

Exercício 3: Transformações de intensidade

```
import numpy as np
import matplotlib.pyplot as plt
from skimage import data
from skimage.util import img_as_ubyte
import cv2

def plot(imagem, descricao):
    plt.imshow(imagem, cmap='gray')
    plt.title(descricao)
    plt.show()

    histograma = cv2.calcHist([imagem], [0], None, [256], [0,256])
    plt.plot(histograma)
    plt.title(f"Histograma da {descricao}")
    plt.show()

def negativo(imagem):
    imgNeg = 255 - imagem
    imgNeg = np.clip(imgNeg, 0, 255).astype(np.uint8)
    plot(imgNeg, "Transformação Negativa")
    return

def constante(imagem, k):
    imgCnst = imagem + k
    imgCnst = np.clip(imgCnst, 0, 255).astype(np.uint8)
    plot(imgCnst, f"Transformação com constante k = {k}")
    return

'''
 $s = T(r) = c \cdot \log(1+r)$ 
 $c = 255 / (\log(1 + \text{max\_input\_pixel\_value}))$ 
'''

def log(imagem):
    c = 255 / np.log1p(1 + 255)
    imgLog = c * (np.log1p(imagem + 1))
    imgLog = np.array(imgLog, dtype = np.uint8)
    plot(imgLog, "Transformação Log")
    return

def exp(imagem):
    c = 255 / np.log1p(1 + 255)
    imgExp = np.exp(imagem**1/c) - 1
    imgExp = np.array(imgExp, dtype = np.uint8)
    plot(imgExp, "Transformação Exp")
    return
```

```
#imagem 1
imagem = data.coins()
imagem = img_as_ubyte(imagem)
plot(imagem, "Imagem Original")

negativo(imagem)
constante(imagem, 50)
log(imagem)
exp(imagem)

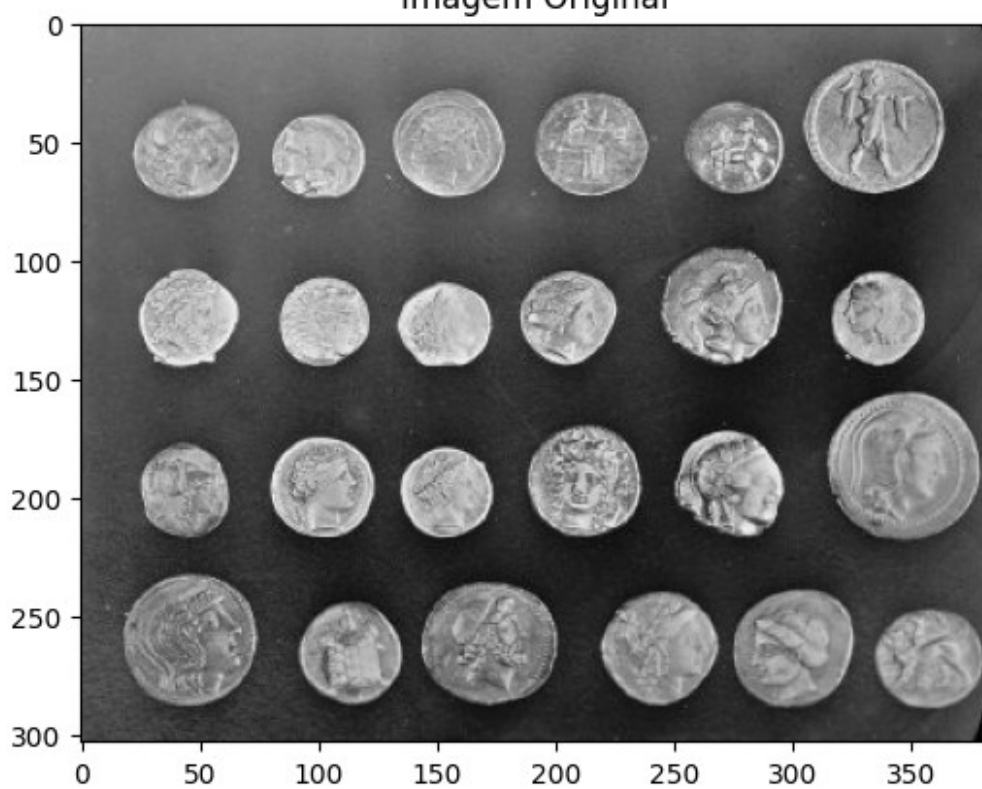
#imagem 2
imagem = data.camera()
imagem = img_as_ubyte(imagem)
plot(imagem, "Imagem Original")

negativo(imagem)
constante(imagem, 100)
log(imagem)
exp(imagem)

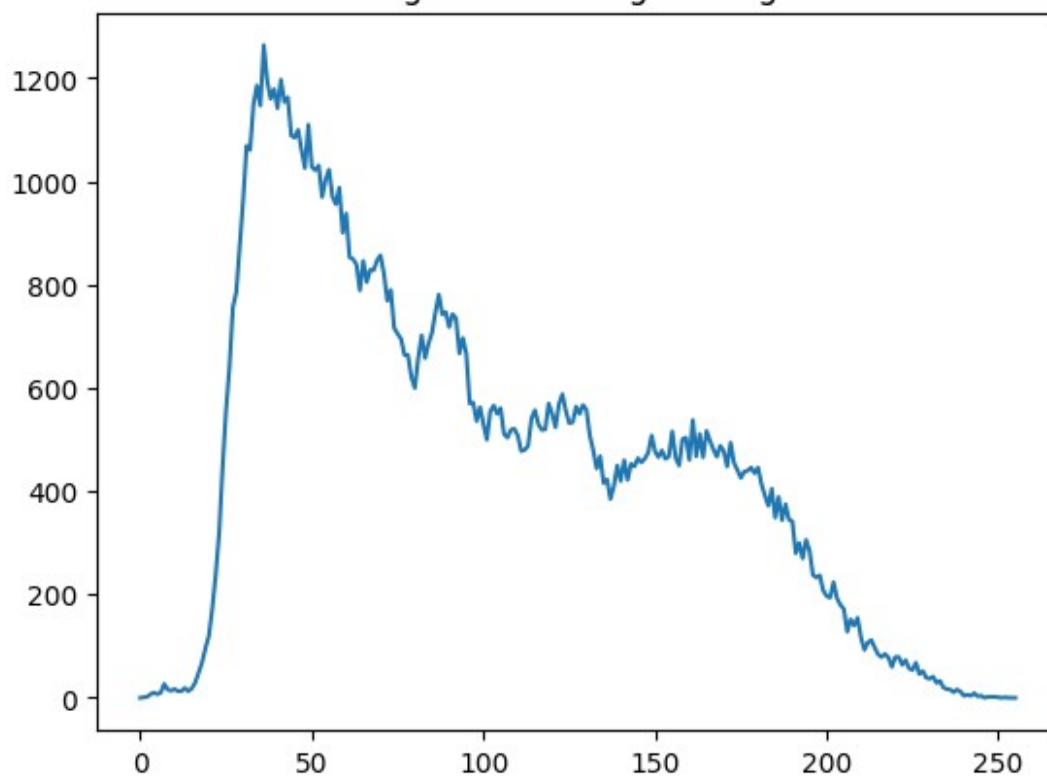
#imagem 3
imagem = data.moon()
imagem = img_as_ubyte(imagem)
plot(imagem, "Imagem Original")

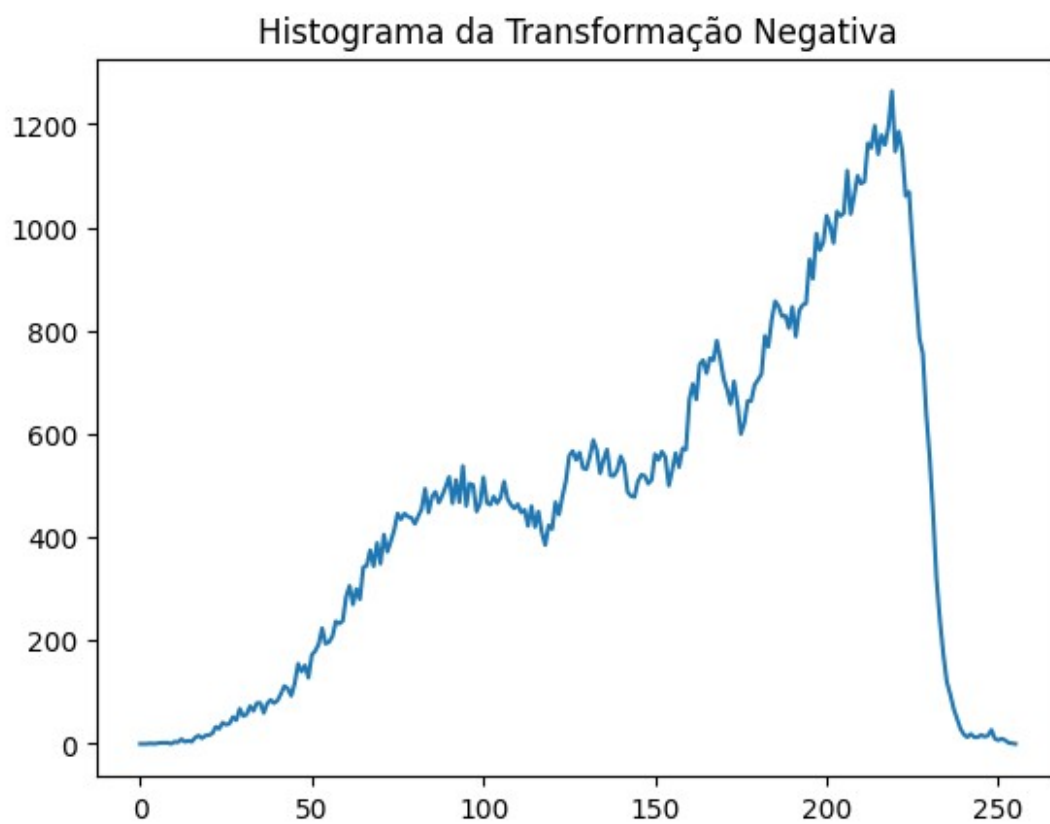
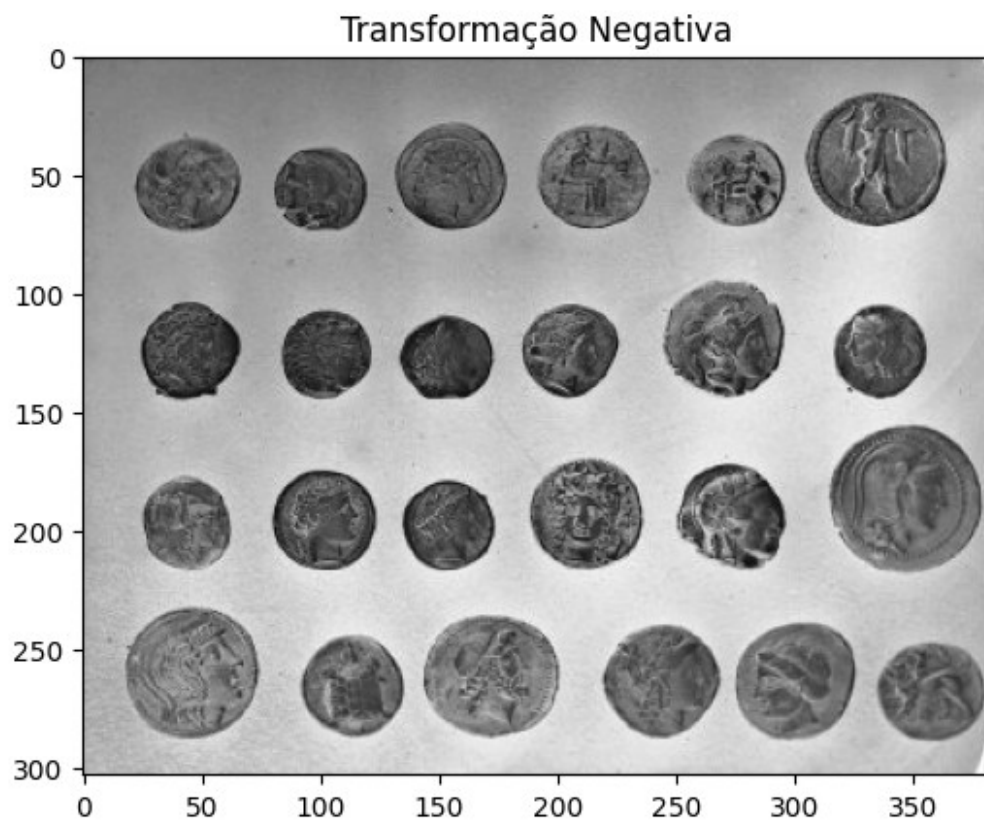
negativo(imagem)
constante(imagem, -50)
log(imagem)
exp(imagem)
```

