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import numpy as np
import matplotlib.pyplot as plt
from skimage import data
from skimage.feature import match_template
import cv2

def convolucao(imagem, template):
    return cv2.matchTemplate(imagem, template, cv2.TM_CCOEFF_NORMED)

def correlacao(imagem, template):
    return cv2.matchTemplate(imagem, template, cv2.TM_CCORR_NORMED)

def templateMatching(imagem, template):
    return match_template(imagem, template)

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

def plot_superficie(imagem, descricao):
    fig = plt.figure()
    ax = fig.add_subplot(111, projection='3d')
    x, y = np.meshgrid(np.arange(imagem.shape[1]),
np.arange(imagem.shape[0]))
    ax.plot_surface(x, y, imagem, cmap='viridis')
    plt.title(descricao)
    plt.show()

def experimento(imagem, x, y, w, h):
    template = imagem[y:y+h, x:x+w]

    imagem_convolucao = convolucao(imagem, template)
    imagem_correlacao = correlacao(imagem, template)
    imagem_templateMatching = templateMatching(imagem, template)

    plt.imshow(imagem, cmap='gray')
    plt.title('Imagem Original')
    plt.axis('off')
    plt.gca().add_patch(plt.Rectangle((x, y), w, h, color='r',
fill=False))
    plt.show()

    plt.imshow(template, cmap='gray')
    plt.title('Template')
```

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plt.axis('off')
plt.show()

plot(imagem_convolucao, 'Convolução')
plot_superficie(imagem_convolucao, 'Convolução 3D')
plot(imagem_correlacao, 'Correlação')
plot_superficie(imagem_correlacao, 'Correlação 3D')
plot(imagem_templateMatching, 'Template Matching')
plot_superficie(imagem_templateMatching, 'Template Matching 3D')

moedas = data.coins()
experimento(moedas, 75, 170, 55, 50)

camera = data.camera()
experimento(camera, 150, 120, 100, 100)

lua = data.moon()
experimento(lua, 150, 120, 100, 100)

