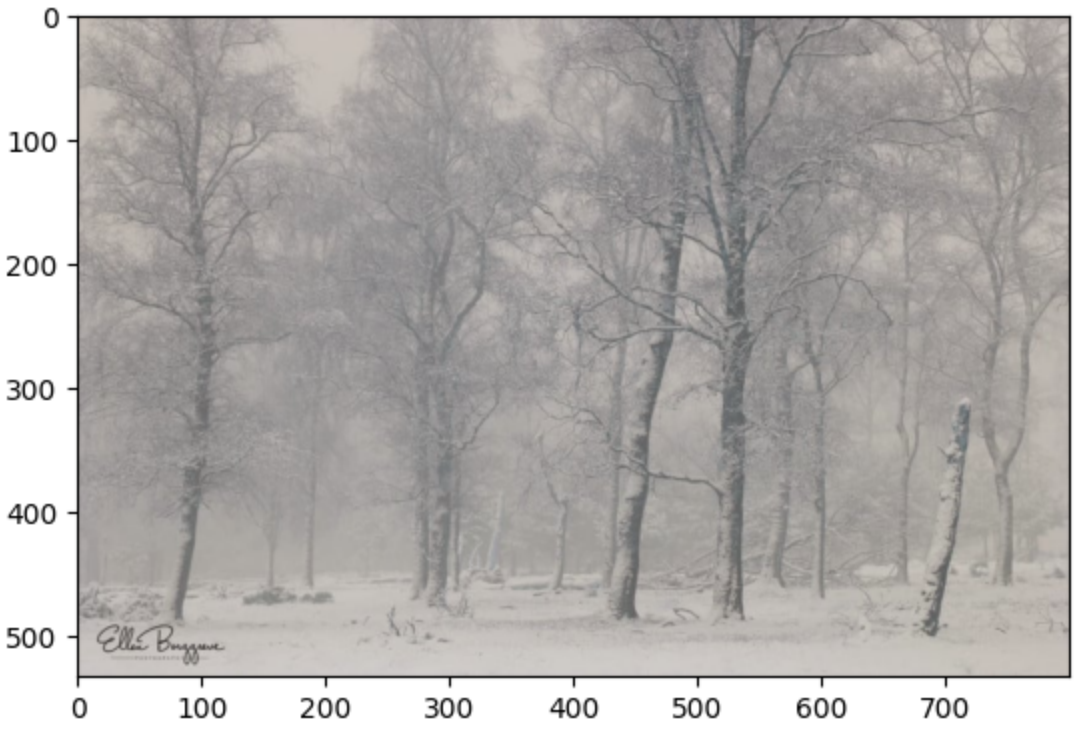
In [1]:
```
import numpy as np
from matplotlib import pyplot as plt
import cv2

gray = cv2.imread("piclowcontrast.jpg")
plt.imshow(gray)
```