Imagem Original

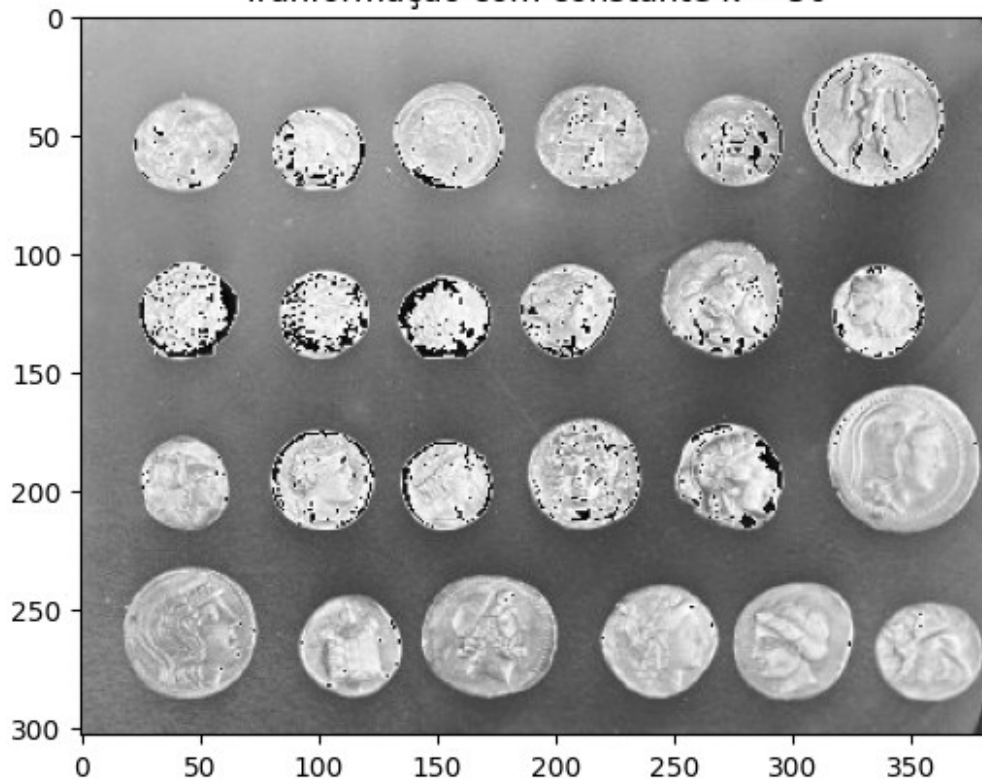


Histograma da Imagem Original

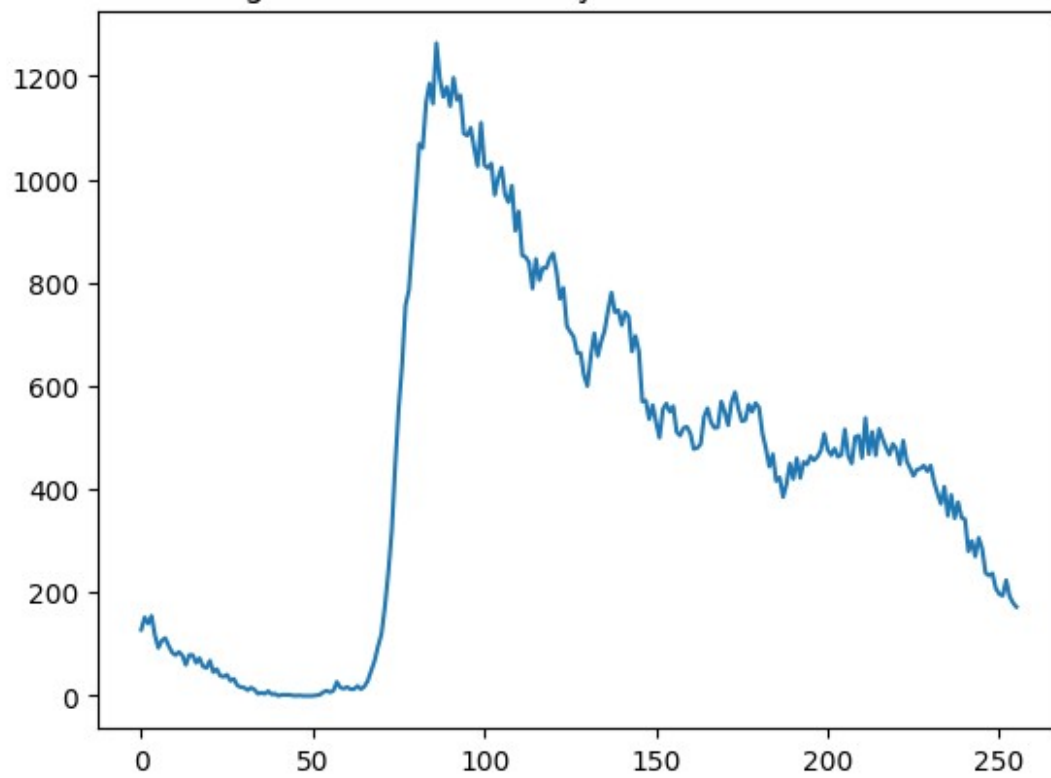


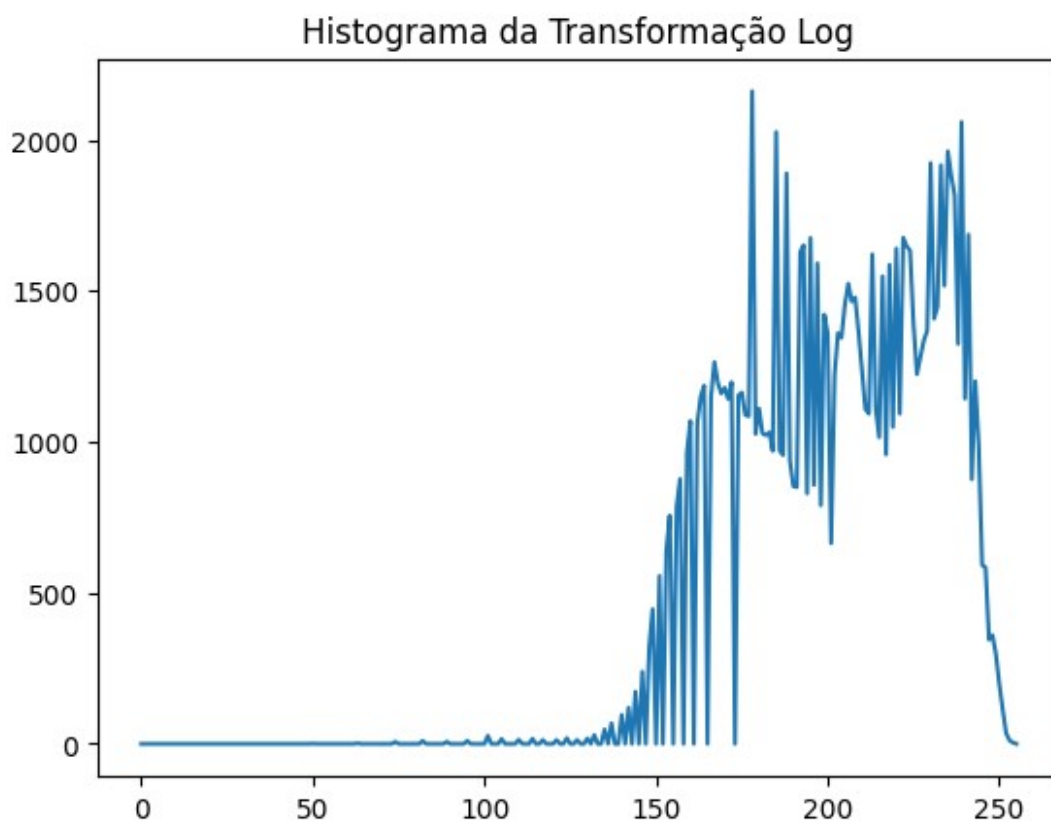
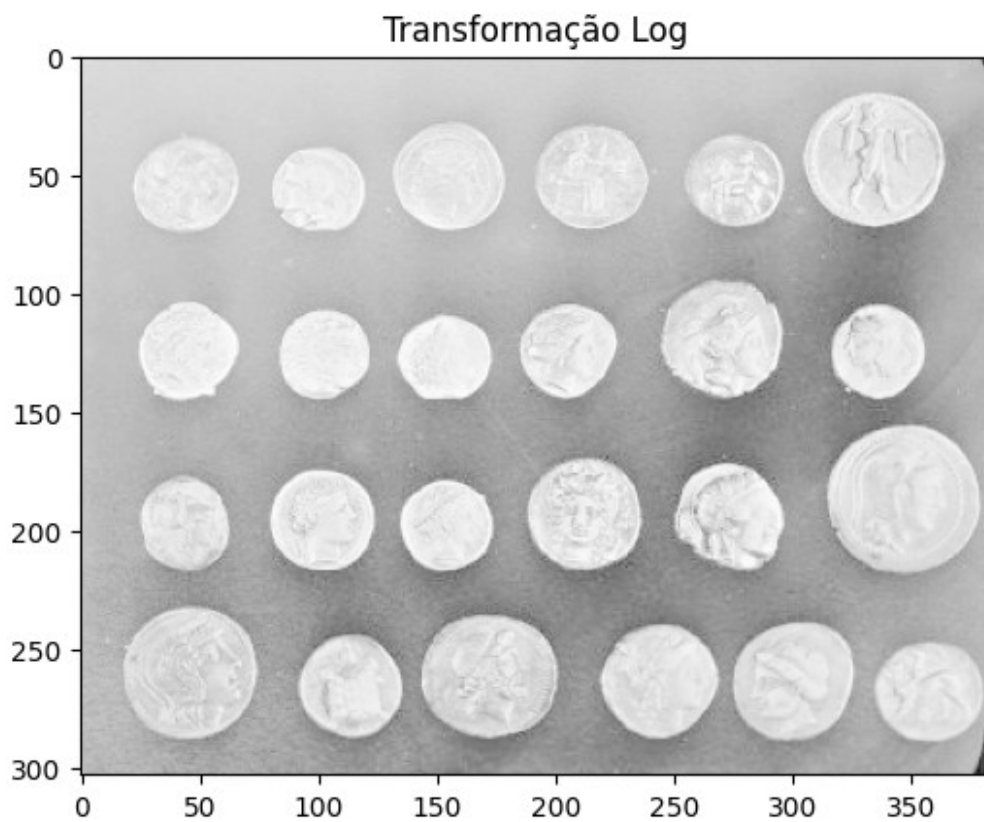