```

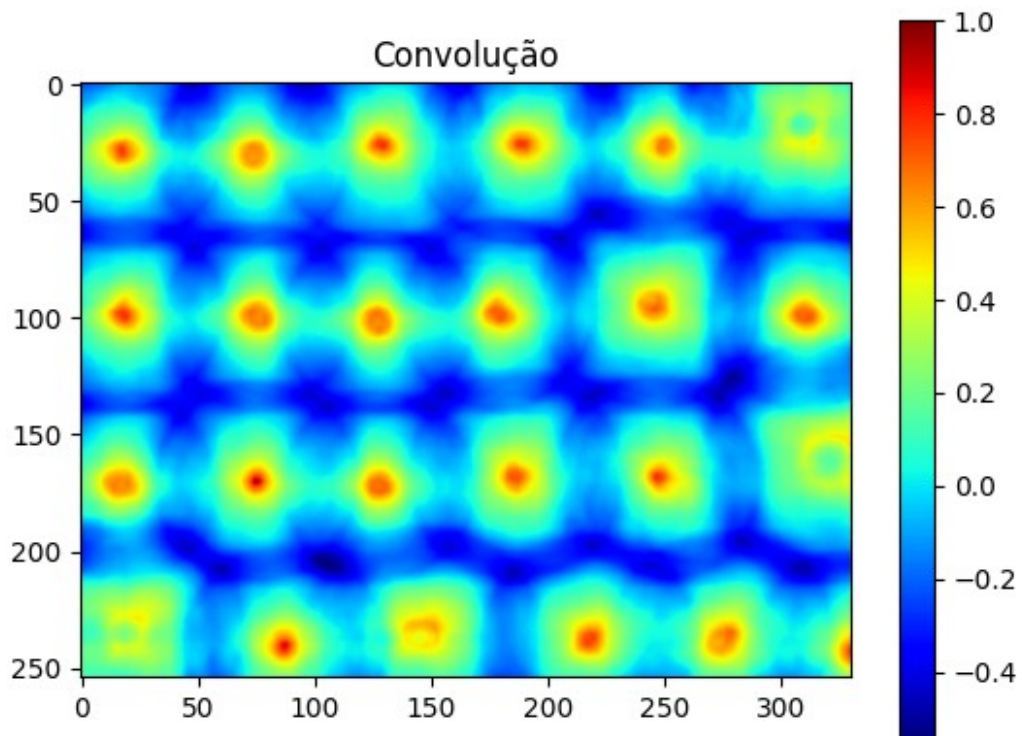
Imagem Original



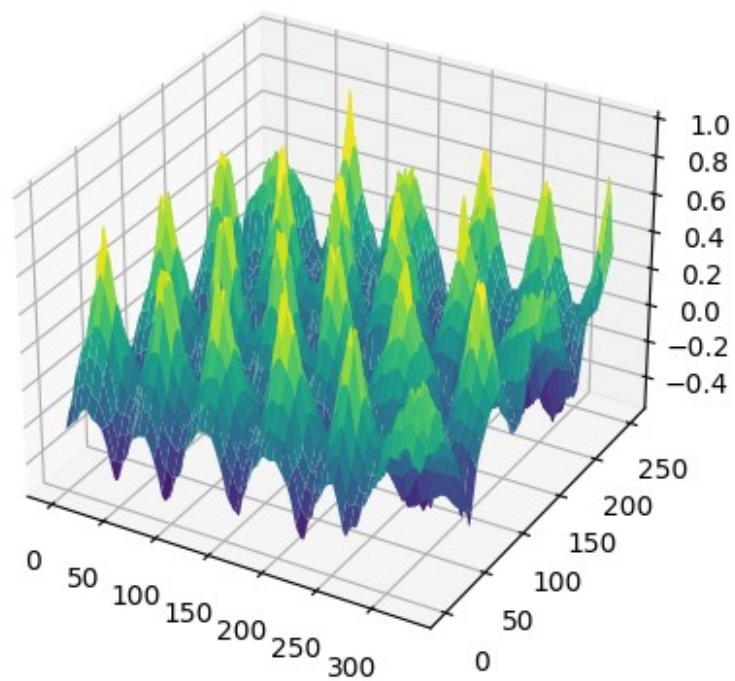
Template



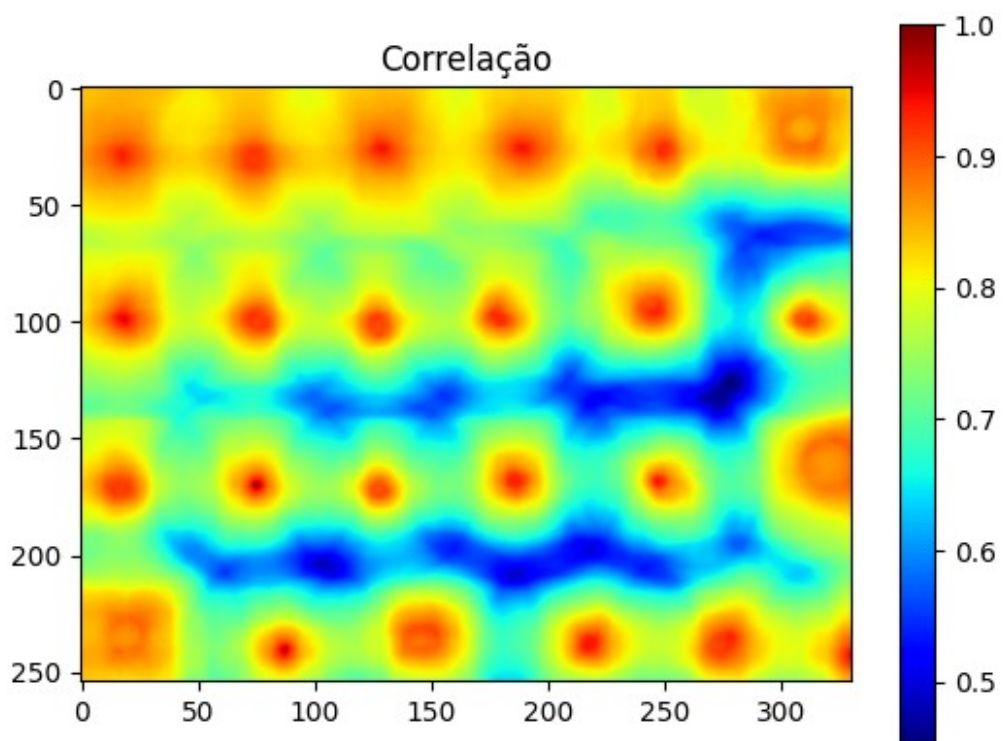
Convolução



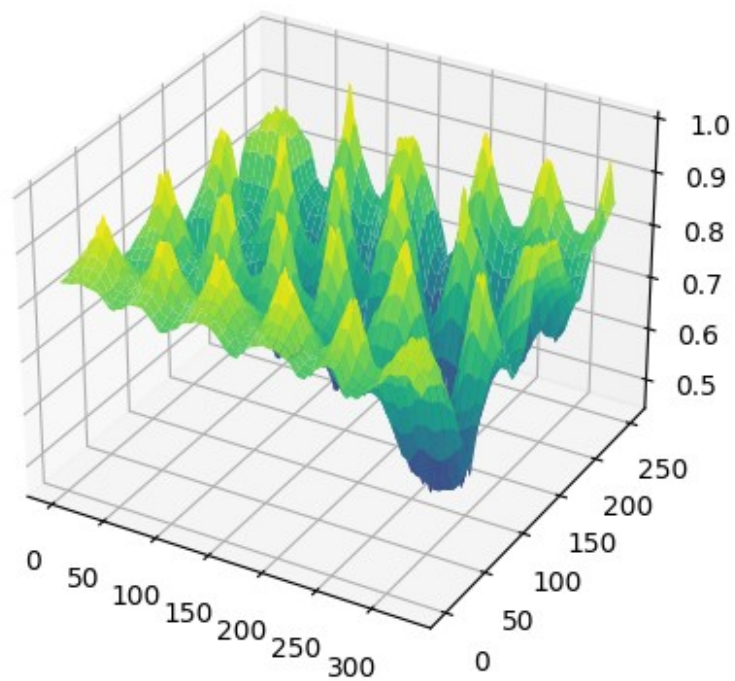
