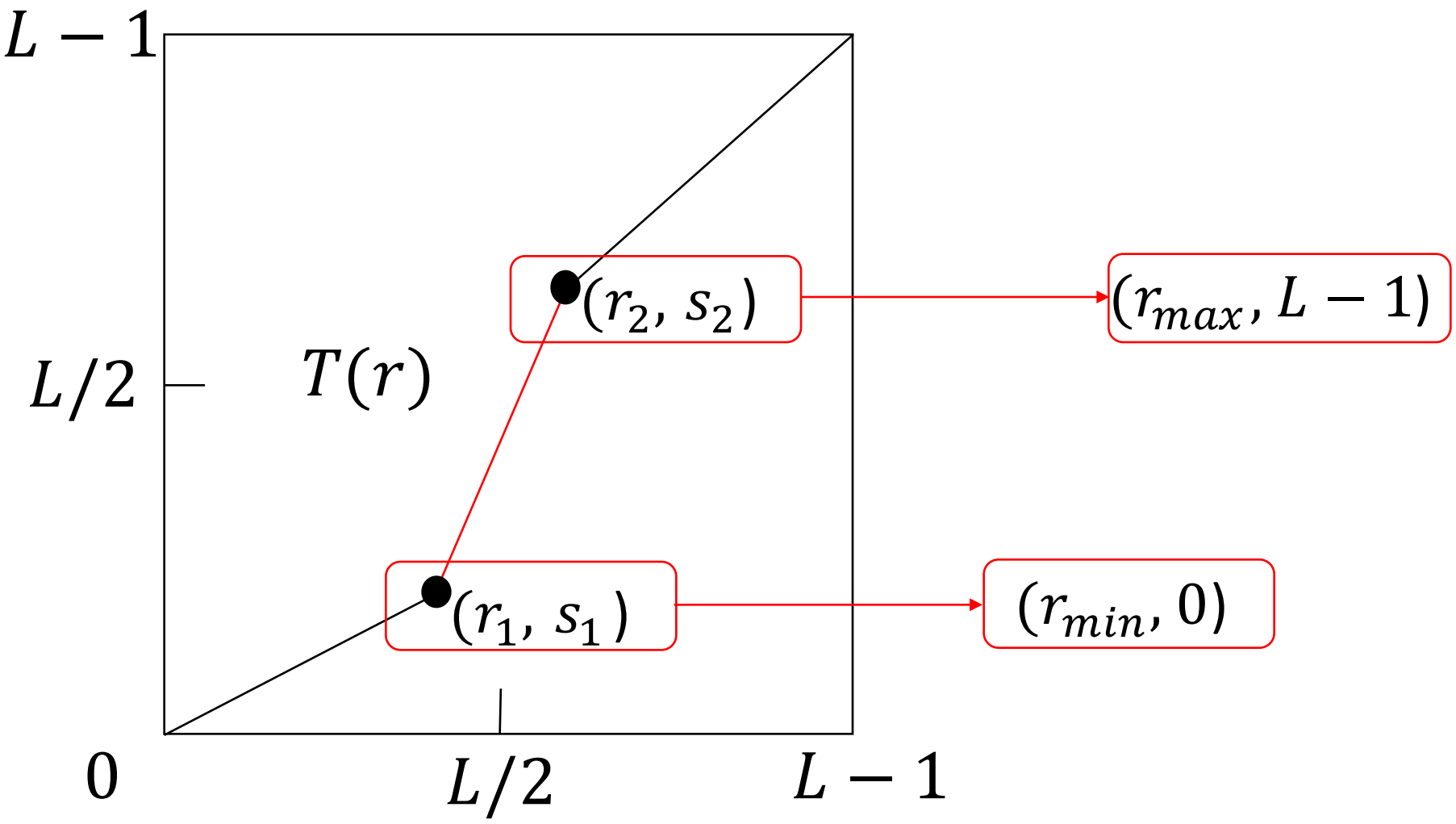
Contrast Stretching



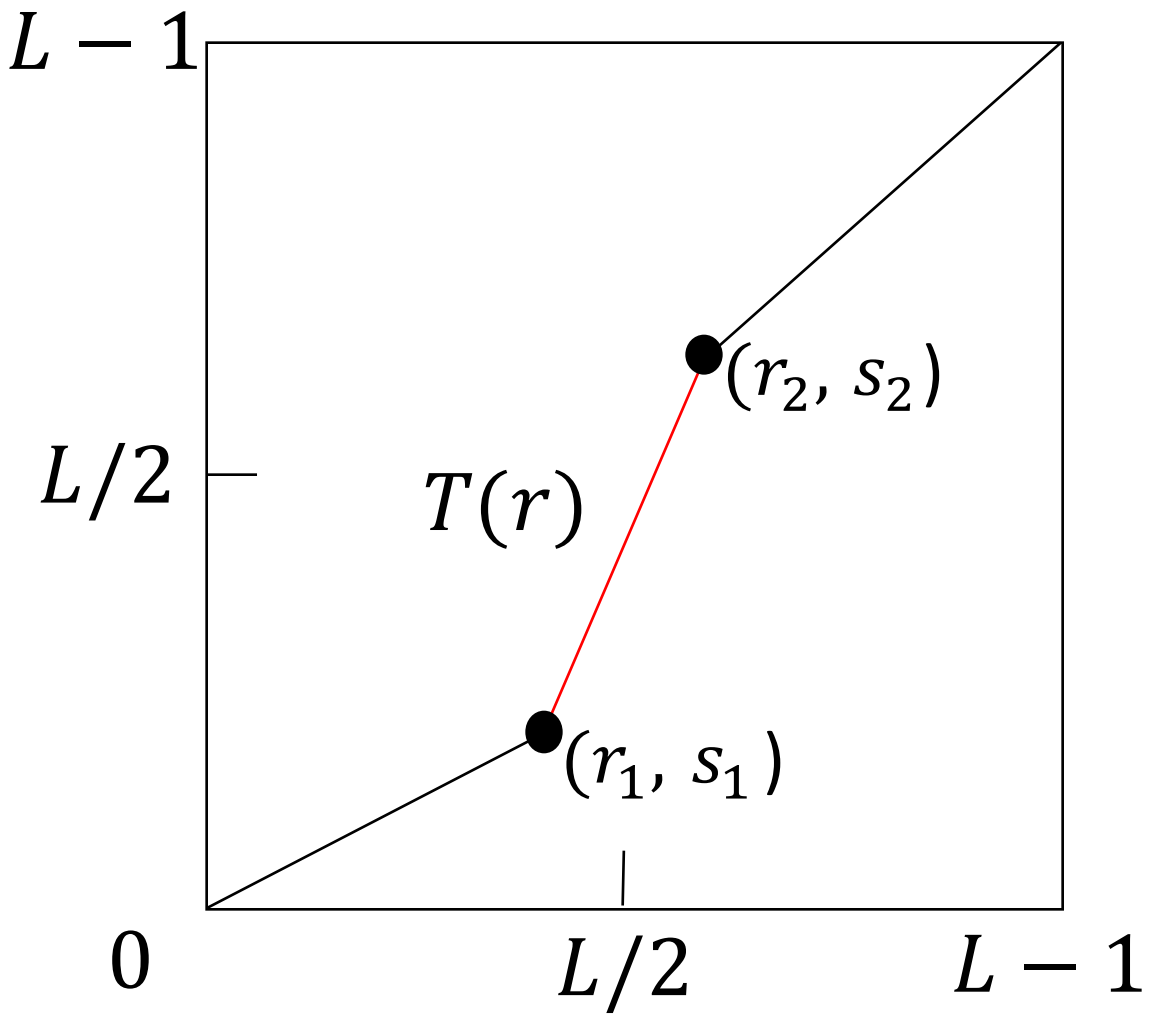
Contrast Stretching

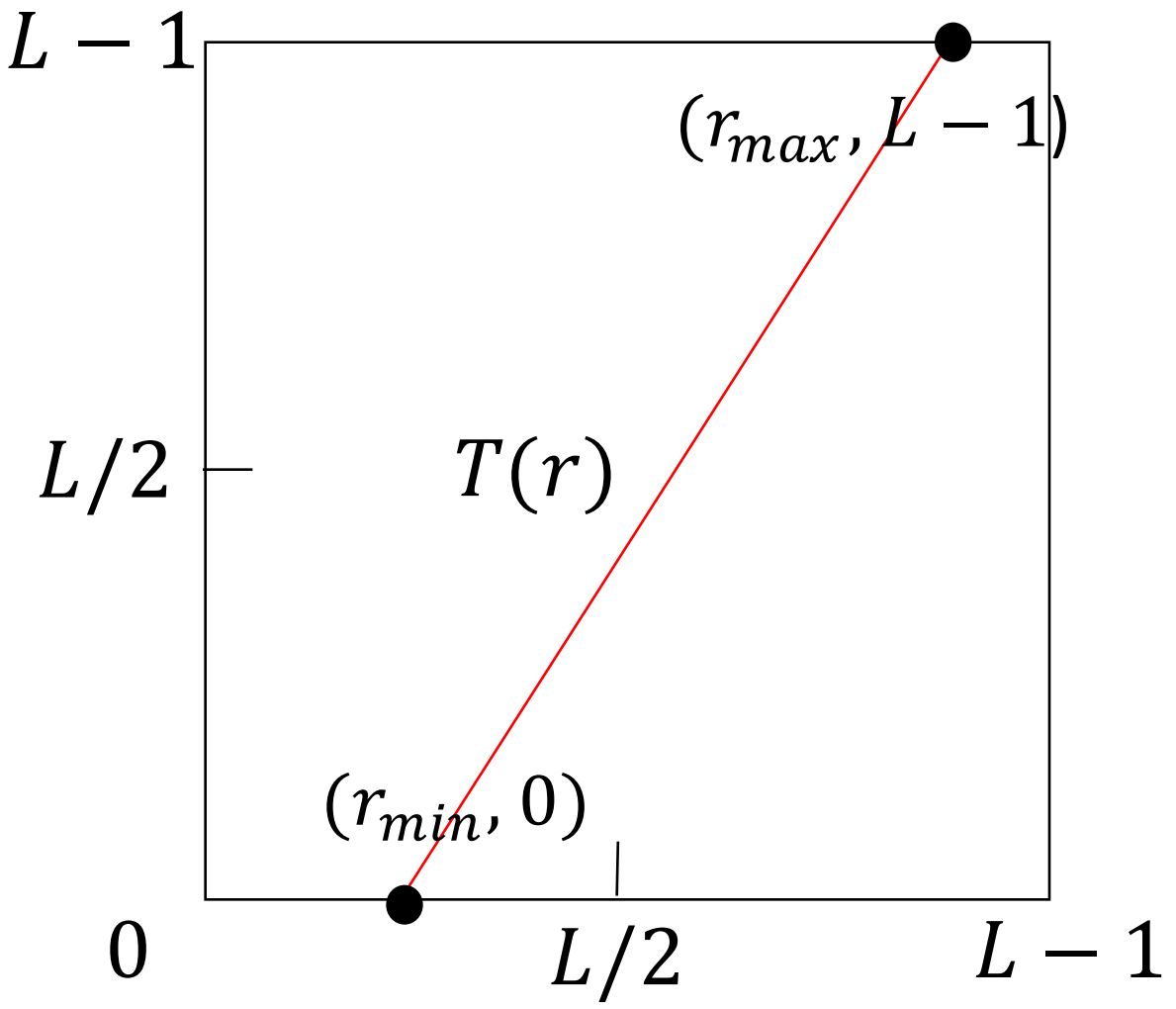


Contrast Stretching

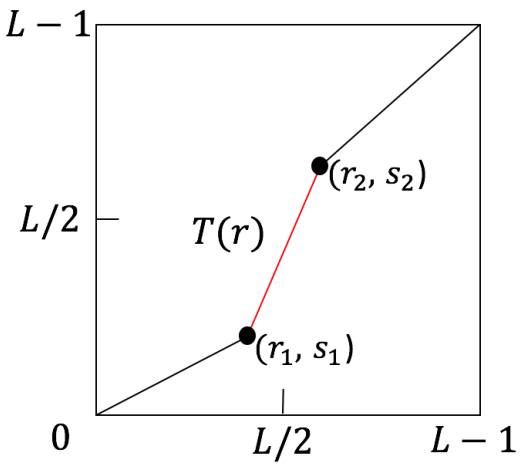


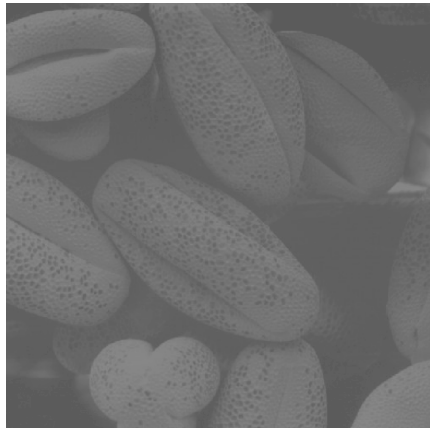
Contrast Stretching



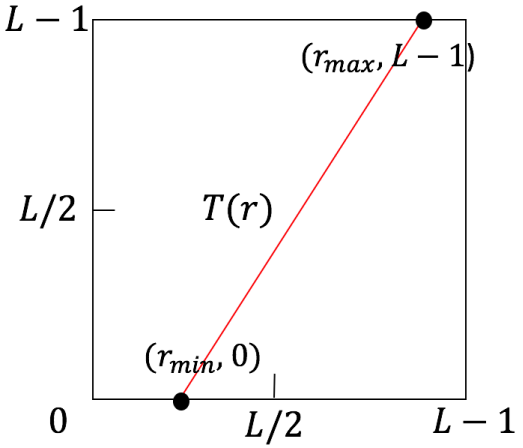


Contrast Stretching



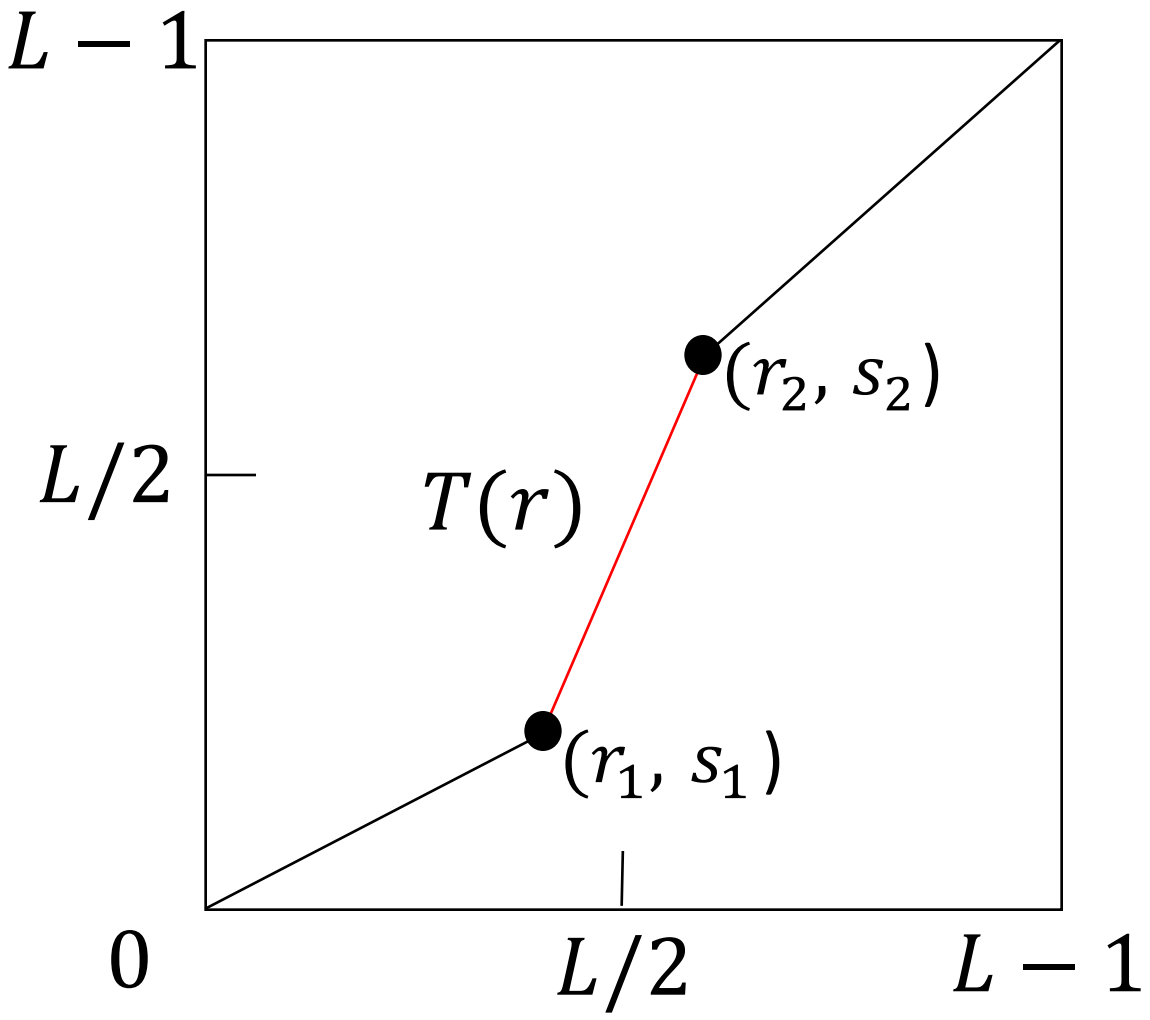


