Image Arithmetics

You can do some meaningful arithmetics on images to get various results. For example you can add images, subtract them, or even multiply them.

Now, we are going to test some of these mathematical operations.

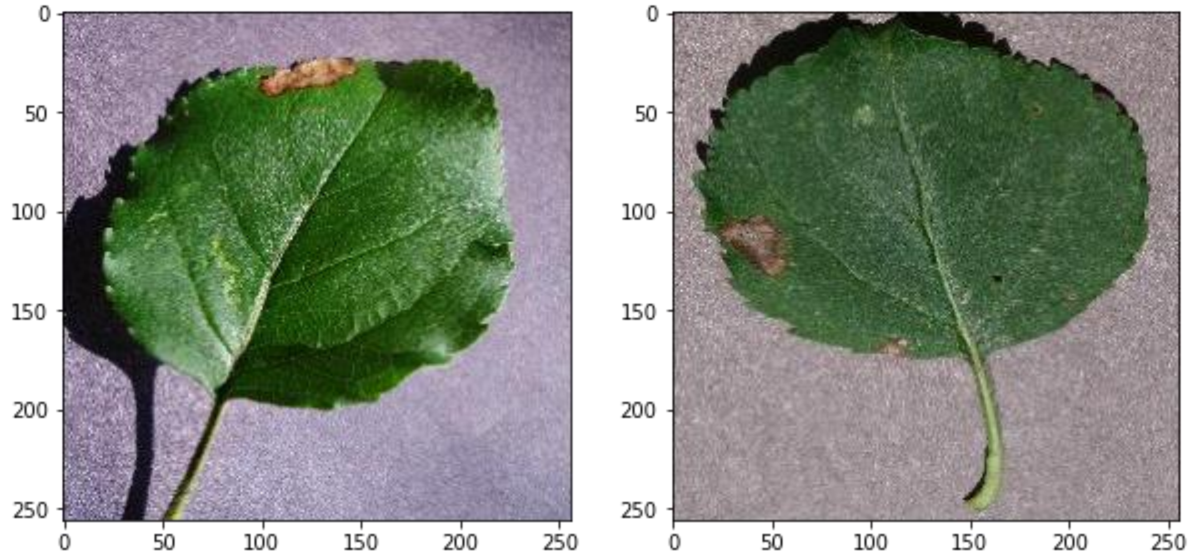
In [10]:

```
from skimage.io import imread
import matplotlib.pyplot as plt
import numpy as np
```

In [11]:

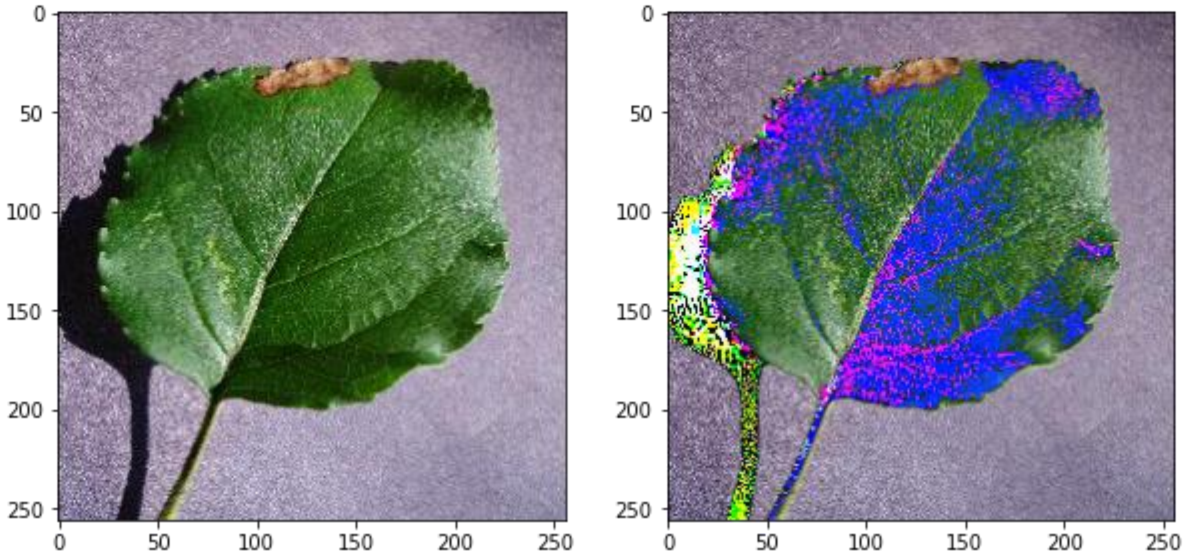
```
live = imread('/content/0b37761a-de32-47ee-a3a4-e138b97ef542___JR_FrgE.S
2908.JPG')
mask = imread('/content/00e909aa-e3ae-4558-9961-336bb0f35db3___JR_FrgE.S
8593.JPG')

plt.figure(figsize=(10, 10))
plt.subplot(121), plt.imshow(live, cmap='gray')
plt.subplot(122), plt.imshow(mask, cmap='gray')
plt.show()
```