Convolução 3D



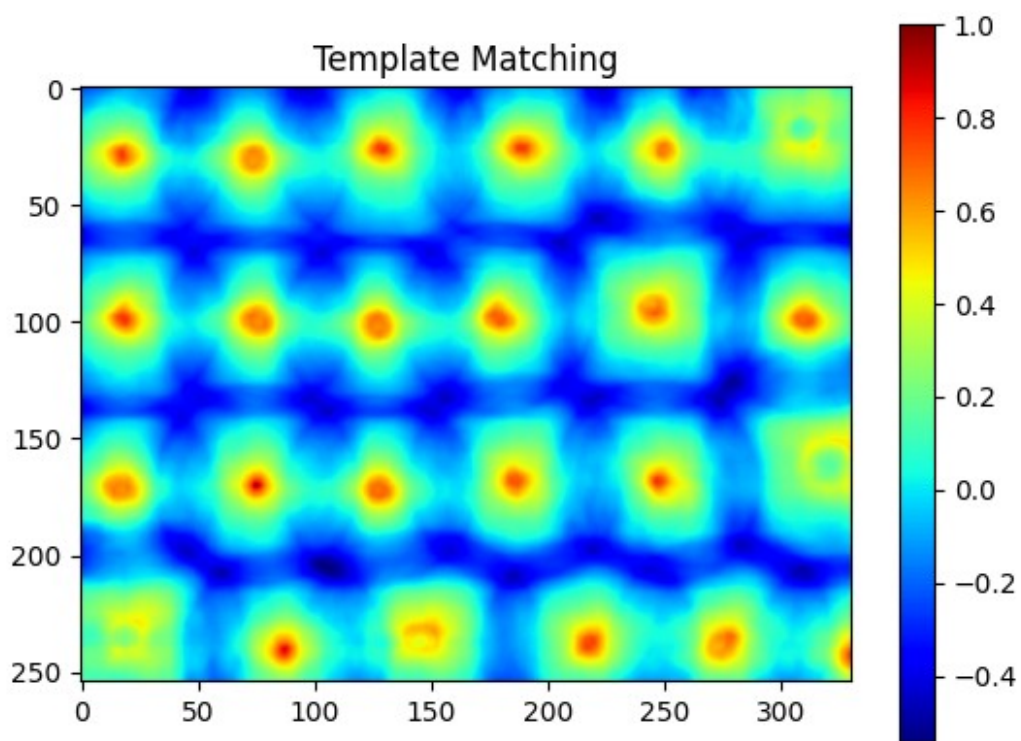
Correlação



Correlação 3D



Template Matching





Template Matching 3D

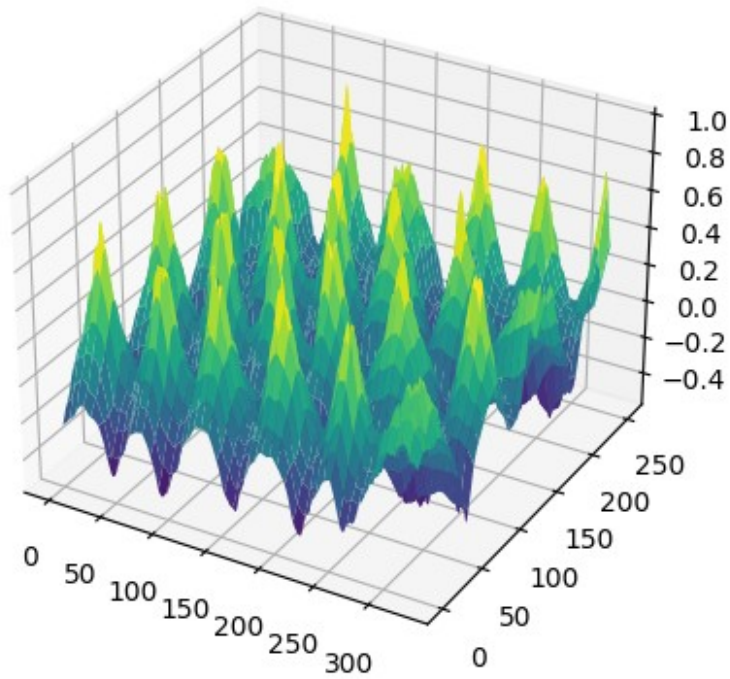
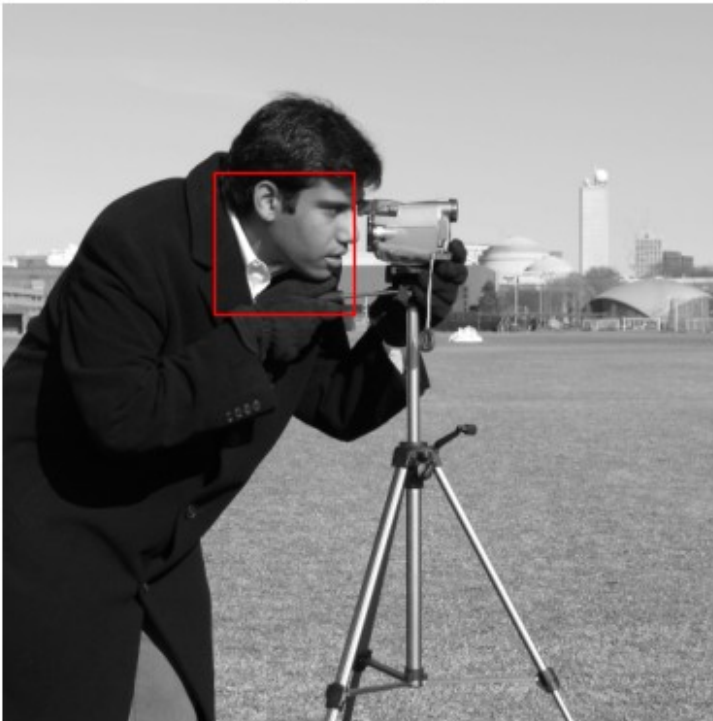