Out[1]:
```
<matplotlib.image.AxesImage at 0x7c8c8cd97460>
```

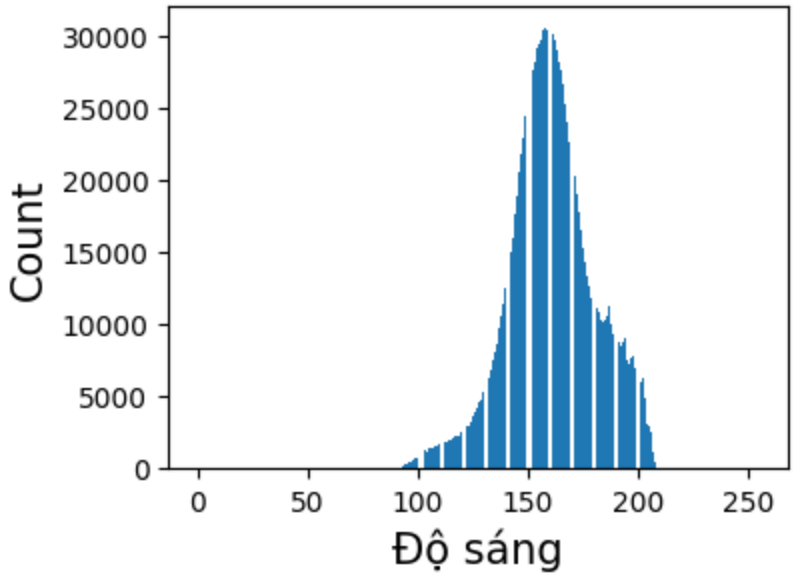


In [2]:
```
gray.max(), gray.min(), gray.mean(), gray.std()
```

Out[2]:
```
(228, 20, 160.6676751094434, 19.862962100833524)
```

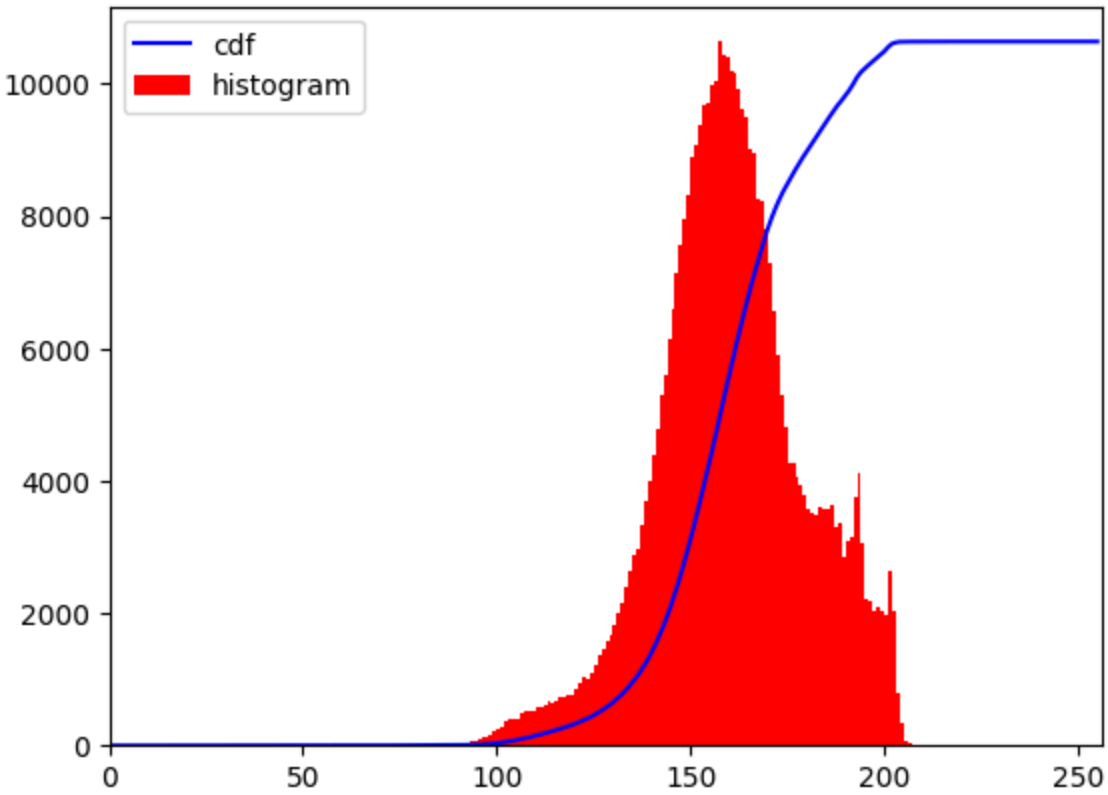
In [3]:
```
# Đếm tần suất xuất hiện của các giá trị độ sáng trong ảnh

def histogram(img):
  hist = {x: 0 for x in range (256)}
  for i in img.ravel():
    hist[i] += 1
  return hist

# Vẽ đồ thị cột biểu diễn sự phụ thuộc của tần suất vào độ sáng
hist = histogram(gray)
plt.figure(figsize=(4,3))
plt.bar(hist.keys(), hist.values())
plt.xlabel(f"Độ sáng", fontsize = 15)
plt.ylabel(f"Count", fontsize = 15)
```

Out[3]:
```
Text(0, 0.5, 'Count')
```



In [5]:
```
gray = cv2.cvtColor(gray,cv2.COLOR_BGR2GRAY)

hist,bins = np.histogram(gray.flatten(),256,[0,256])
```