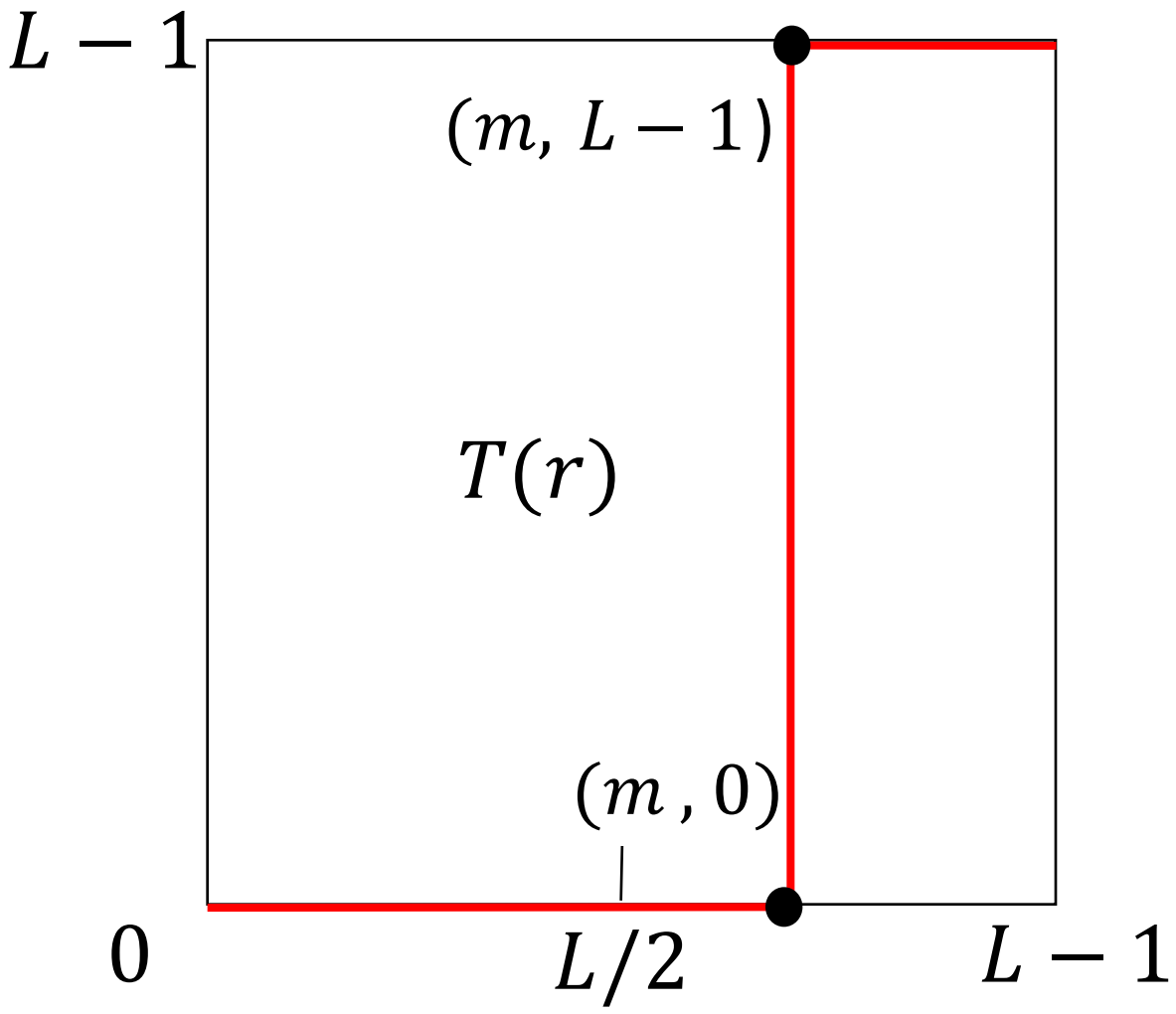
Original Image



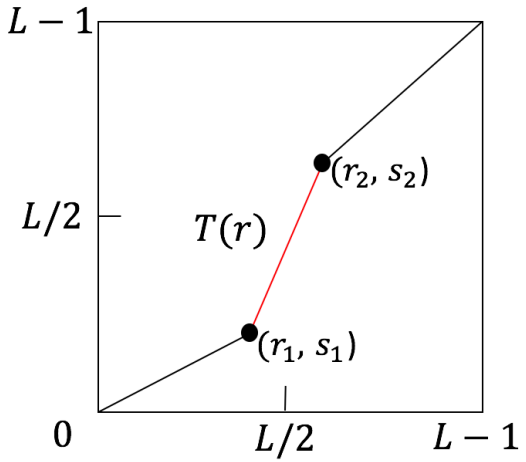
Result of Contrast Stretching

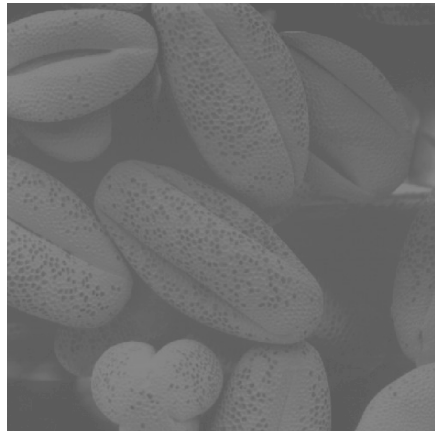
Contrast Stretching



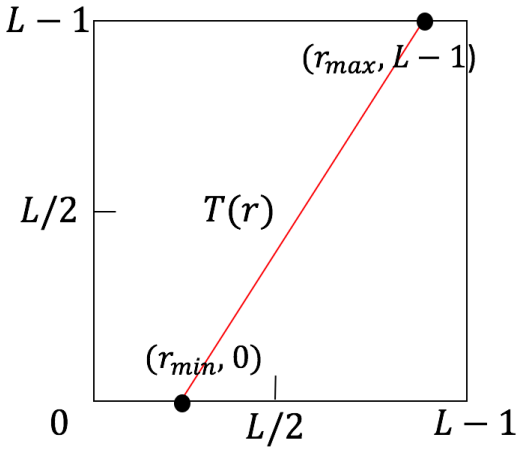


Contrast Stretching

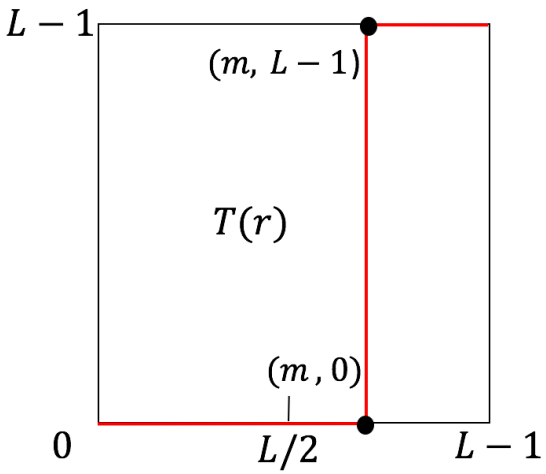




Original Image



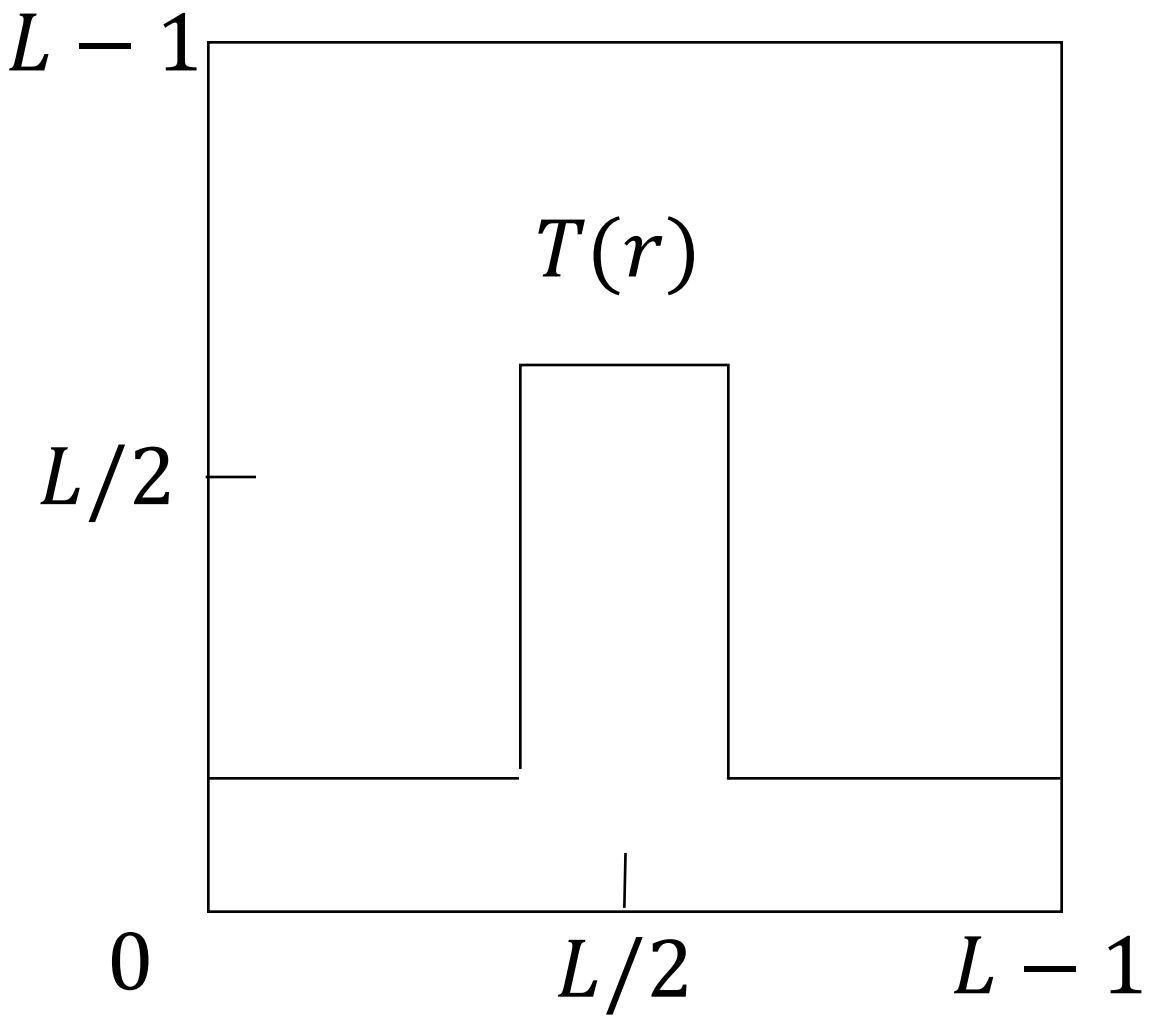
Result of Contrast Stretching