Tranformação com constante $k = 50$



Histograma da Tranformação com constante $k = 50$





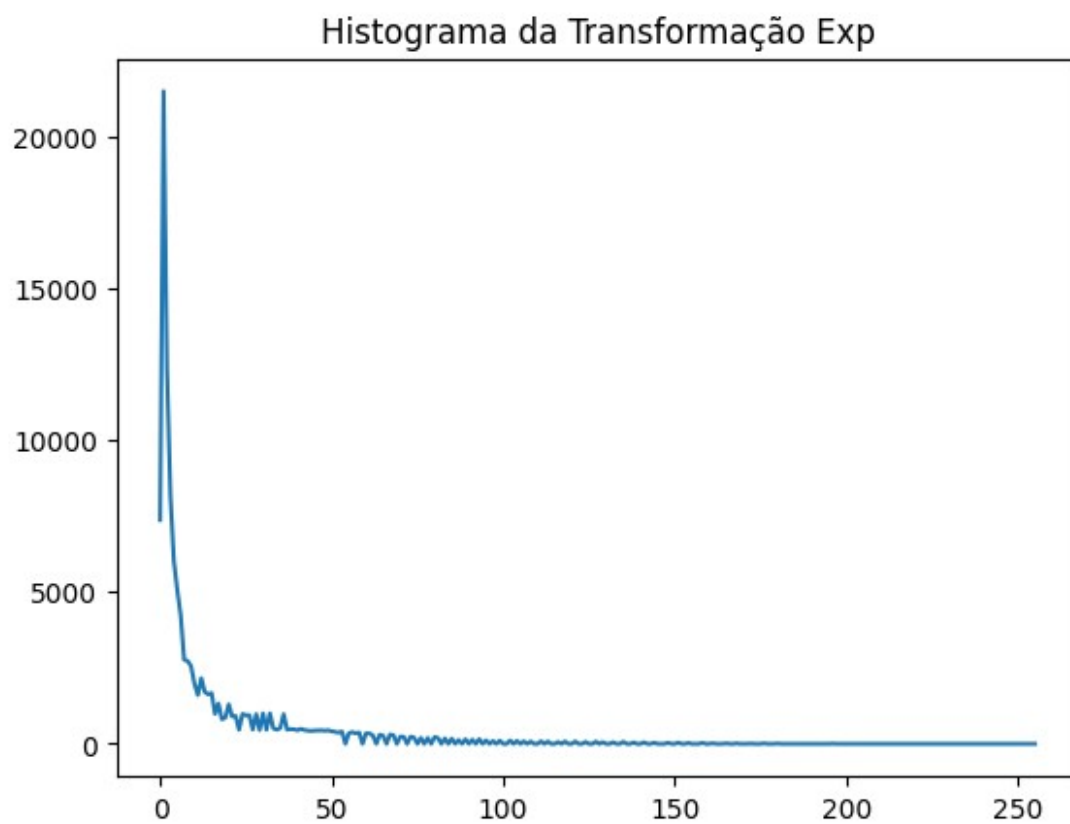
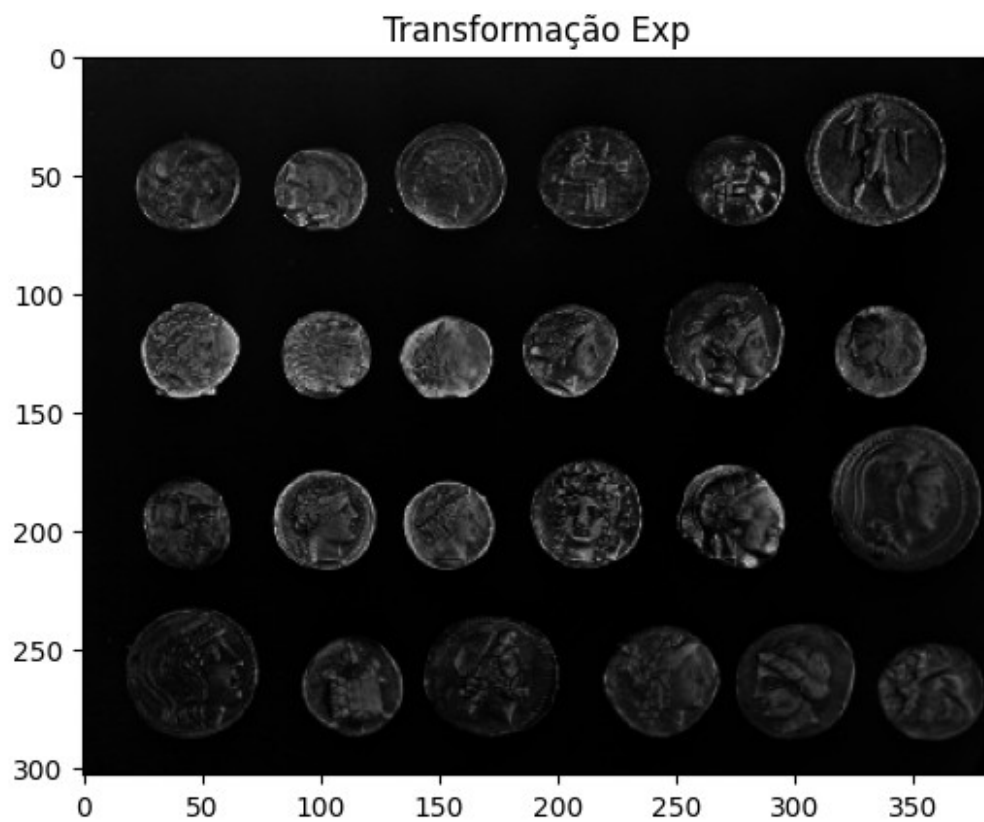
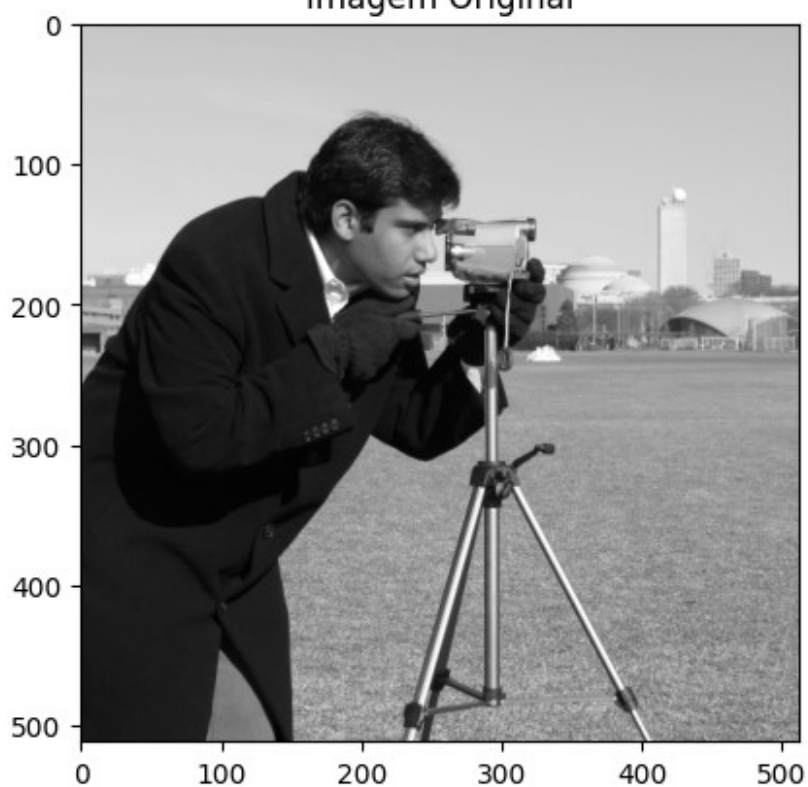
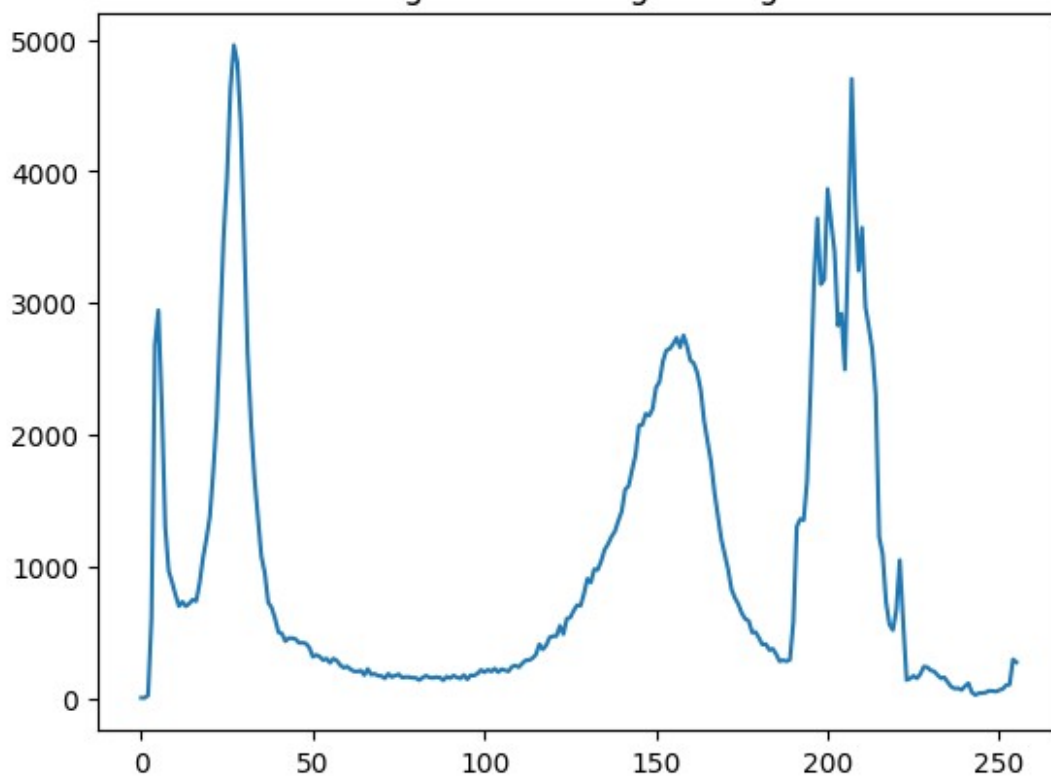