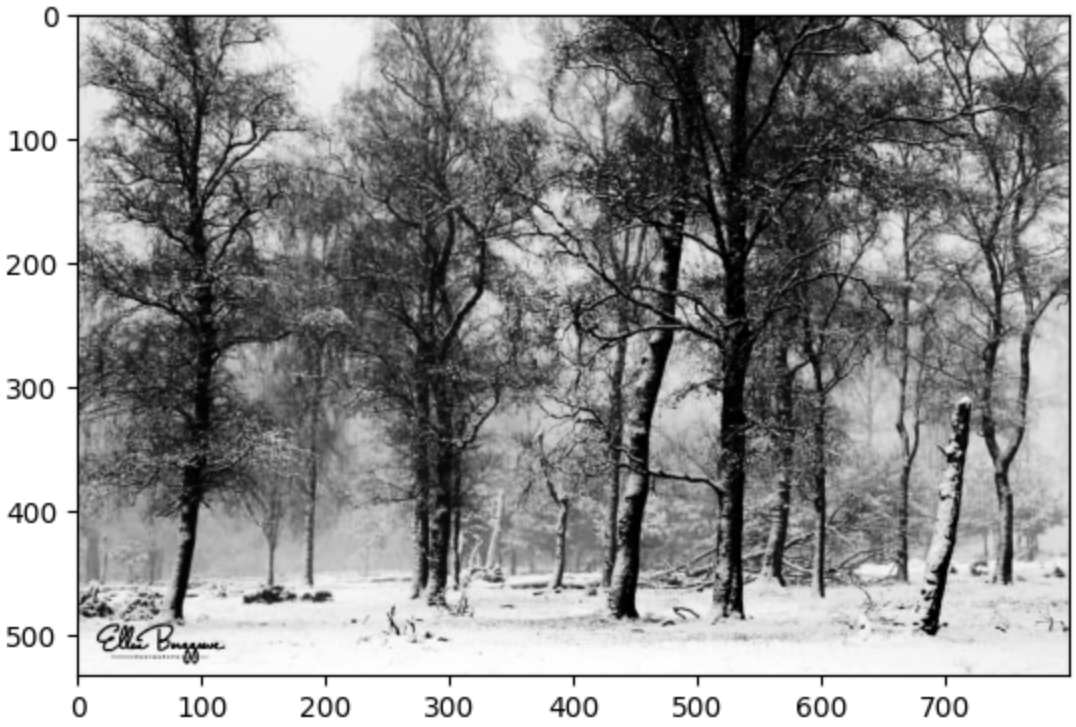
In [6]:
```
cdf = hist.cumsum()
cdf_normalized = cdf * float(hist.max())/cdf.max()
plt.plot(cdf_normalized,color='b')
plt.hist(gray.flatten(),256,[0,256], color = 'r')
plt.xlim([0,256])
plt.legend(('cdf','histogram'), loc = 'upper left')
plt.show()
```



In [7]:
```
cdf_m = np.ma.masked_equal(cdf,0)
cdf_m = (cdf_m - cdf_m.min())*255/(cdf_m.max()-cdf_m.min())
cdf = np.ma.filled(cdf_m,0).astype('uint8')
```

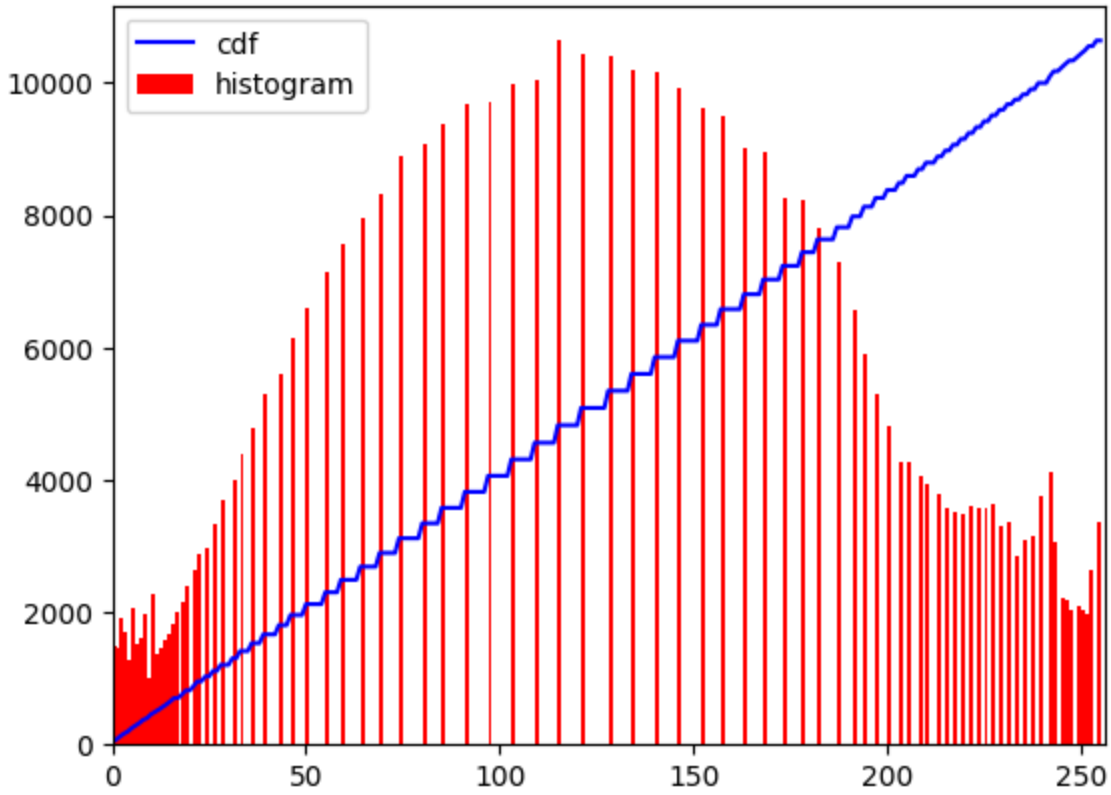
In [8]:
```
img2 = cdf[gray]
plt.imshow(img2,cmap='gray')
```