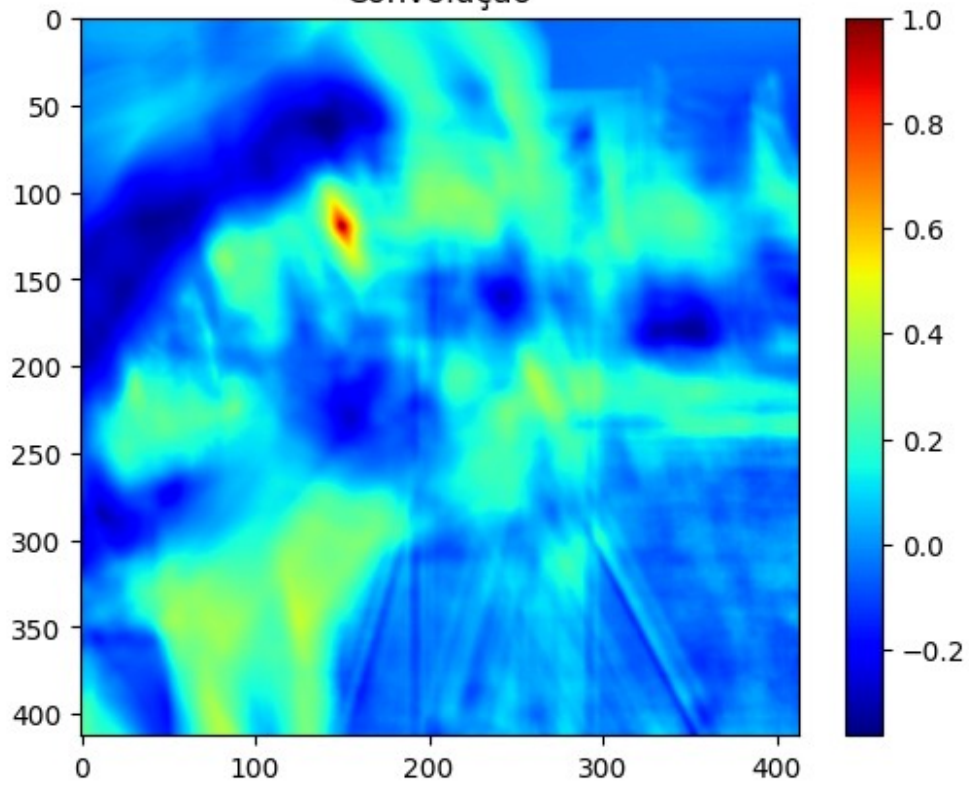
Imagem Original



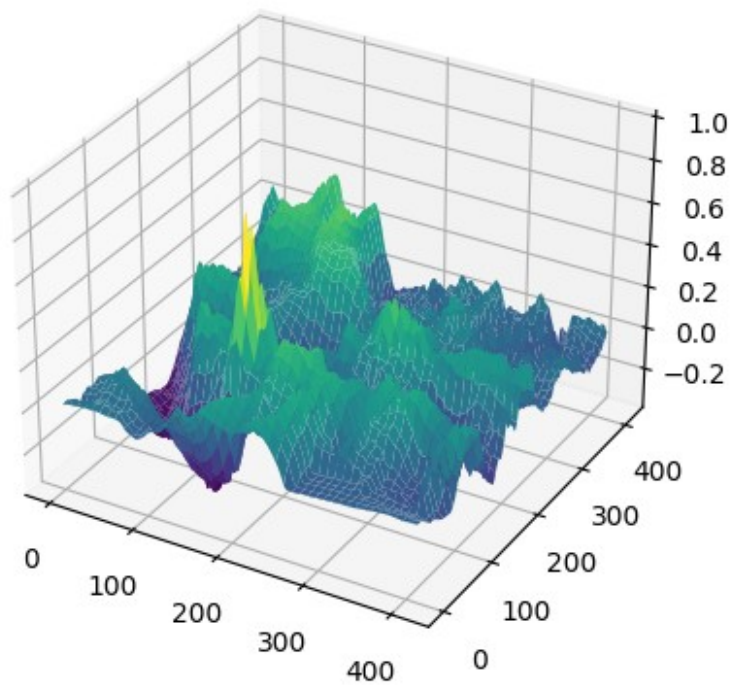
Template



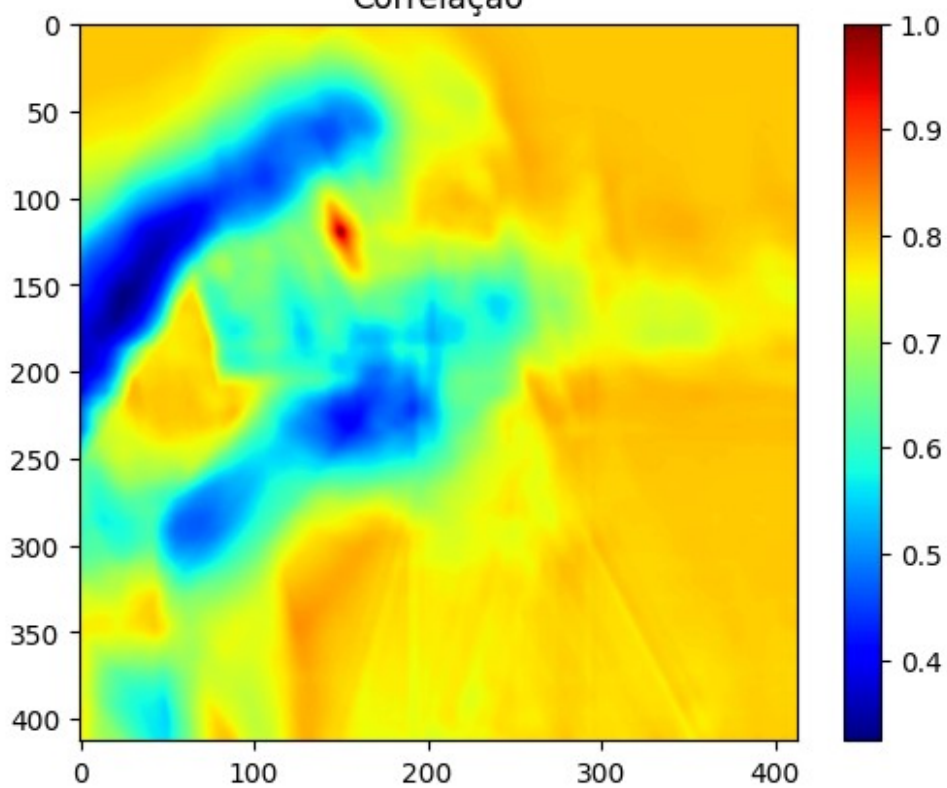