Result of Contrast Stretching

Intensity-level Slicing

Intensity-level Slicing



Intensity-level Slicing

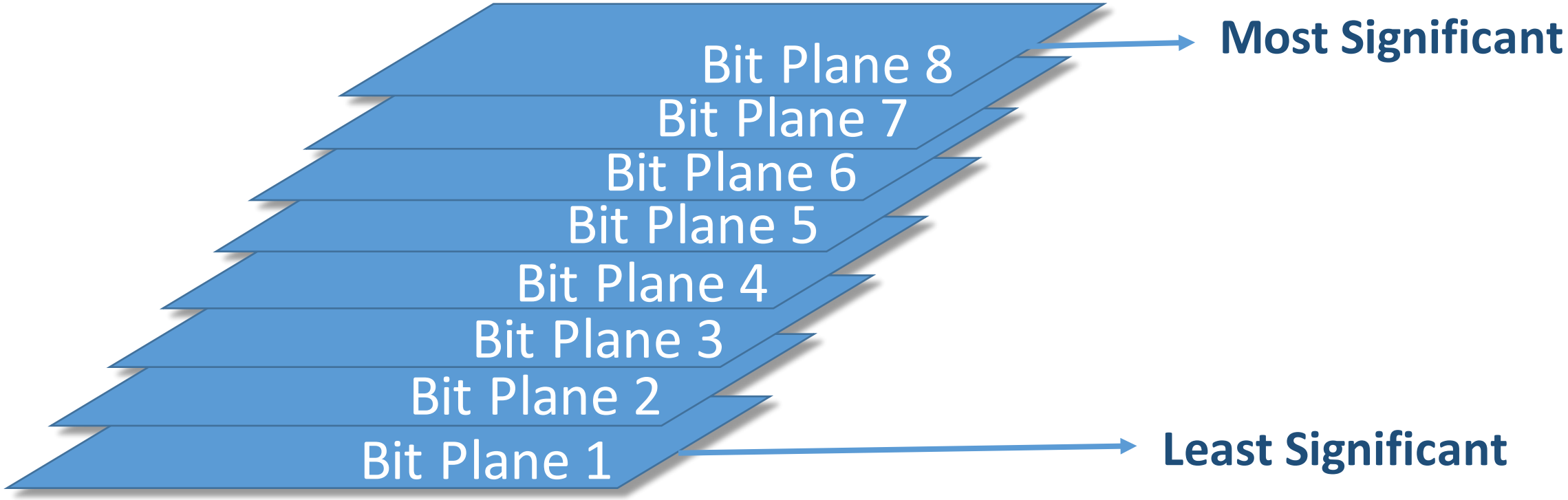
Original Image

Result of Intensity-level Slicing

Bit-plane Slicing

0 1 1 1 0 1 1 1

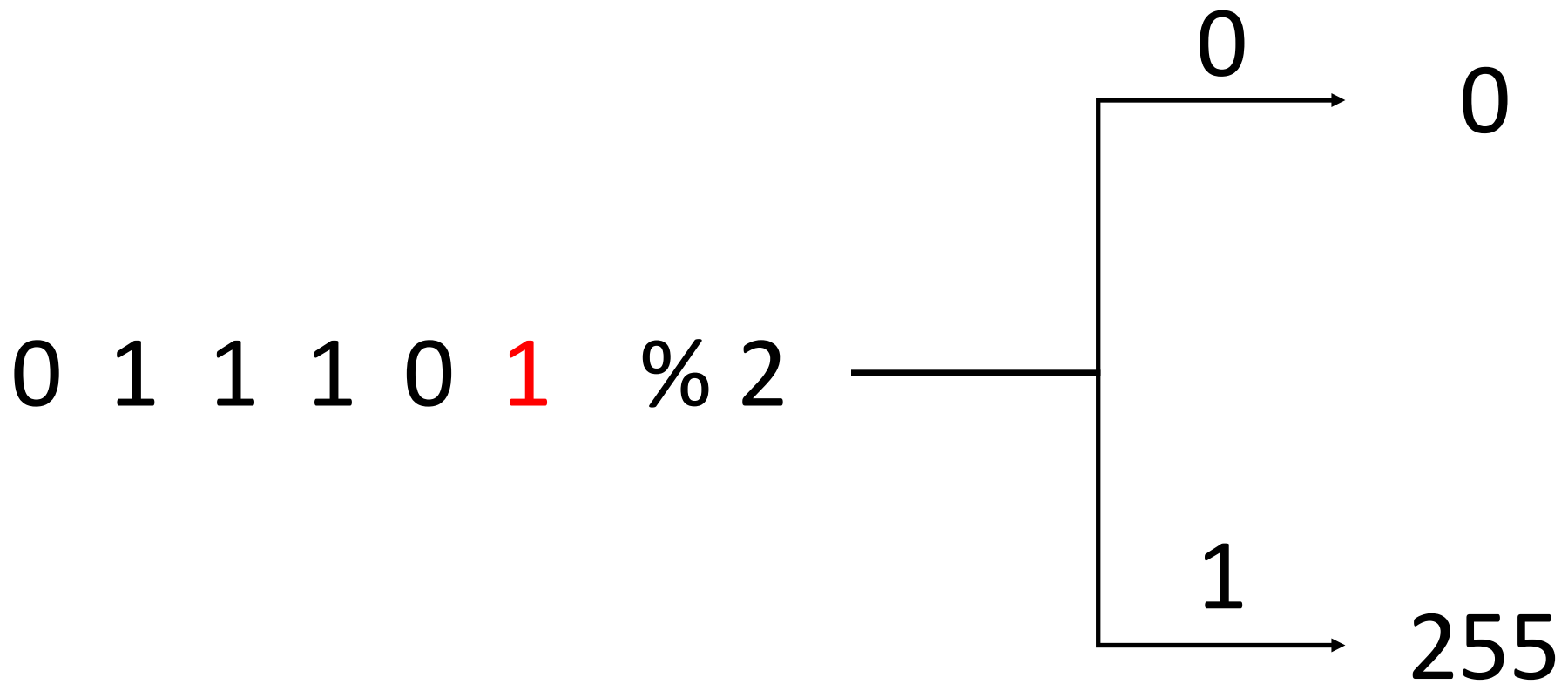
Bit-plane Slicing



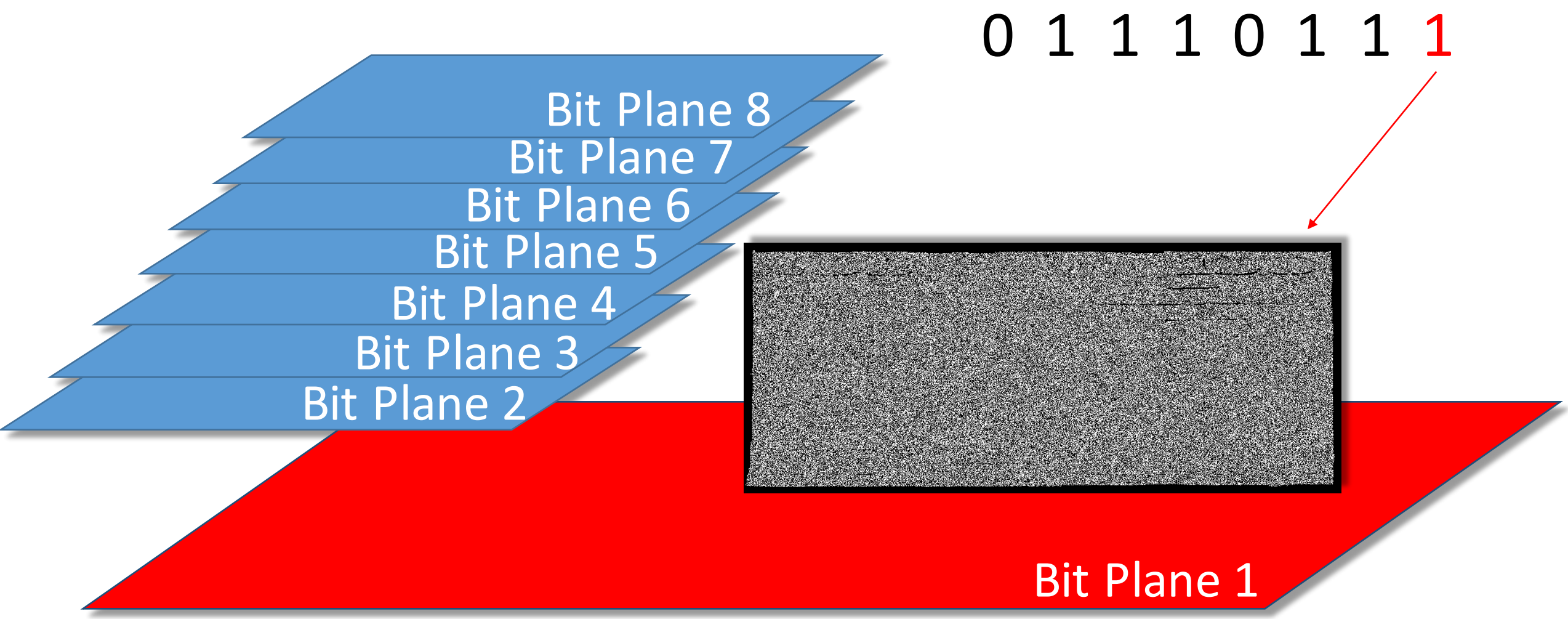
Intensity-level Slicing

0 1 1 1 0 1 1 1