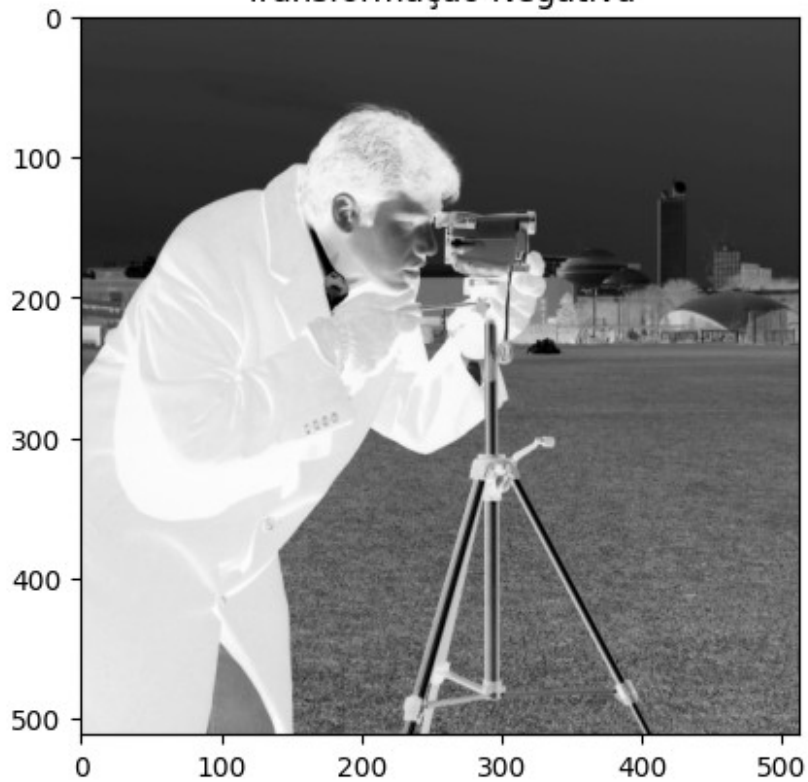
Imagem Original



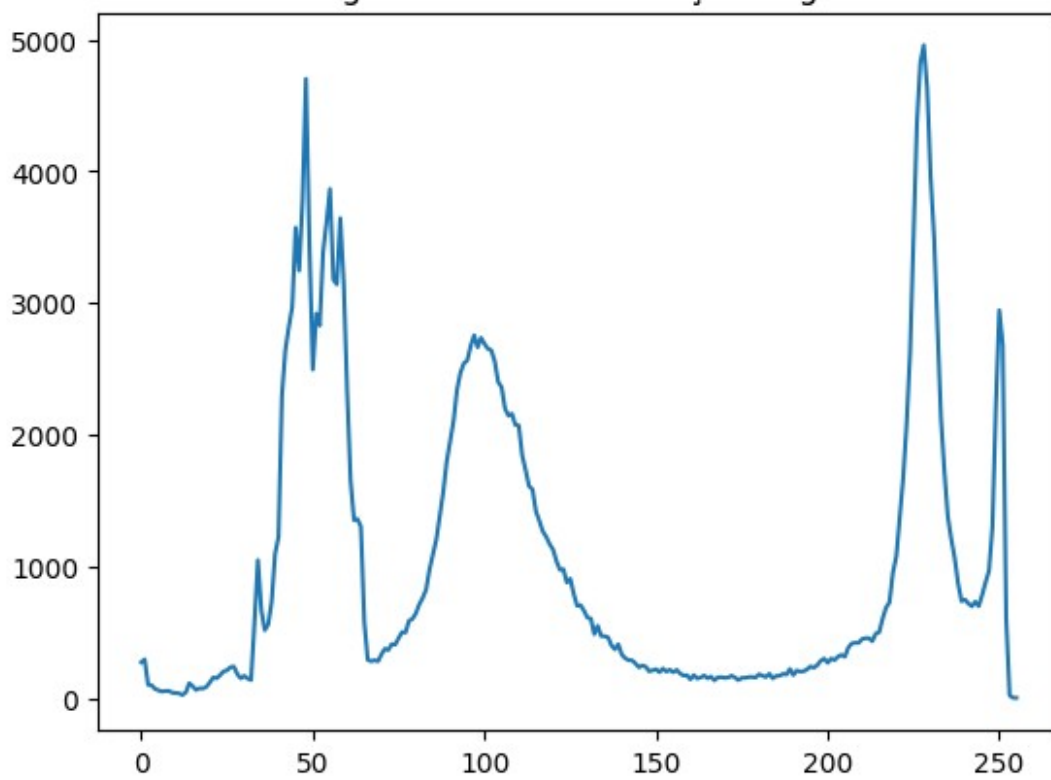
Histograma da Imagem Original



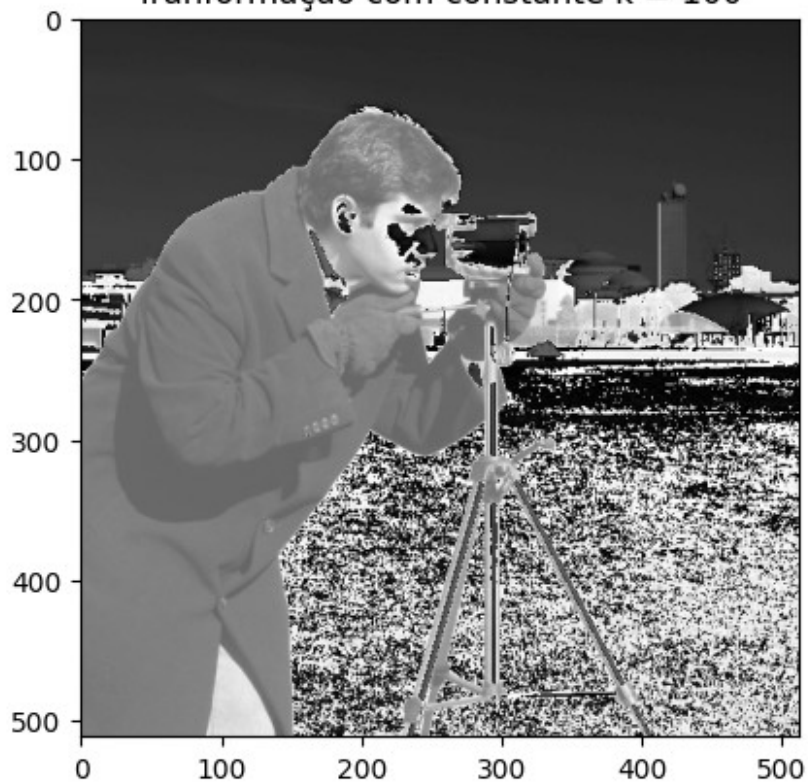
Transformação Negativa



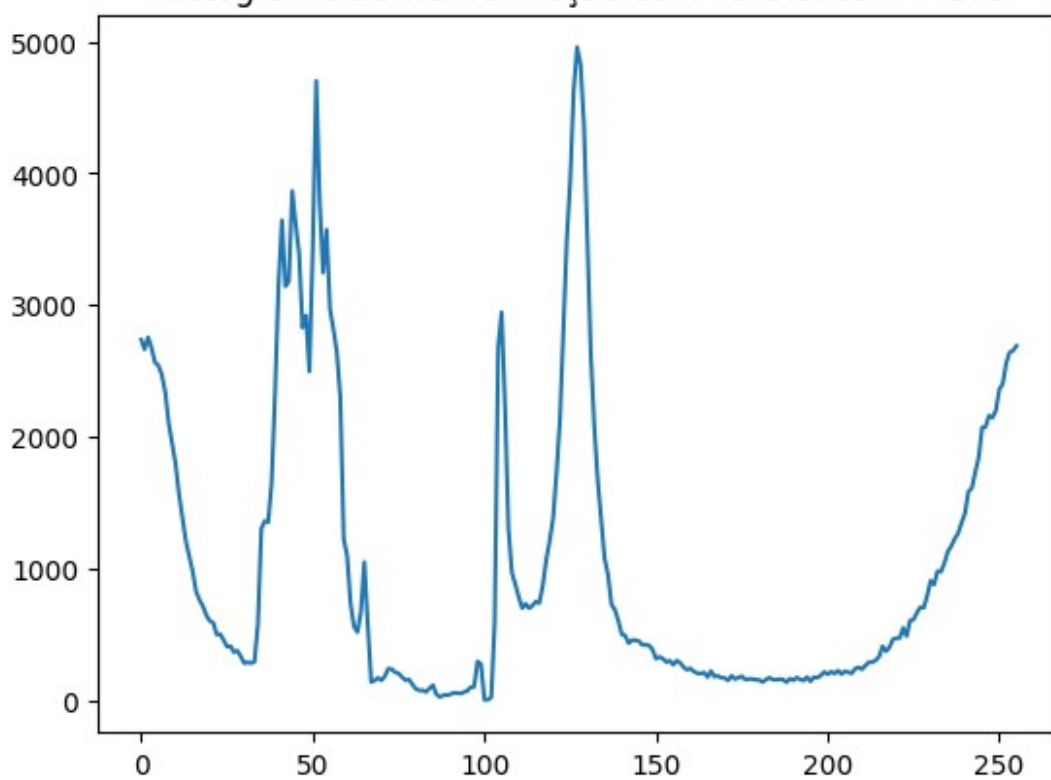