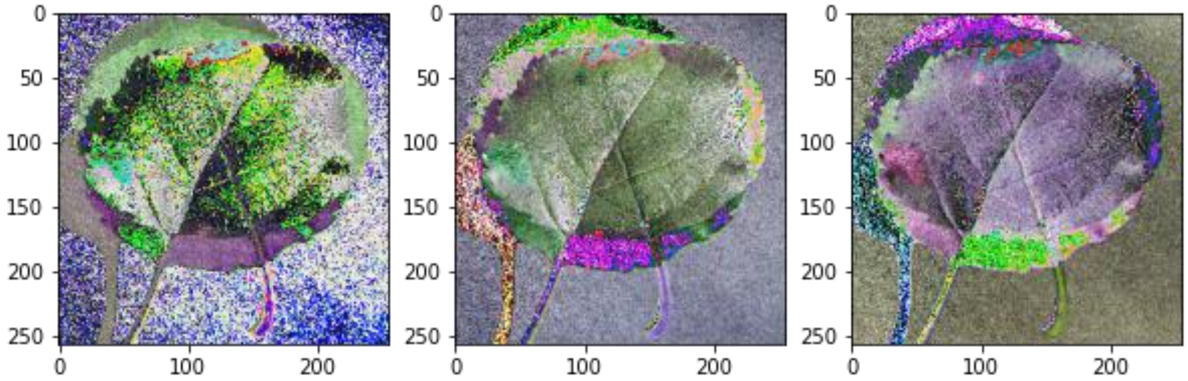
In [12]:

```
plt.figure(figsize=(10, 10))
plt.subplot(121), plt.imshow(live, cmap='gray')
plt.subplot(122), plt.imshow(live - 20, cmap='gray')
plt.show()
```



In [13]:

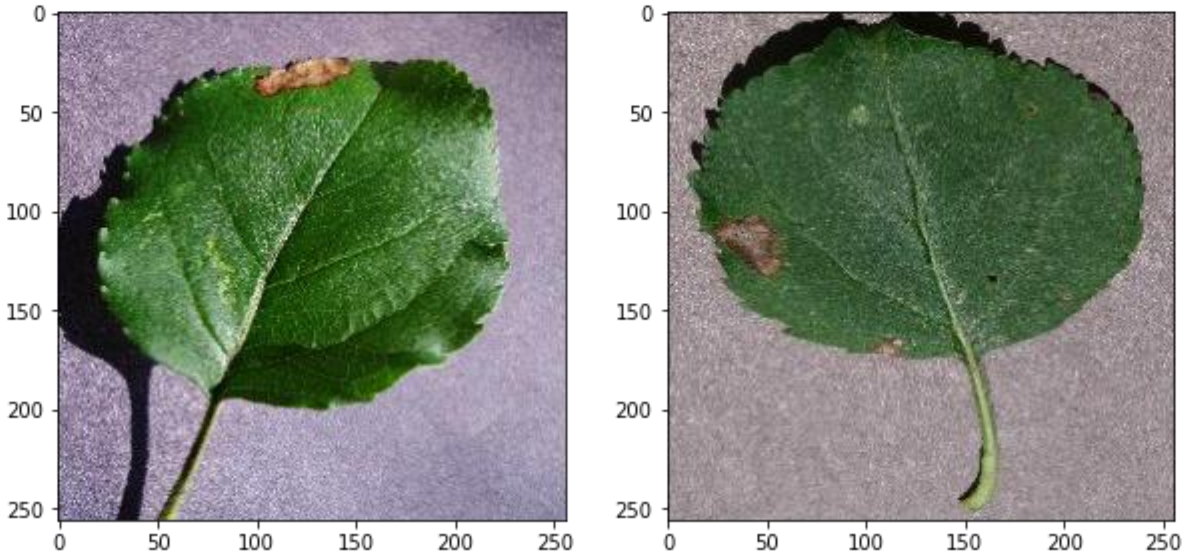
```
plt.figure(figsize=(10, 10))
plt.subplot(131), plt.imshow(mask - live, cmap='gray')
plt.subplot(132), plt.imshow(-(mask - live + 128), cmap='gray')
plt.subplot(133), plt.imshow(mask - live + 128, cmap='gray')
plt.show()
```