Out[8]:
```
<matplotlib.image.AxesImage at 0x7c8c7dbafdf0>
```



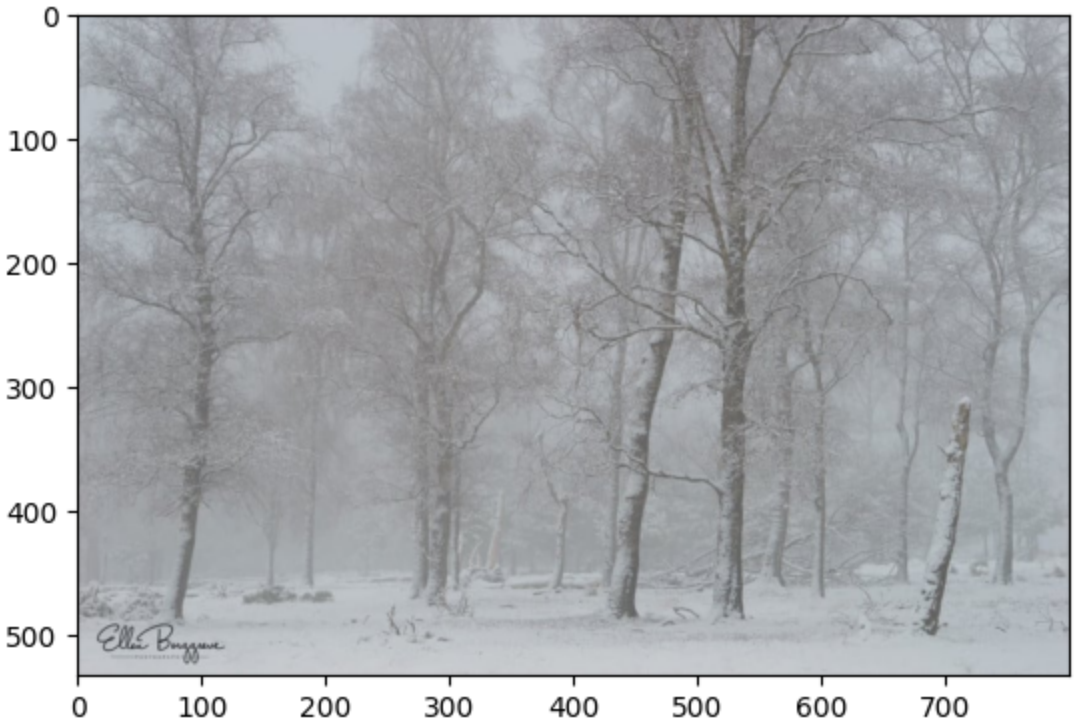
In [9]:
```
hist1,bins1 = np.histogram(img2.flatten(),256,[0,256])
cdf1 = hist1.cumsum()
cdf1_normalized = cdf1 * float(hist1.max())/cdf1.max()
plt.plot(cdf1_normalized,color='b')
plt.hist(img2.flatten(),256,[0,256], color = 'r')
plt.xlim([0,256])
plt.legend(('cdf','histogram'), loc = 'upper left')
```