Histograma da Transformação Negativa



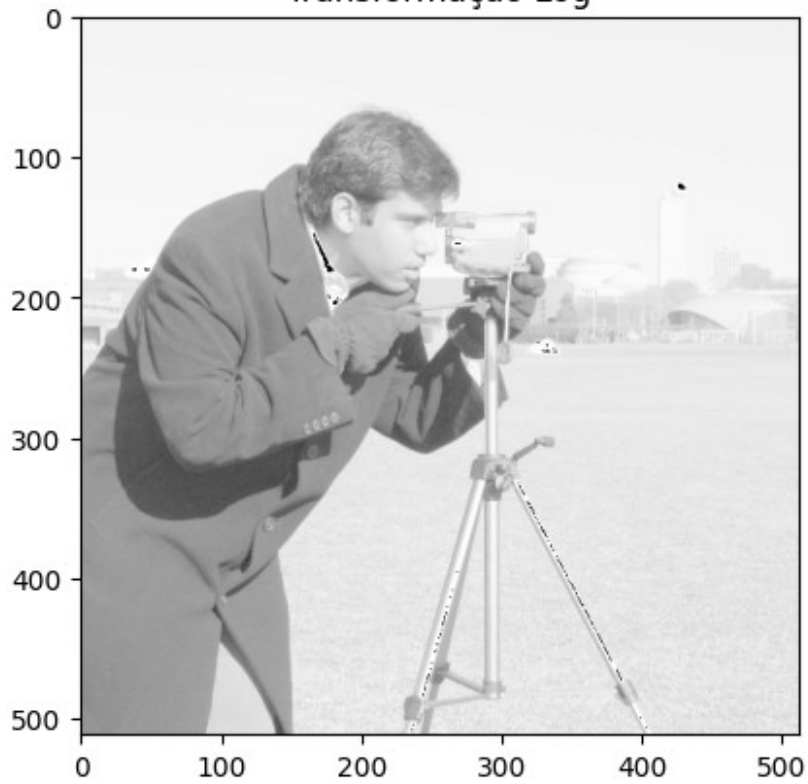
Tranformação com constante $k = 100$



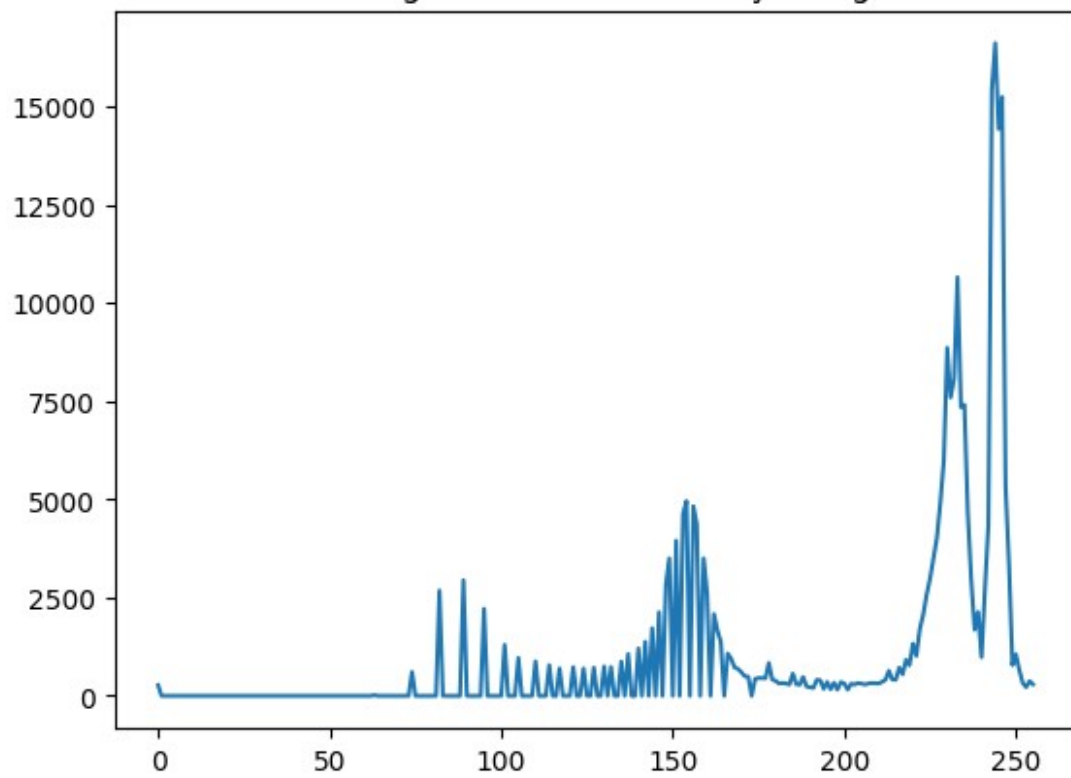
Histograma da Tranformação com constante $k = 100$