In [22]:

```
shaded = imread('/content/0b37761a-de32-47ee-a3a4-e138b97ef542___JR_FrgE.S
2908.JPG')
shading = imread('/content/00e909aa-e3ae-4558-9961-336bb0f35db3___JR_FrgE.S
8593.JPG')

plt.figure(figsize=(10, 10))
plt.subplot(121), plt.imshow(shaded, cmap='gray')
plt.subplot(122), plt.imshow(shading, cmap='gray')
plt.show()
```



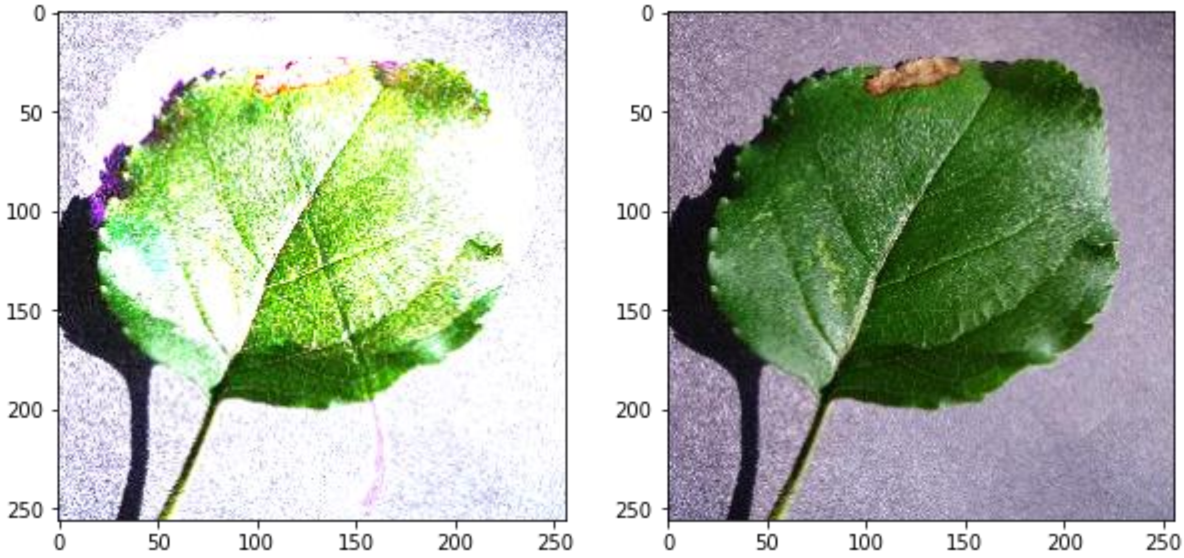
In [23]:

```
plt.figure(figsize=(10, 10))
plt.subplot(121), plt.imshow(np.multiply(shaded, 1/shading), cmap='gray')
plt.subplot(122), plt.imshow(shaded, cmap='gray')
plt.show()
```

```
/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: RuntimeWarn
ing: divide by zero encountered in true_divide

/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py:2: RuntimeWarn
ing: invalid value encountered in multiply

WARNING:matplotlib.image:Clipping input data to the valid range for imshow
with RGB data ([0..1] for floats or [0..255] for integers).
```