Out[9]:
```
<matplotlib.legend.Legend at 0x7c8c8c26c460>
```



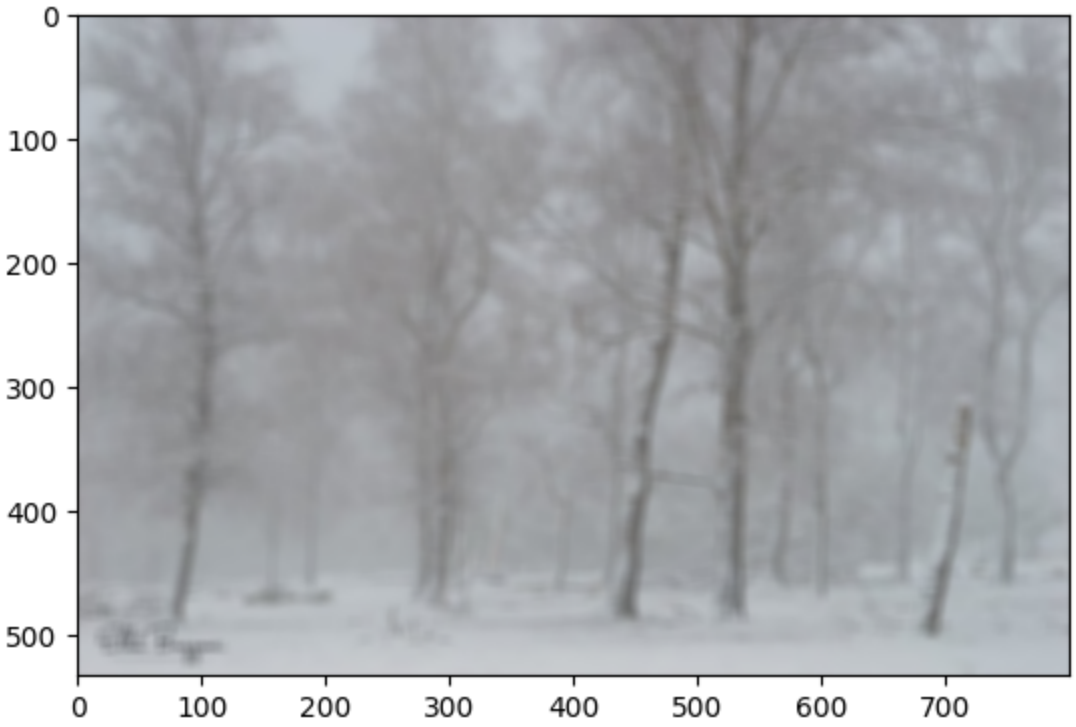
In [11]:
```
img = cv2.imread('piclowcontrast.jpg')
img = cv2.cvtColor(img,cv2.COLOR_BGR2RGB)

plt.imshow(img)
```