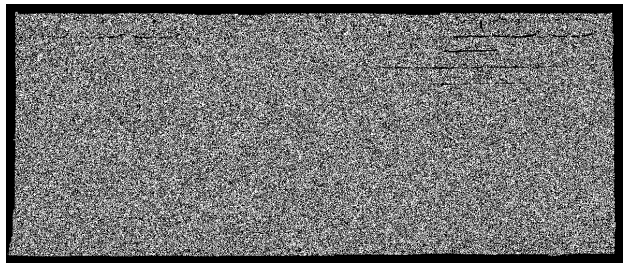
Intensity-level Slicing



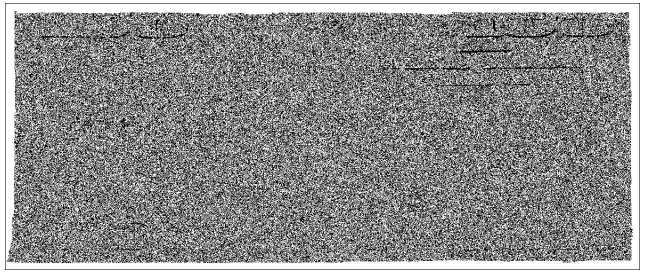
Bit-plane Slicing



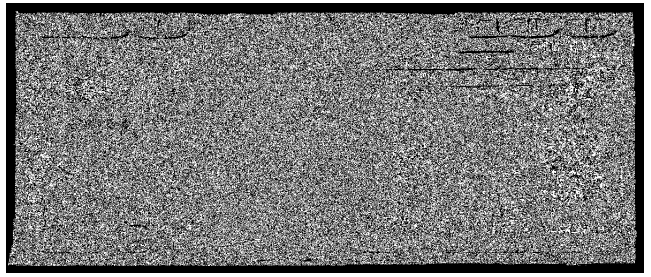
Bit-plane Slicing



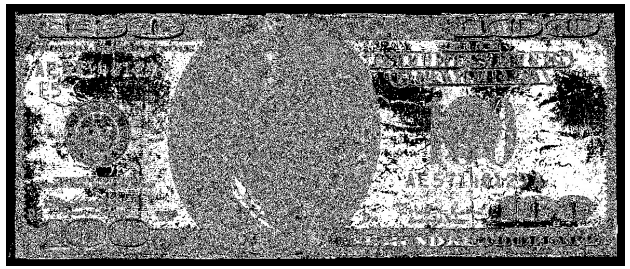
Bit Plane 1



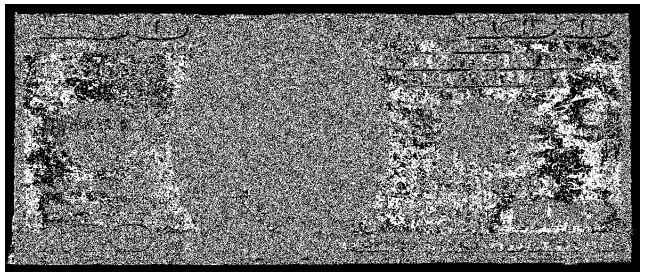
Bit Plane 2



Bit Plane 3



Bit Plane 4



Bit Plane 5

Bit Plane 6

Bit Plane 7

Bit Plane 8

Image Reconstructed