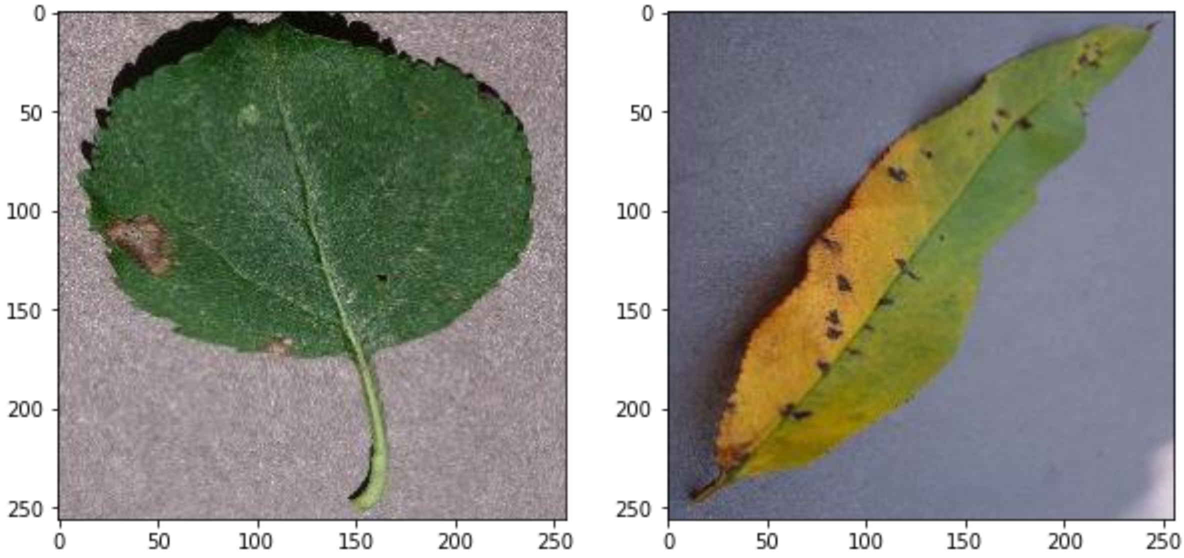
In [24]:

```
# Test on the X-ray dental image
xray = imread('/content/00e909aa-e3ae-4558-9961-336bb0f35db3___JR_FrgE.S
8593.JPG')
```

```
mask_xray = imread('/content/00ddc106-692e-4c67-b2e8-
569c924caf49___Rutg._Bact.S 1228.JPG')
```

In [25]:

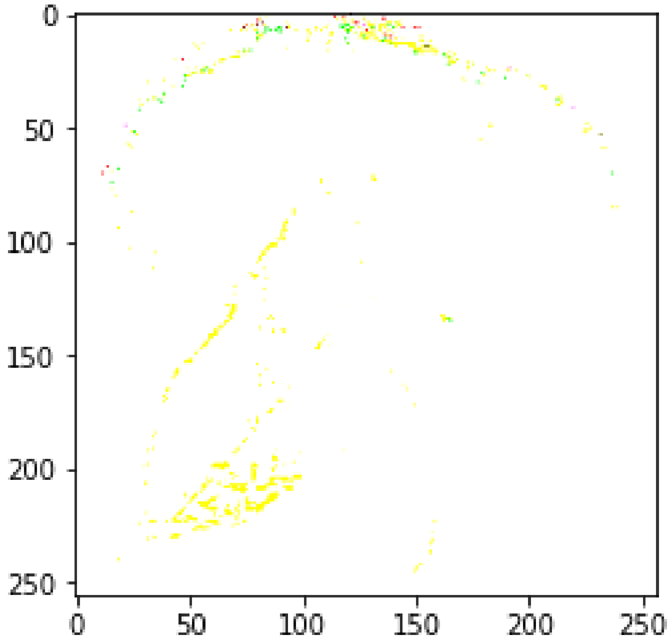
```
plt.figure(figsize=(10, 10))
plt.subplot(121), plt.imshow(xray, cmap='gray')
plt.subplot(122), plt.imshow(mask_xray, cmap='gray')
plt.show()
```