Convolução



Convolução 3D

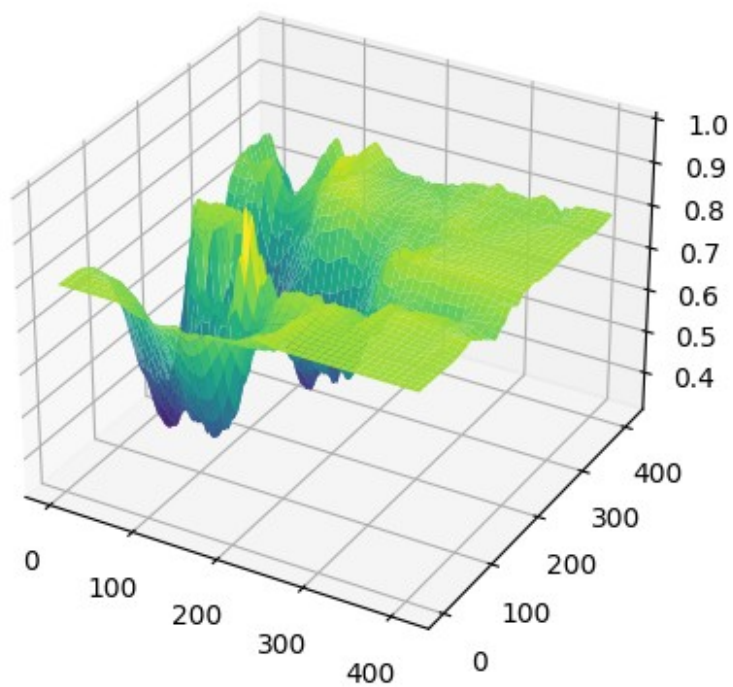


Correlação

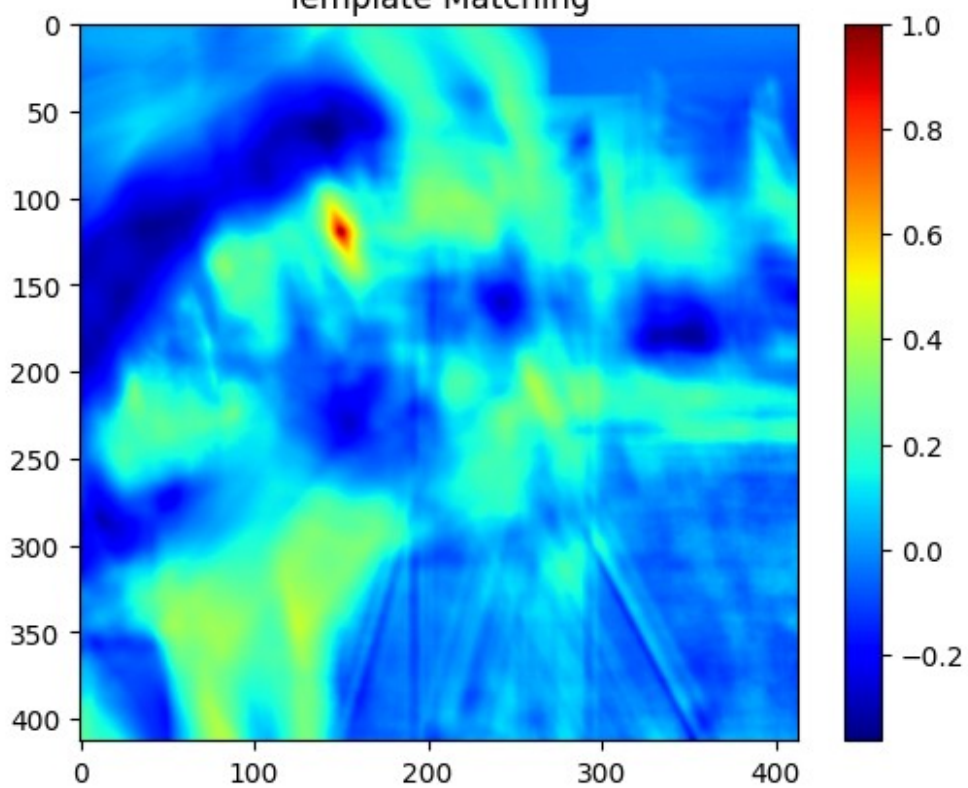




Correlação 3D



Template Matching