Transformação Log



Histograma da Transformação Log



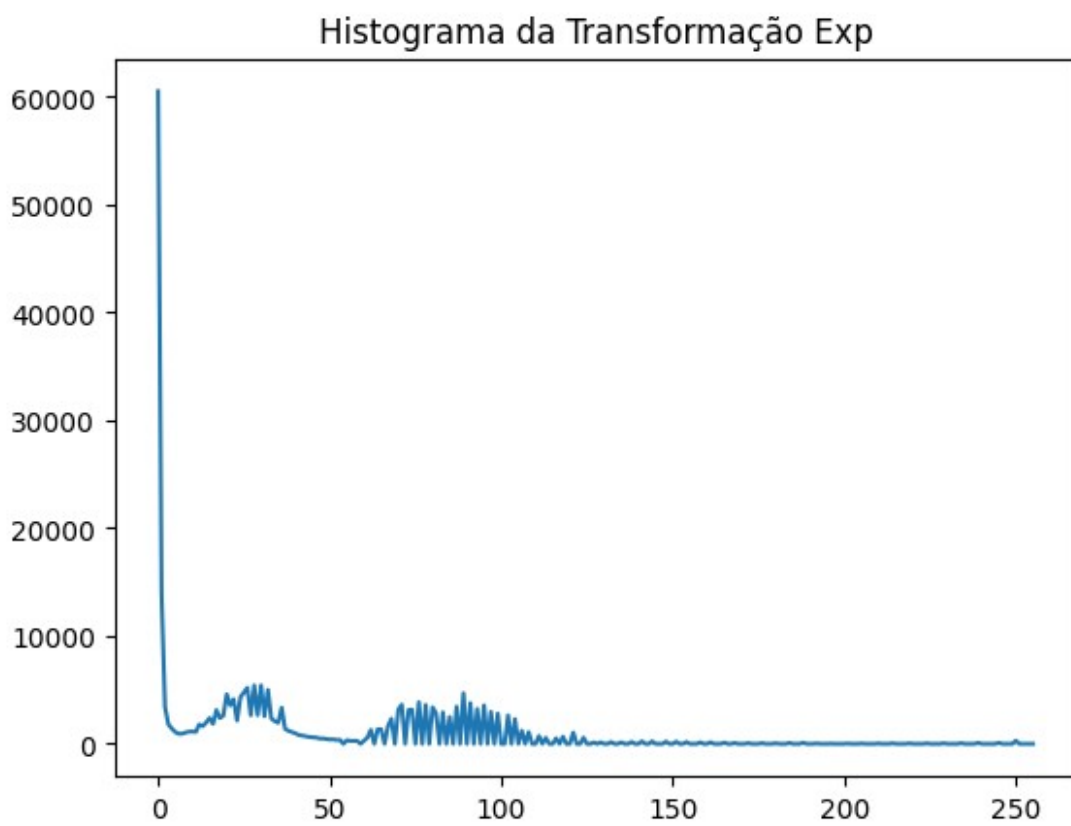
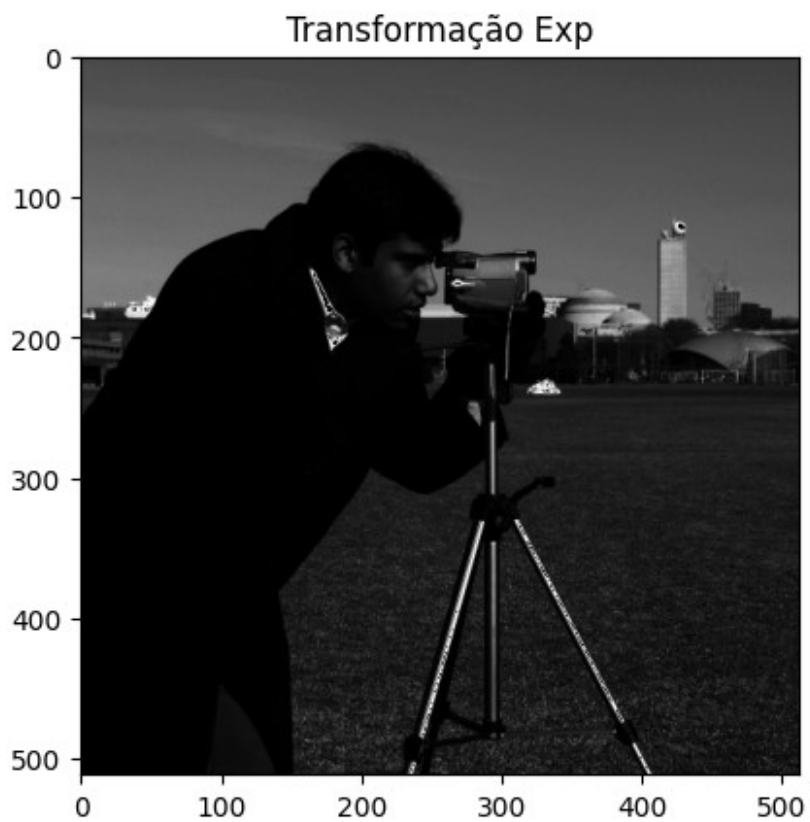
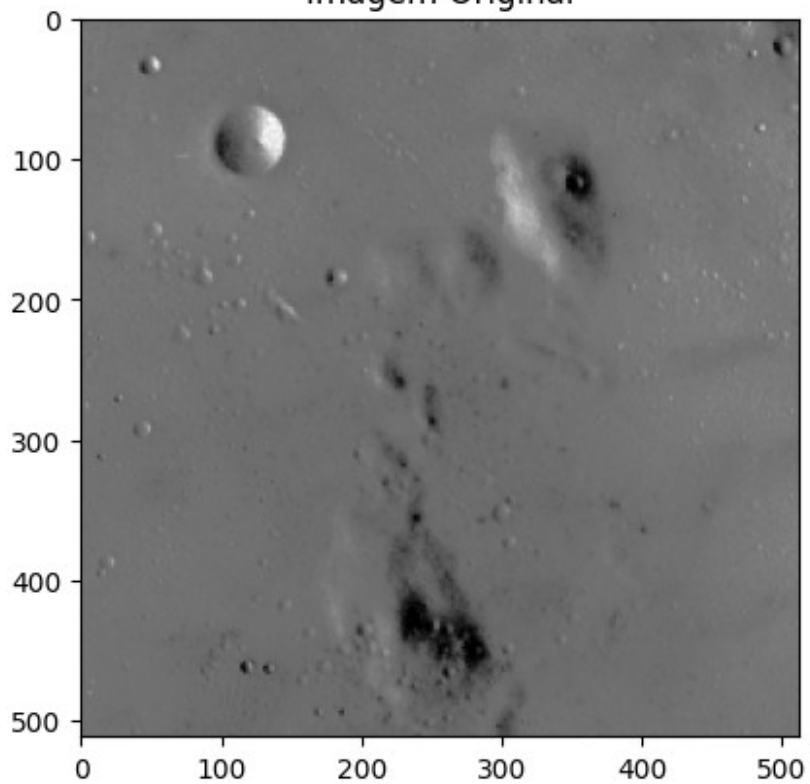
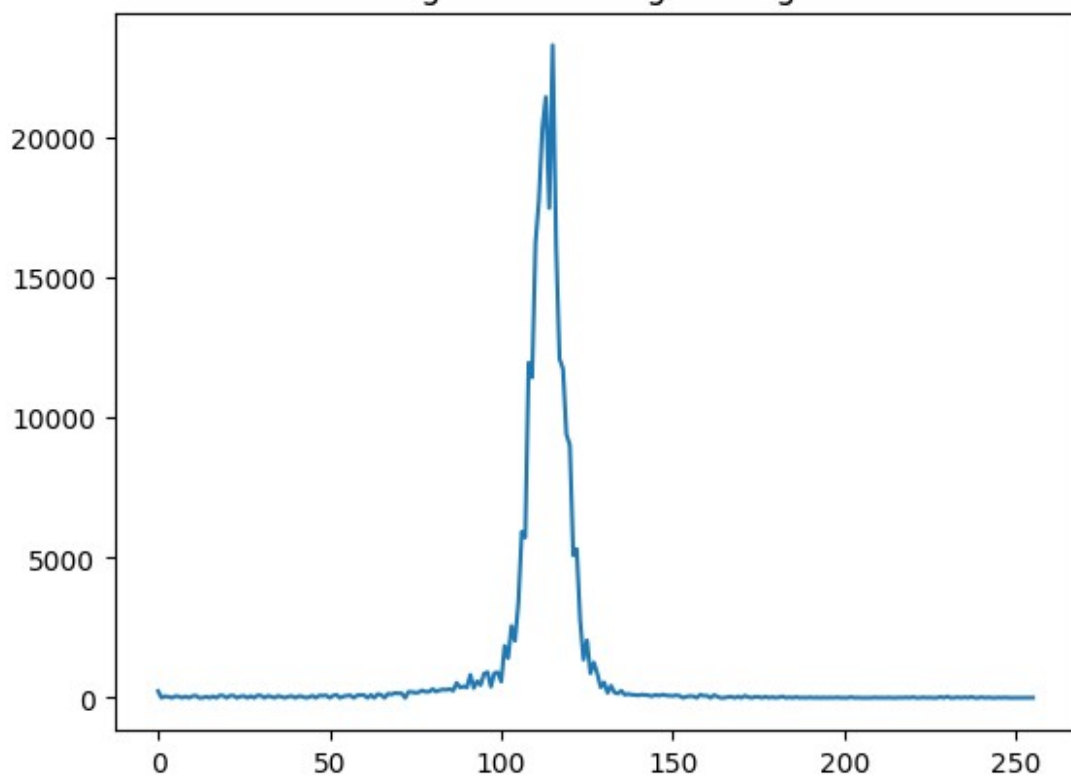