$$\sum_{n=8}^{k} s_n/(L-1)\times 2^{(n-1)}(k=7,6..)$$

Image Reconstructed

Bit Plane 7

$\times 2^6$

Bit Plane 8

$\times 2^7$

$\sum$

Bit Plane 8 + Bit Plane 7

Image Reconstructed

Bit Plane 8 + Bit Plane 7+ Bit Plane 6

Image Reconstructed

Bit Plane 8 + Bit Plane 7+ Bit Plane 6 + Bit Plane 5

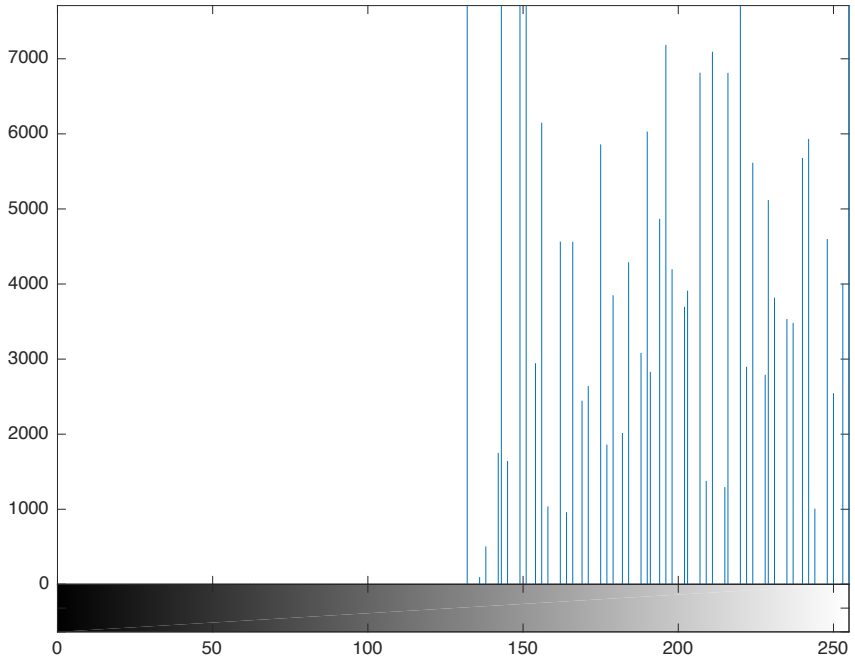
Image Reconstructed

Original Image