In [26]:

```
plt.figure()
plt.imshow(np.multiply(xray, mask_xray/255), cmap='gray')
plt.show()
```

```
WARNING:matplotlib.image:Clipping input data to the valid range for imshow
with RGB data ([0..1] for floats or [0..255] for integers).
```



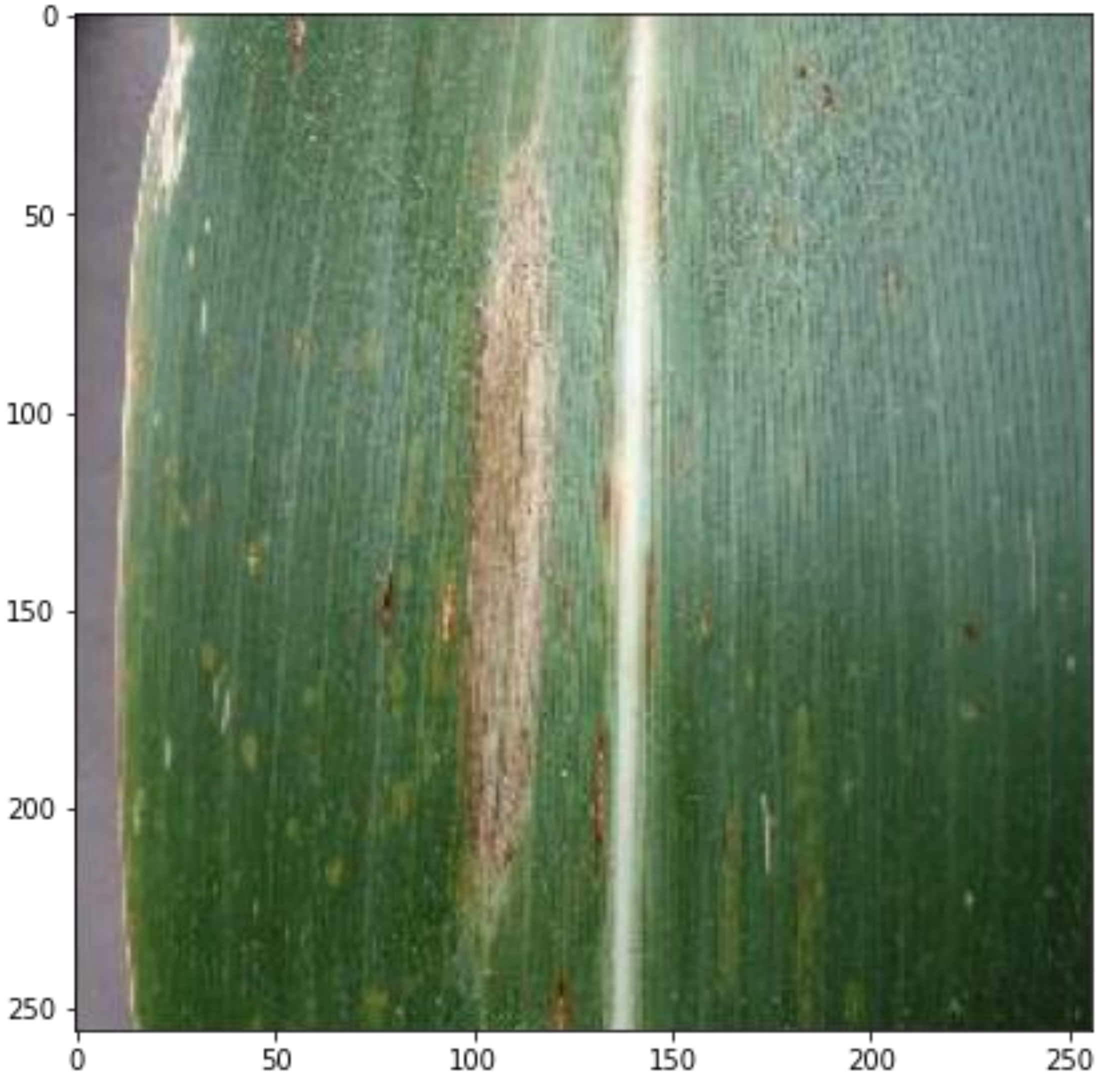
In [27]:

```
# Test on another image
scan = imread('/content/0a62fe5a-22db-42e2-bca0-53a8dcfd8129___RS_NLB
0810.JPG')
print(scan.shape)
```