Template Matching 3D

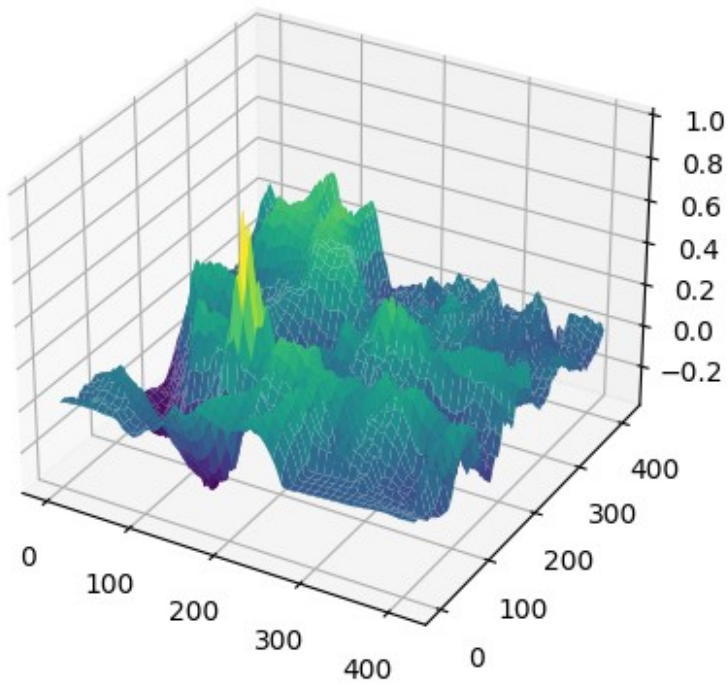
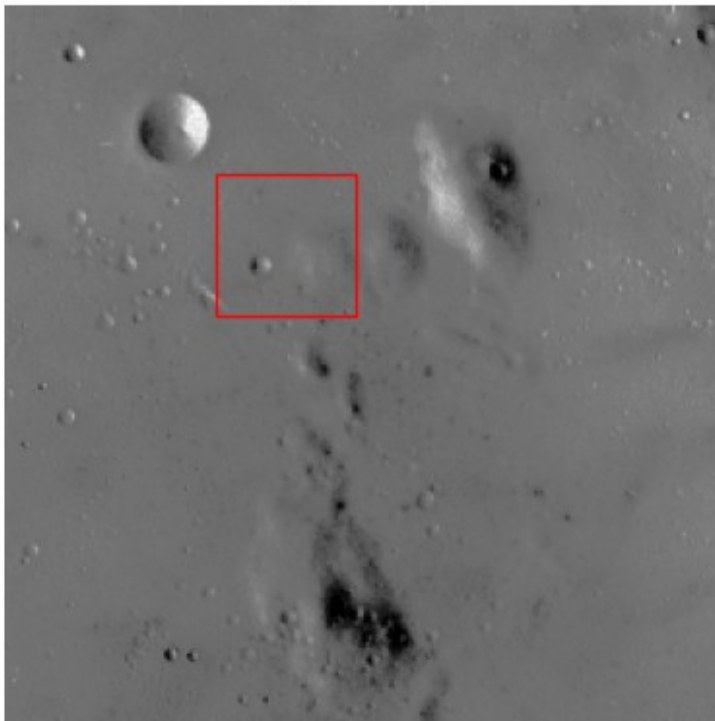
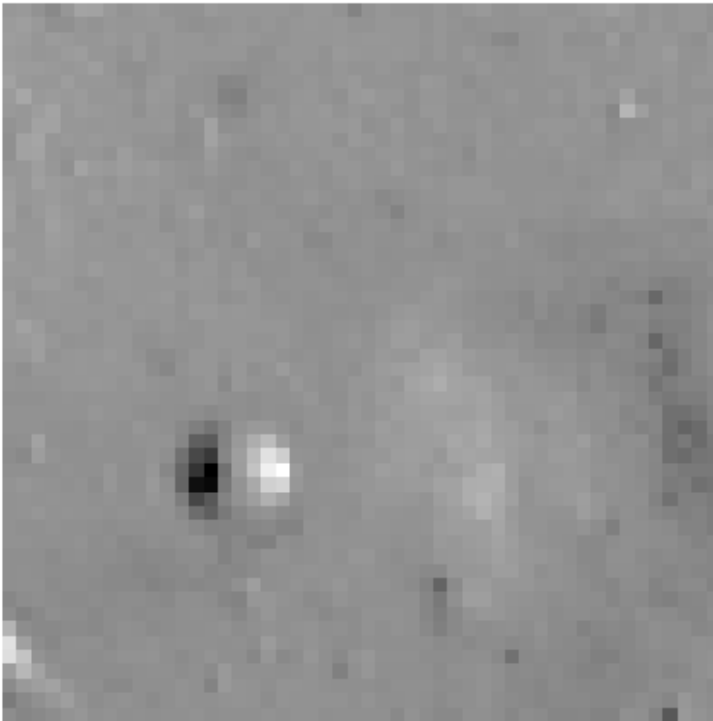