Image reconstructed using bit planes 8,7,6 and 5

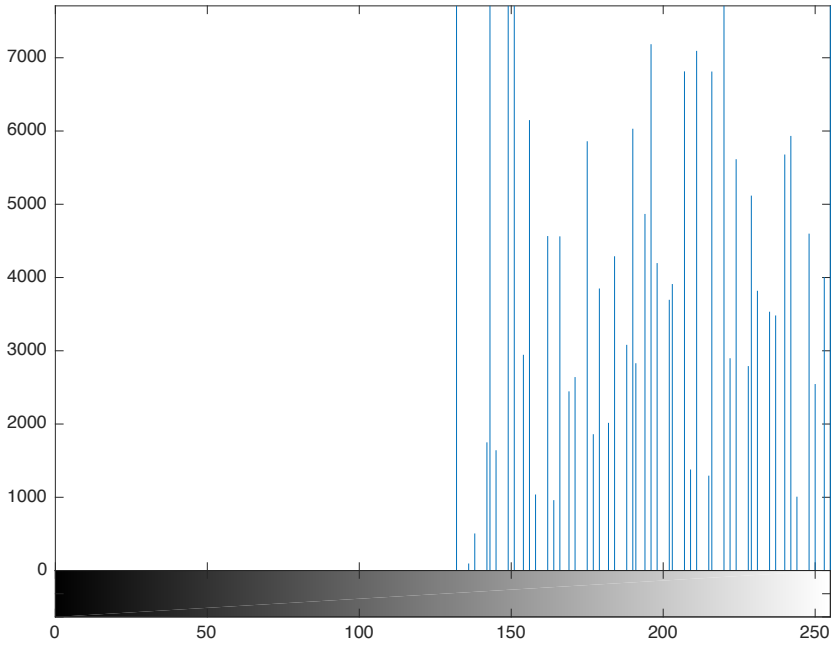
Histogram Equalization

Original Image

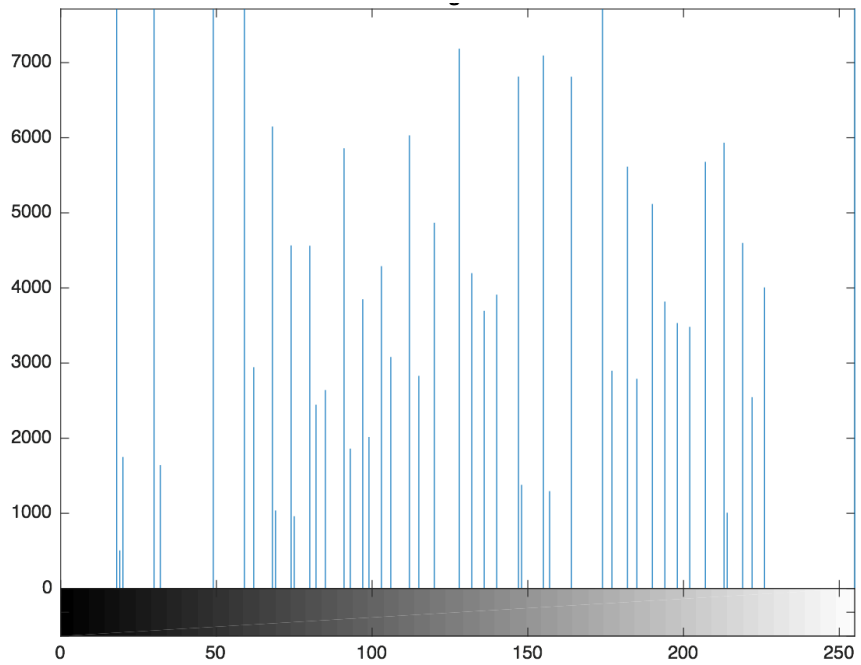


Histogram

Histogram Equalization



Original Histogram



Processed Histogram

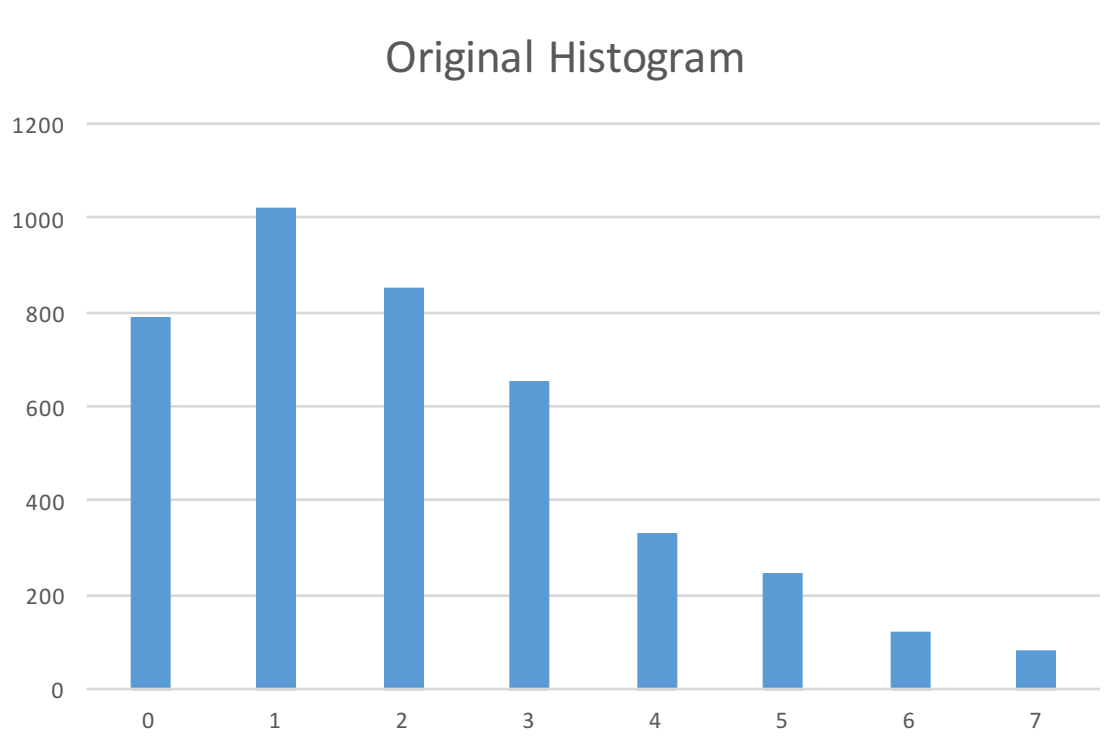
Histogram Equalization

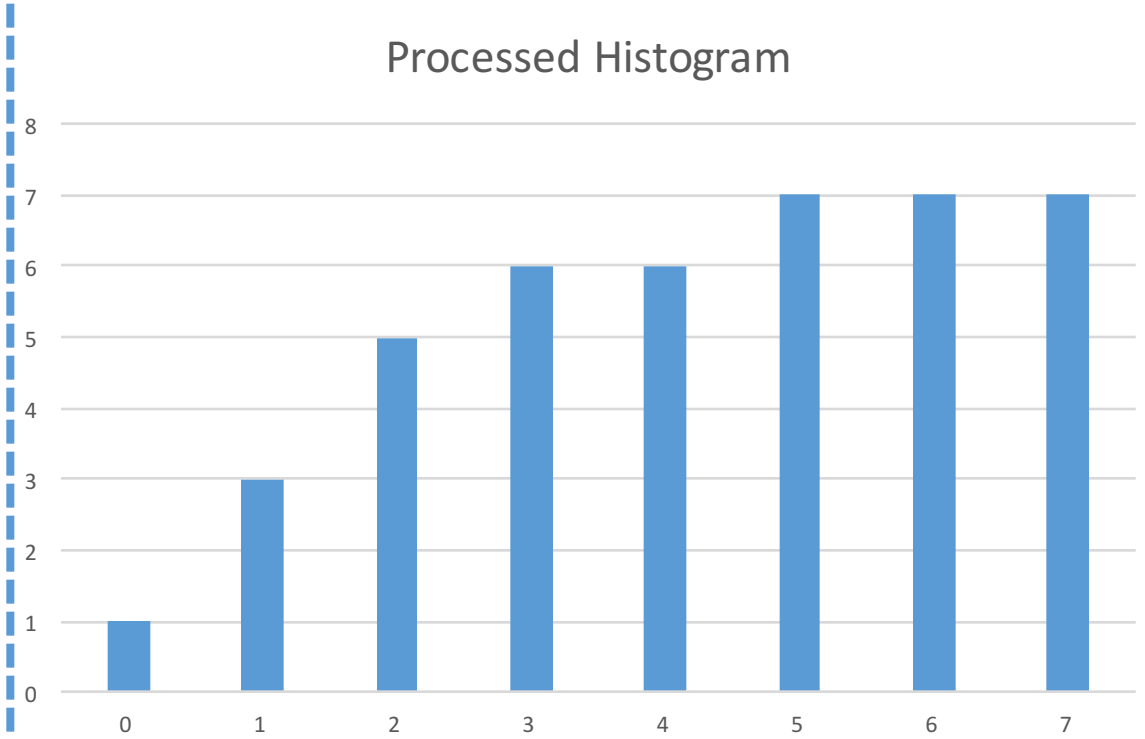
$$s_k = T(r_k) = (L-1)\sum_{j=0}^{k} p_r(r_j) = \frac{L-1}{MN}\sum_{j=0}^{k} n_j$$