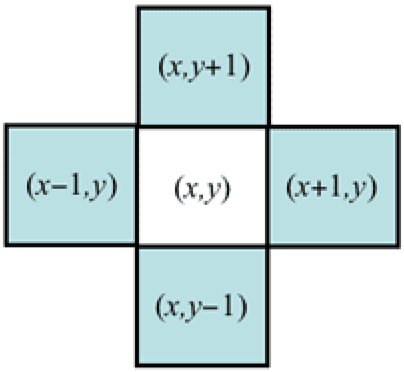
```
(256, 256, 3)
```

In [28]:

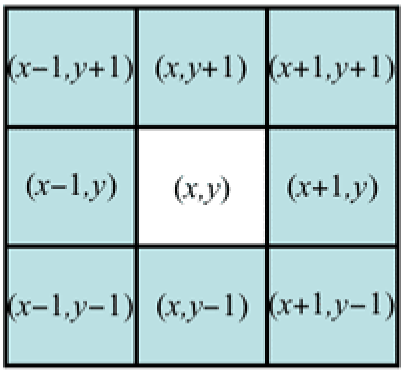
```
# Showing the body scan image
plt.figure(figsize=(7, 7))
plt.imshow(scan, cmap='gray')
plt.show()
```



Pixel relationships



4-neighbourhood



8-neighbourhood

Usual processes in DIP

Pixel (Point) processing

Only individual pixels are entered into a process. The output is dependent on the single pixel values.

Some of this kind of processes are:

Histogram Processing

1. Contrast Enhancement
2. Histogram Equalization
3. Histogram Matching
4. Histogram Strtching

Intensity Transformations

1. Negative of an image
2. Log transformation
3. n-th power transformation
4. piecewise transformations

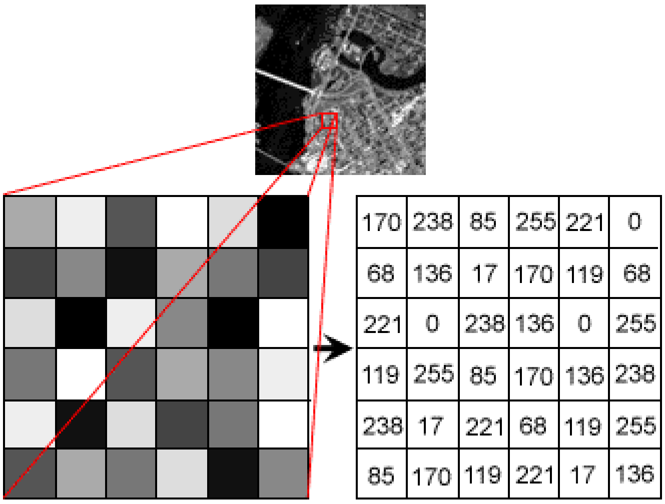
Region (Neighborhood) processing

A region (area) of pixels are entered into a process. The output is dependent on the values of entire region.