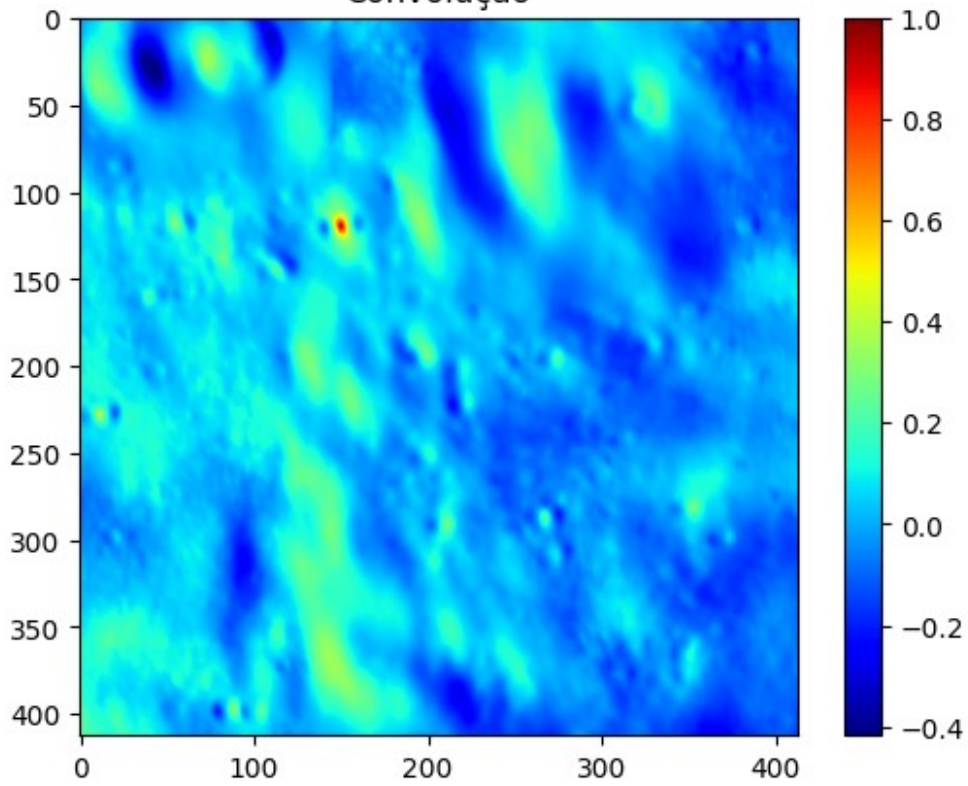
Imagem Original



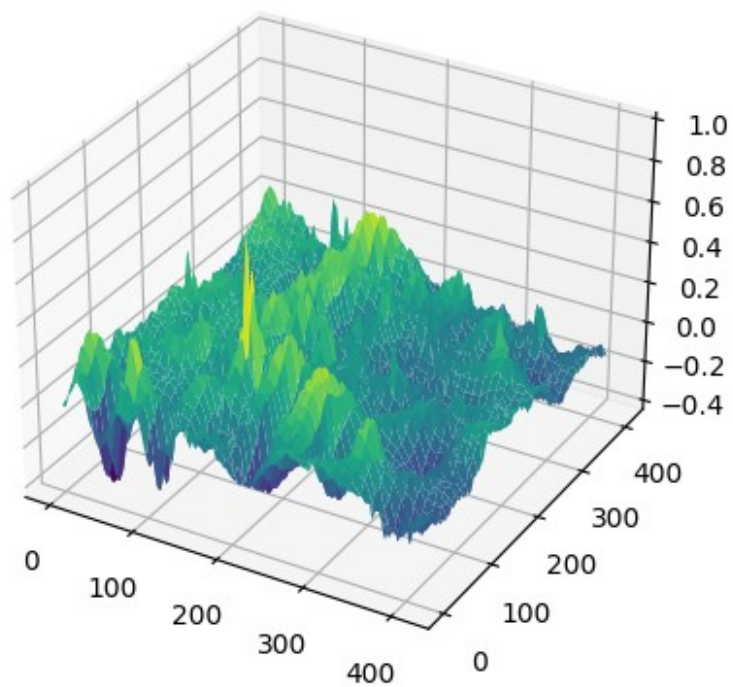
Template



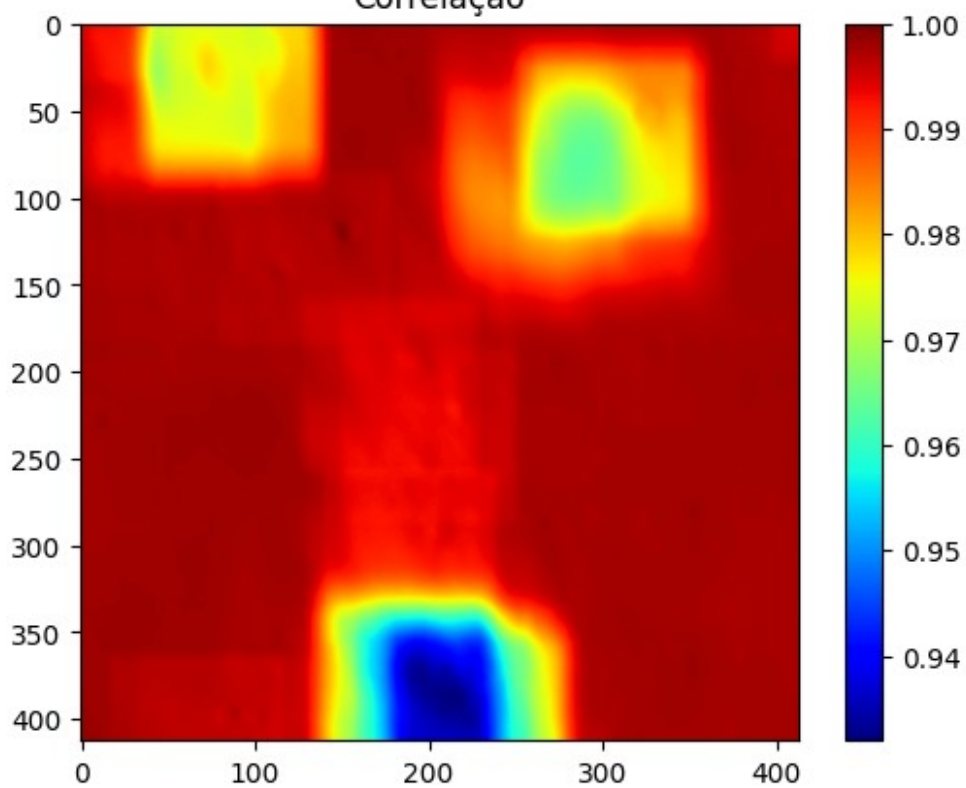
Convolução