Histogram Equalization

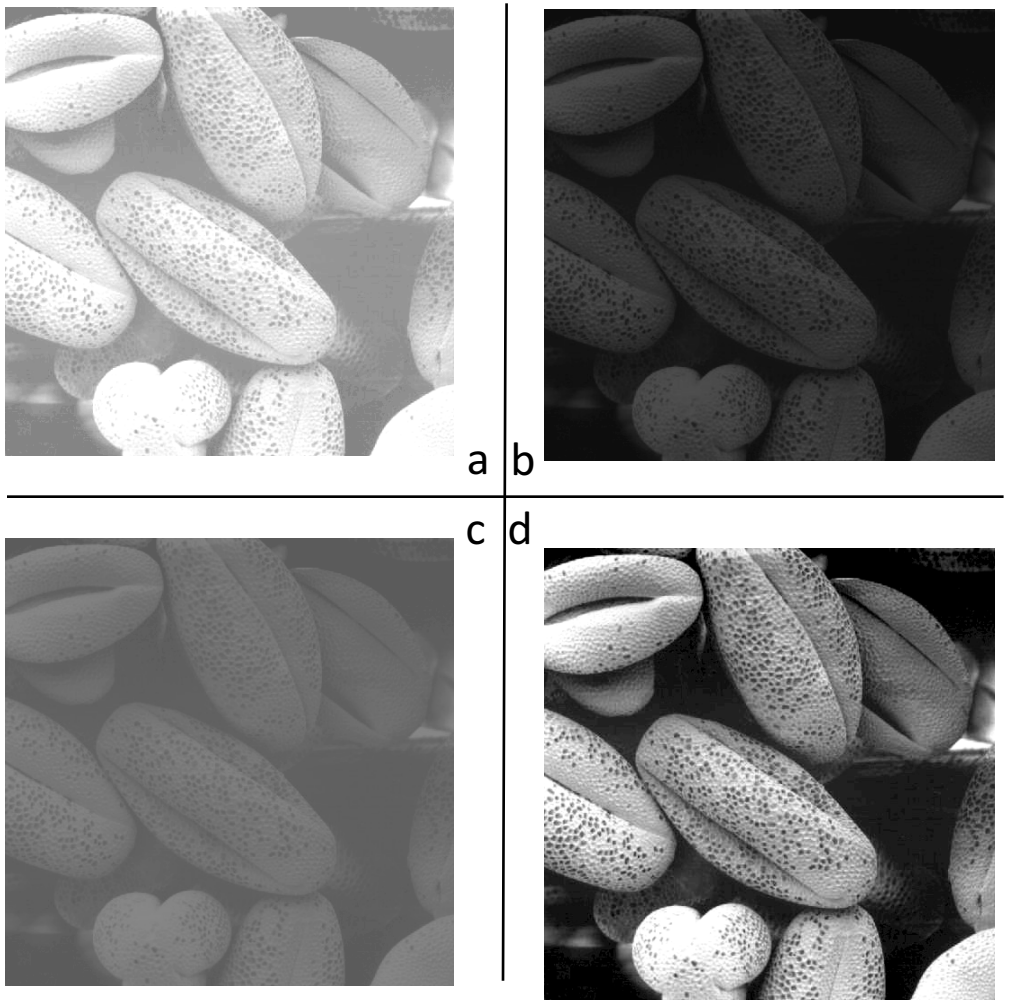
r_k	n_k	$p_r(r_k)$	$\sum p_r(r_k)$	s_k
$r_0 = 0$	790	0.19	0.19	1.33->1
$r_1 = 1$	1023	0.25	0.44	3.08->3
$r_2 = 2$	850	0.21	0.65	4.55->5
$r_3 = 3$	656	0.16	0.81	5.67->6
$r_4 = 4$	329	0.08	0.89	6.23->6
$r_5 = 5$	245	0.06	0.95	6.65->7
$r_6 = 6$	122	0.03	0.98	6.86->7
$r_7 = 7$	81	0.02	1.00	7.00->7