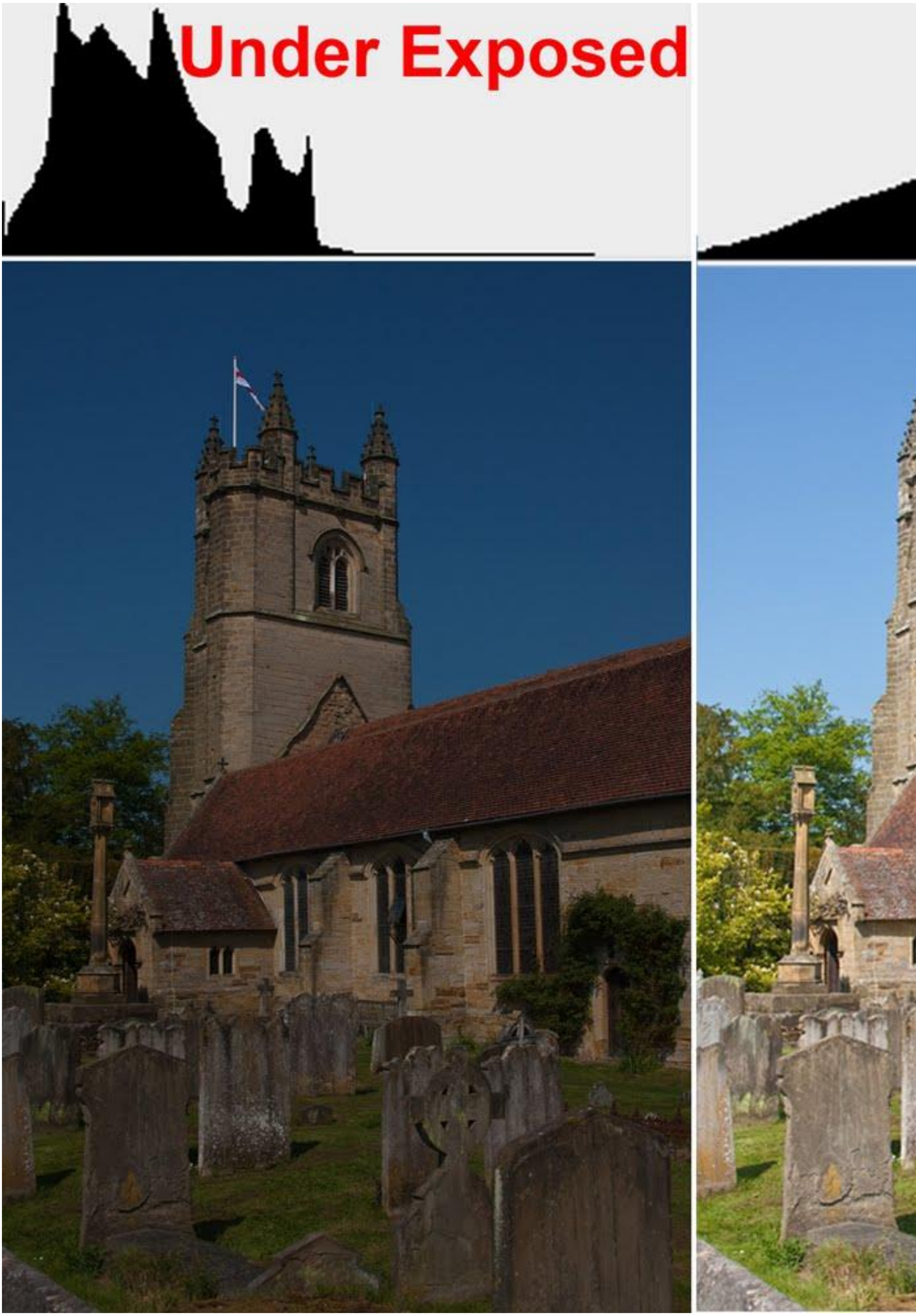
A common example of this kind of process includes **Spatial Filtering** and **Morphological Operators**, which are:

1. Average filtering
2. Median filtering
3. Sharpening filters
4. Edge detectors
5. Morphological Operations

Histogram of an image



170	238	85	255	221	0
68	136	17	170	119	68
221	0	238	136	0	255
119	255	85	170	136	238
238	17	221	68	119	255
85	170	119	221	17	136


Under Exposed

In [31]:

```
plt.figure(figsize=(10, 10))
plt.subplot(211), plt.imshow(xray, cmap='gray')
plt.subplot(212), plt.plot(np.histogram(xray, bins=256)[0])
plt.show()
```