Out[11]:
```
<matplotlib.image.AxesImage at 0x7c8c7d624a90>
```



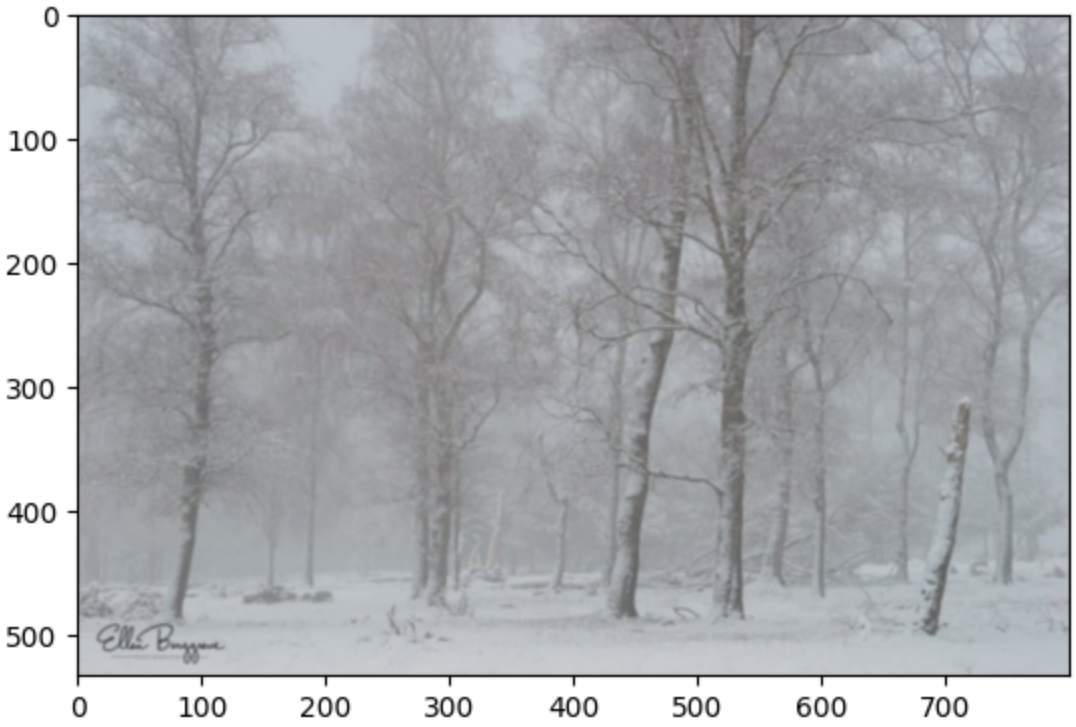
In [12]:
```
img_blur= cv2.blur(img,(10,10))
plt.imshow(img_blur)
```

Out[12]: <matplotlib.image.AxesImage at 0x7c8c7d675030>



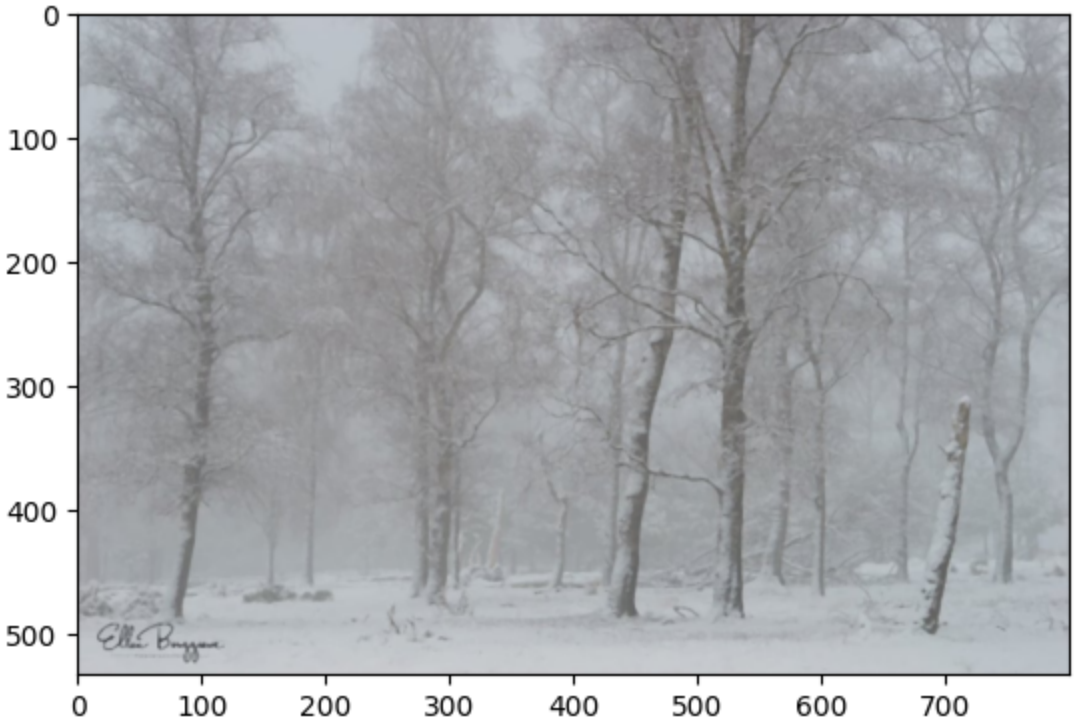
In [13]:
```
img_gau = cv2.GaussianBlur(img,(3,3),0)
plt.imshow(img_gau)
```