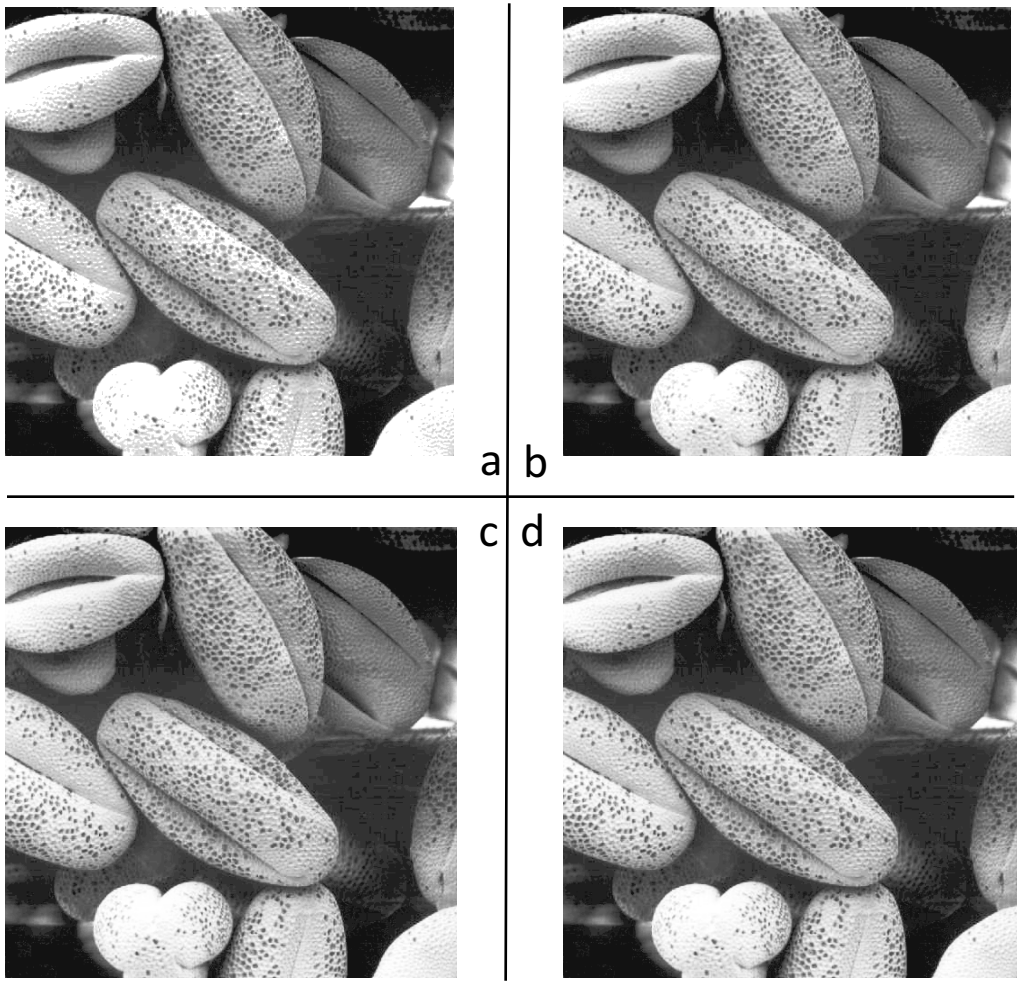
Histogram Equalization



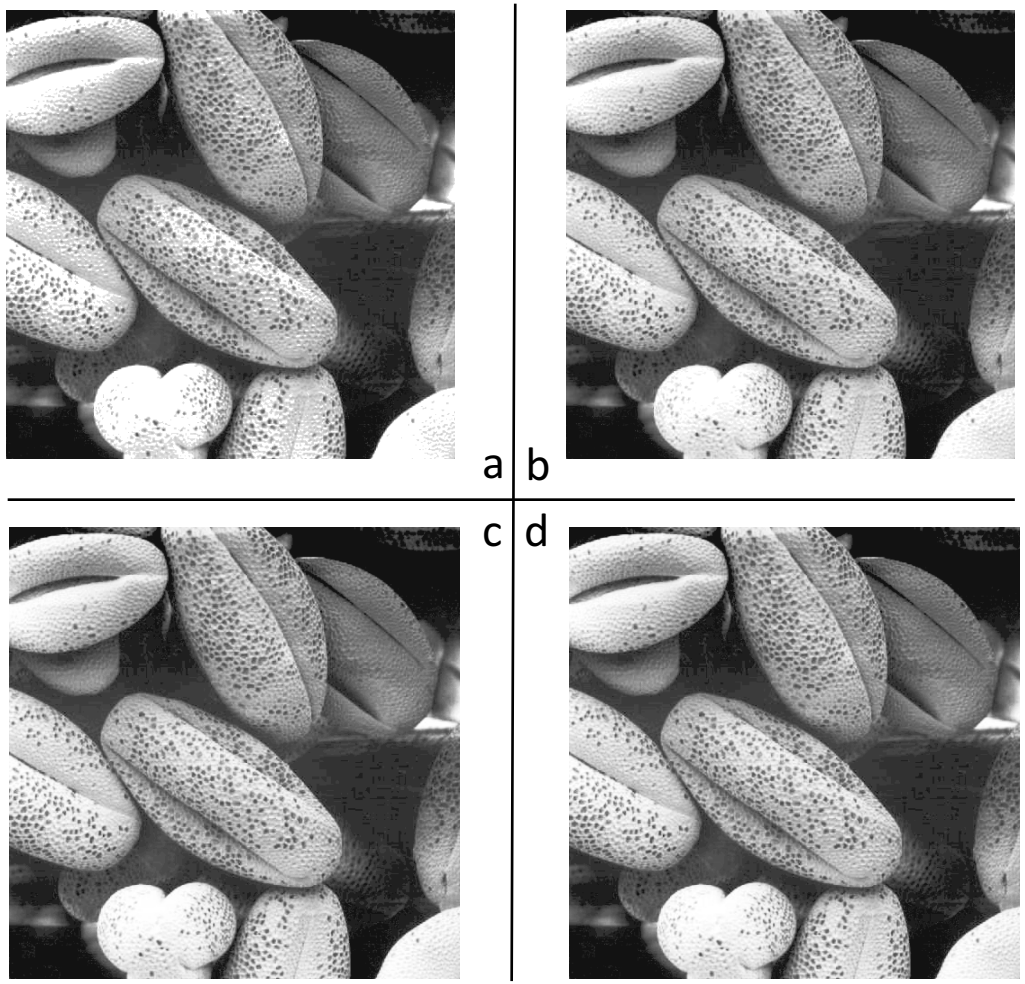


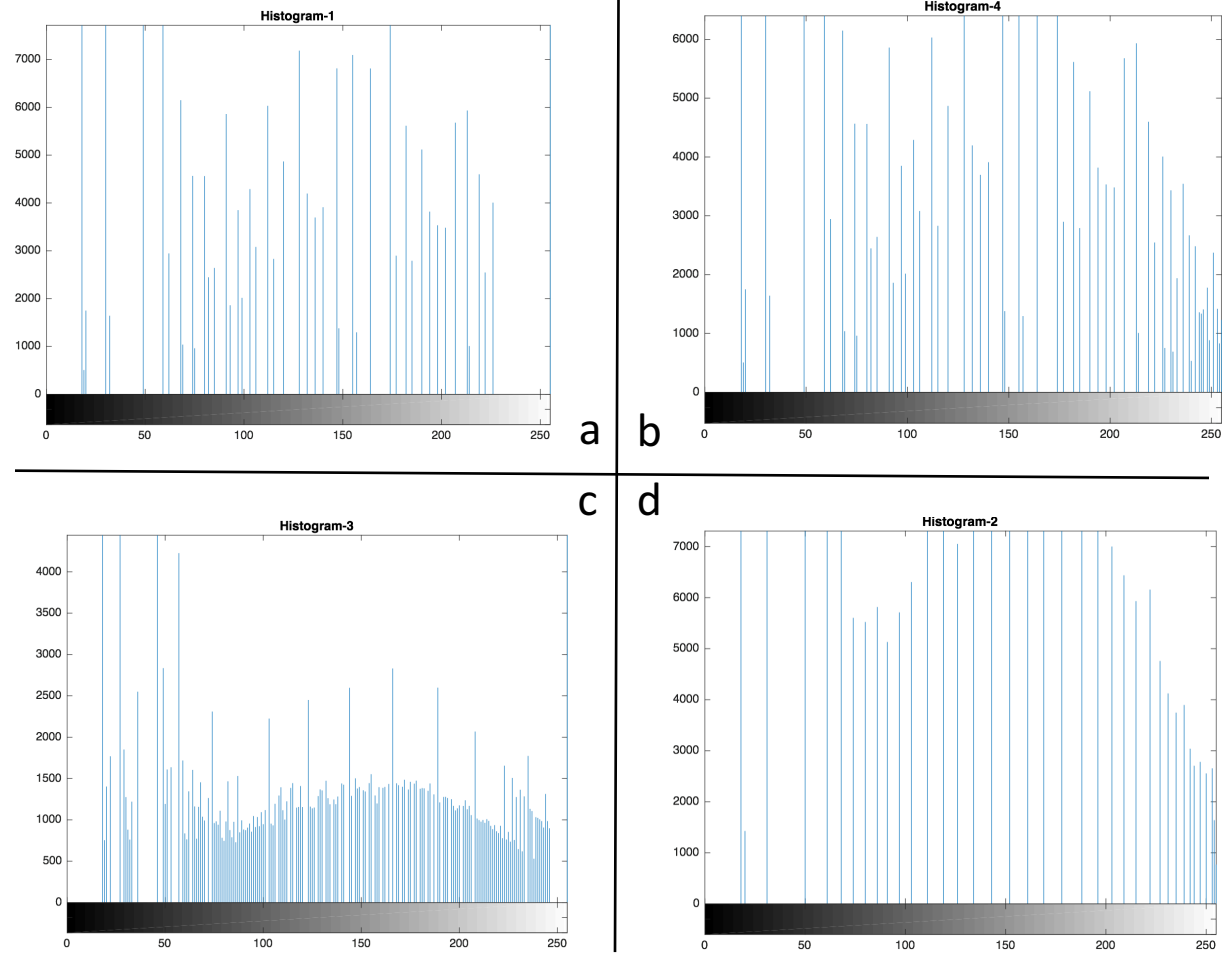
Histogram Equalization





Histogram Equalization



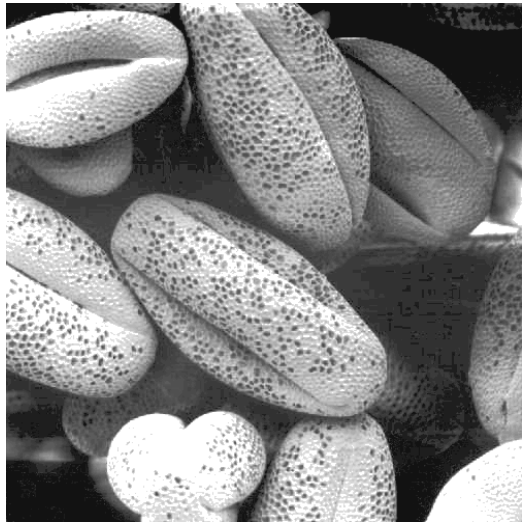


Contrast

Original Image

Gamma Transformation

Contrast stretching



Histogram Transformation

Thanks!