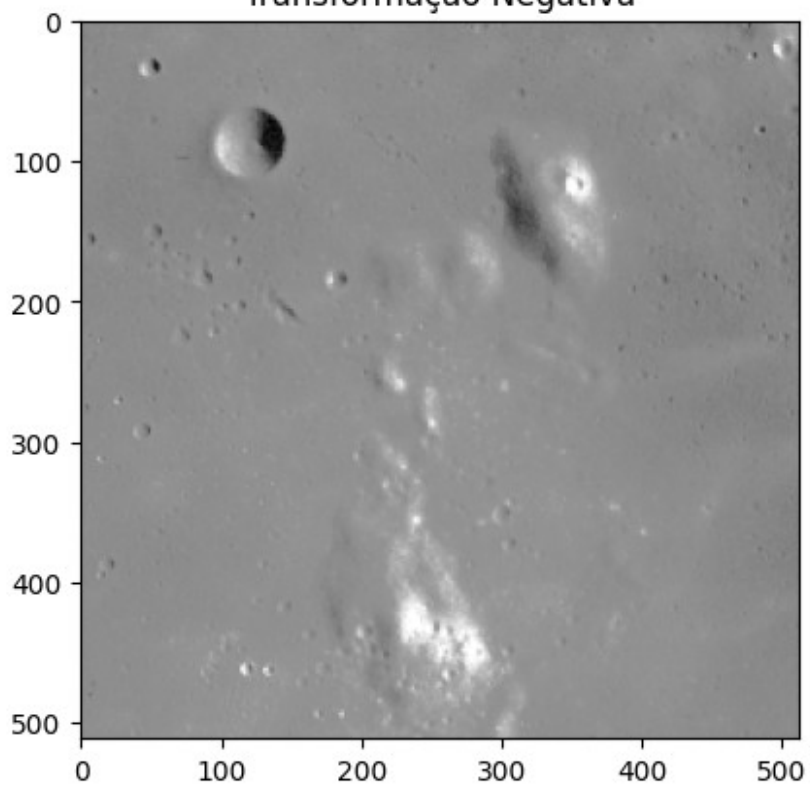
Imagem Original



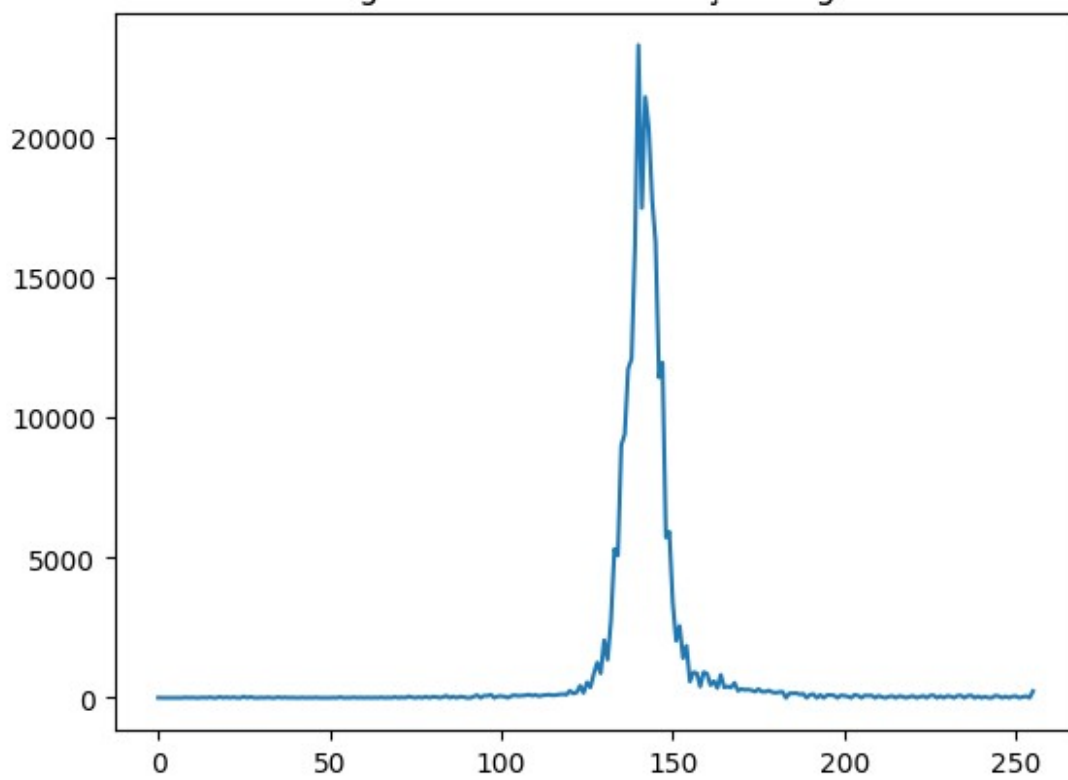
Histograma da Imagem Original



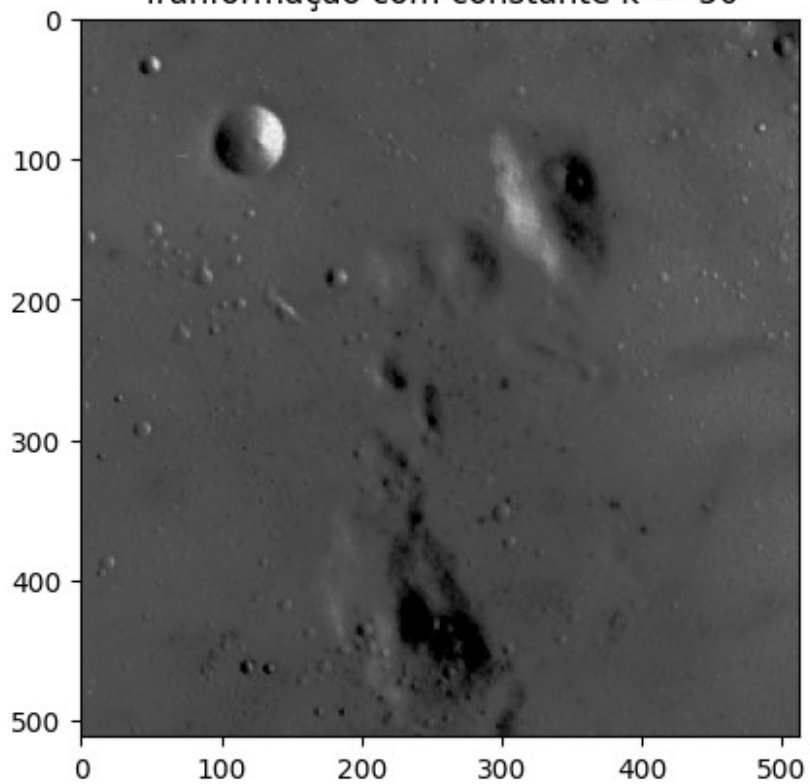
Transformação Negativa



Histograma da Transformação Negativa



Tranformação com constante $k = -50$



Histograma da Tranformação com constante $k = -50$