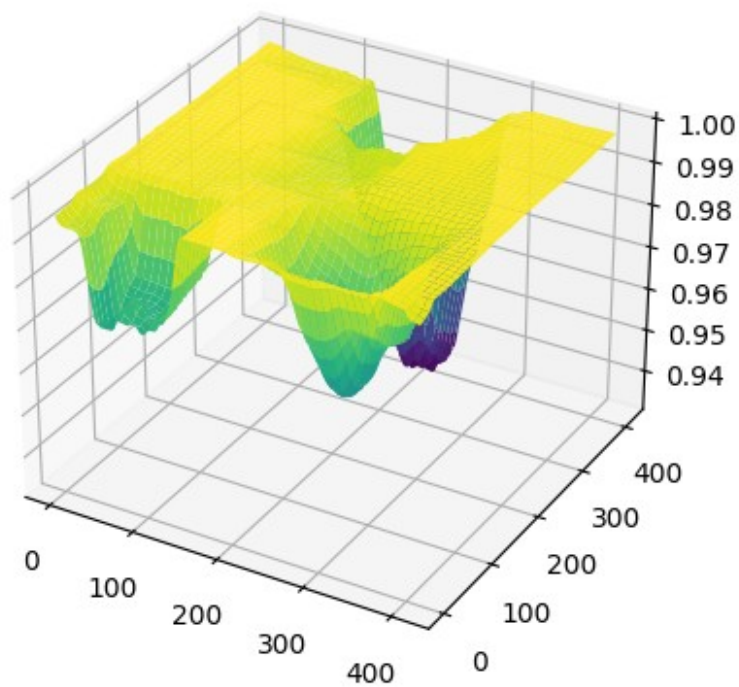
Convolução 3D



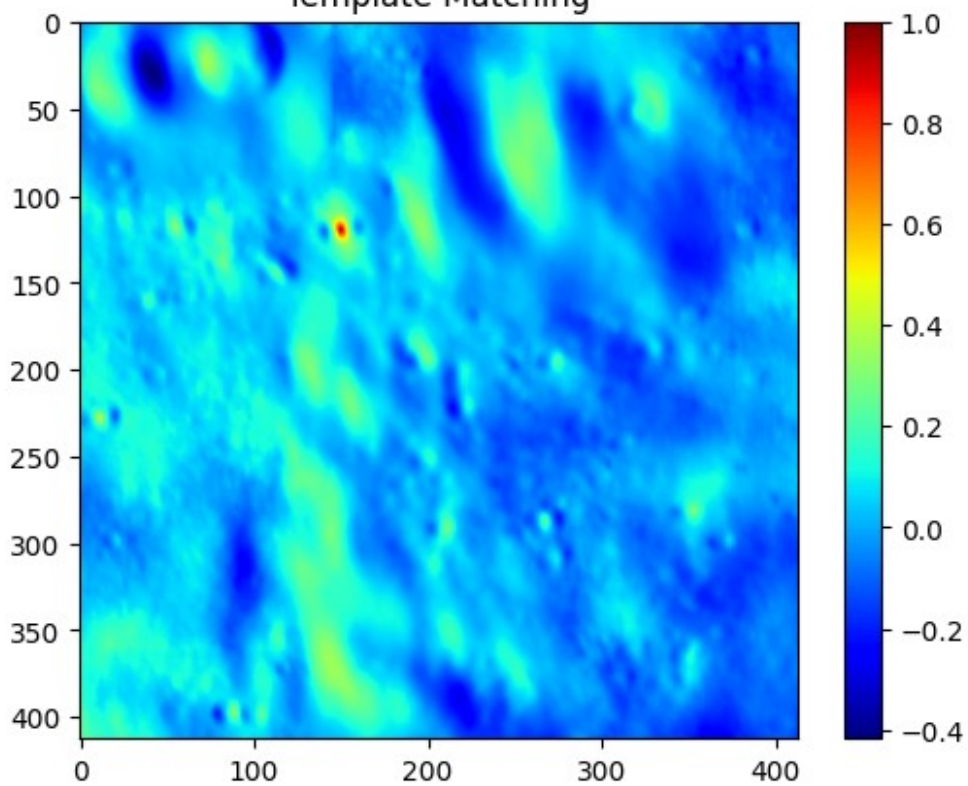
Correlação



Correlação 3D



Template Matching





## Template Matching 3D