Out[13]: <matplotlib.image.AxesImage at 0x7c8c7d520cd0>



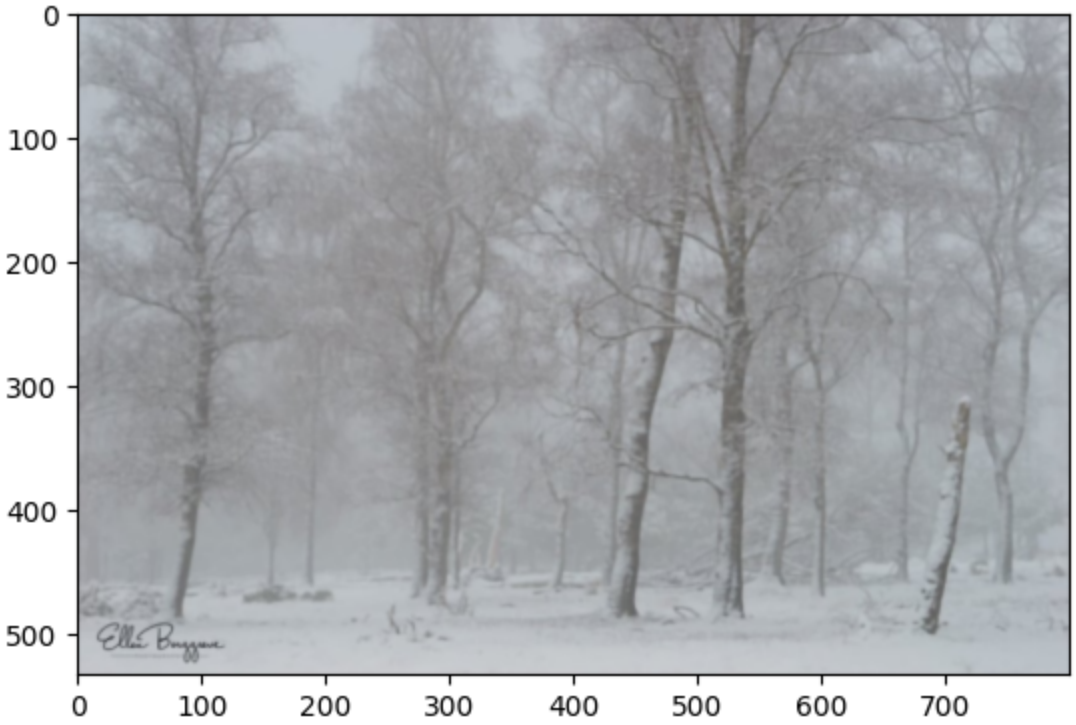
In [14]:
```
img_median = cv2.medianBlur(img,3)
plt.imshow(img_median)
```

Out[14]: <matplotlib.image.AxesImage at 0x7c8c7d957f70>



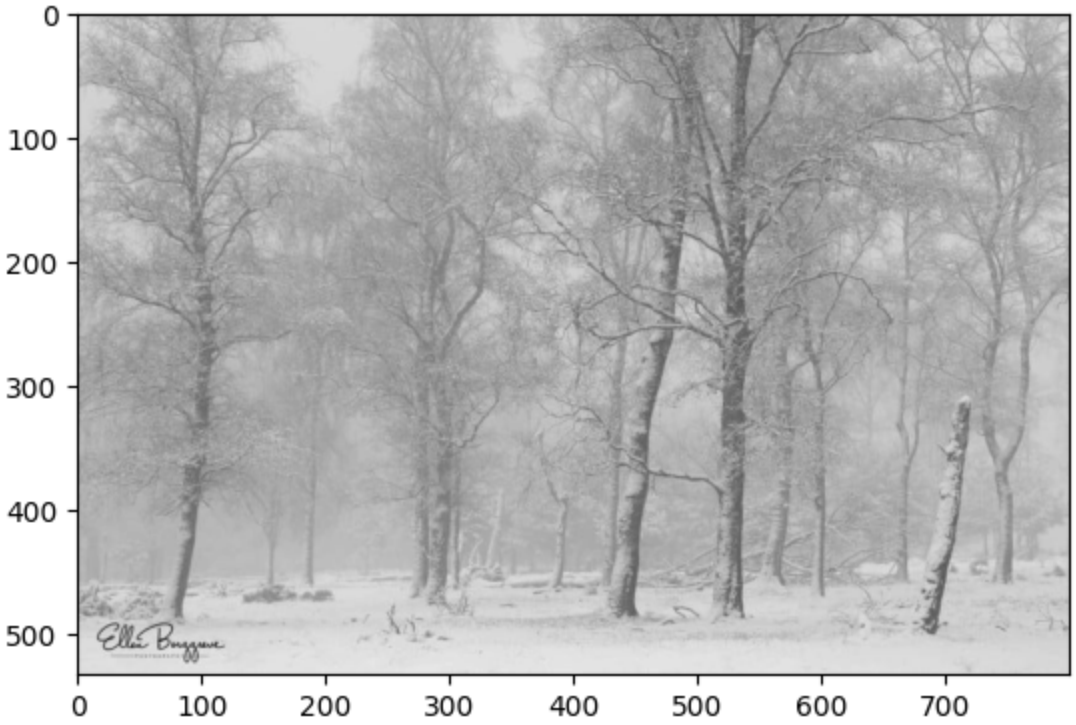
In [15]:
```
img_bila = cv2.bilateralFilter(img,5,180,180)
plt.imshow(img_bila)
```

Out[15]:
```
<matplotlib.image.AxesImage at 0x7c8c7d4180d0>
```



In [17]:
```
img=cv2.imread('piclowcontrast.jpg')
img_gray=cv2.cvtColor(img,cv2.COLOR_BGR2GRAY)
plt.imshow(img_gray, cmap='gray')
```

Out[17]:
```
<matplotlib.image.AxesImage at 0x7c8c7d484dc0>
```

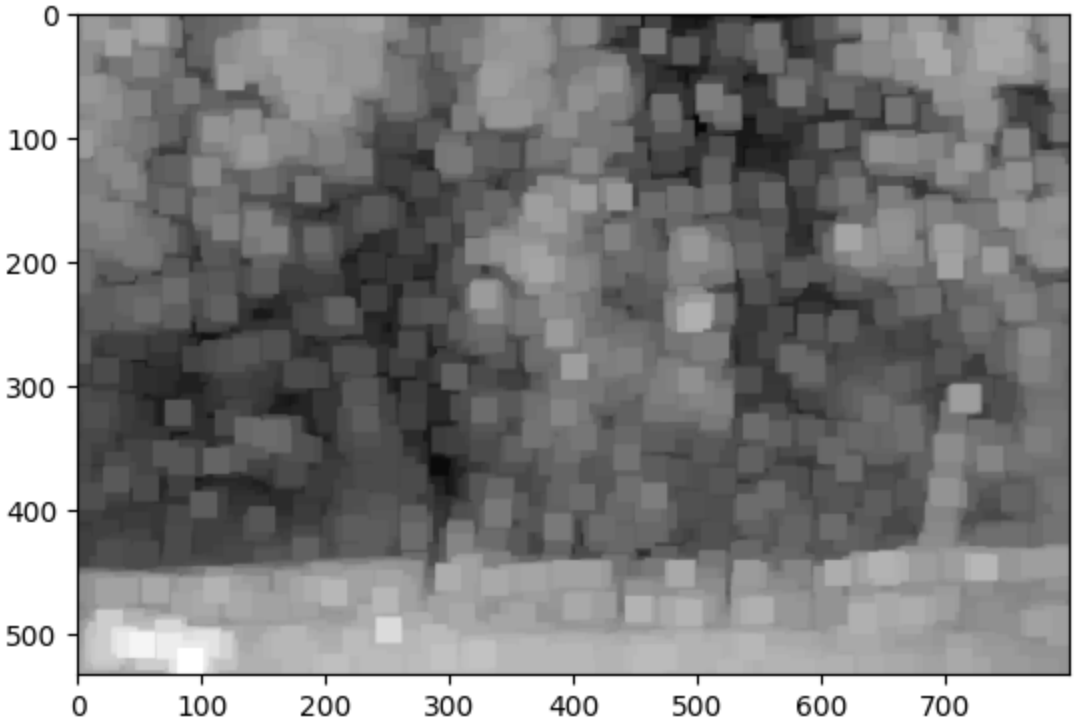


In [18]:
```
kernel=np.ones((5,5),np.uint8)
print(kernel)
```

```
[[1 1 1 1 1]
 [1 1 1 1 1]
 [1 1 1 1 1]
 [1 1 1 1 1]
 [1 1 1 1 1]]
```

In [19]:
```
dilation=cv2.dilate(img_gray,kernel,iterations=5)
plt.imshow(dilation, cmap='gray')
```

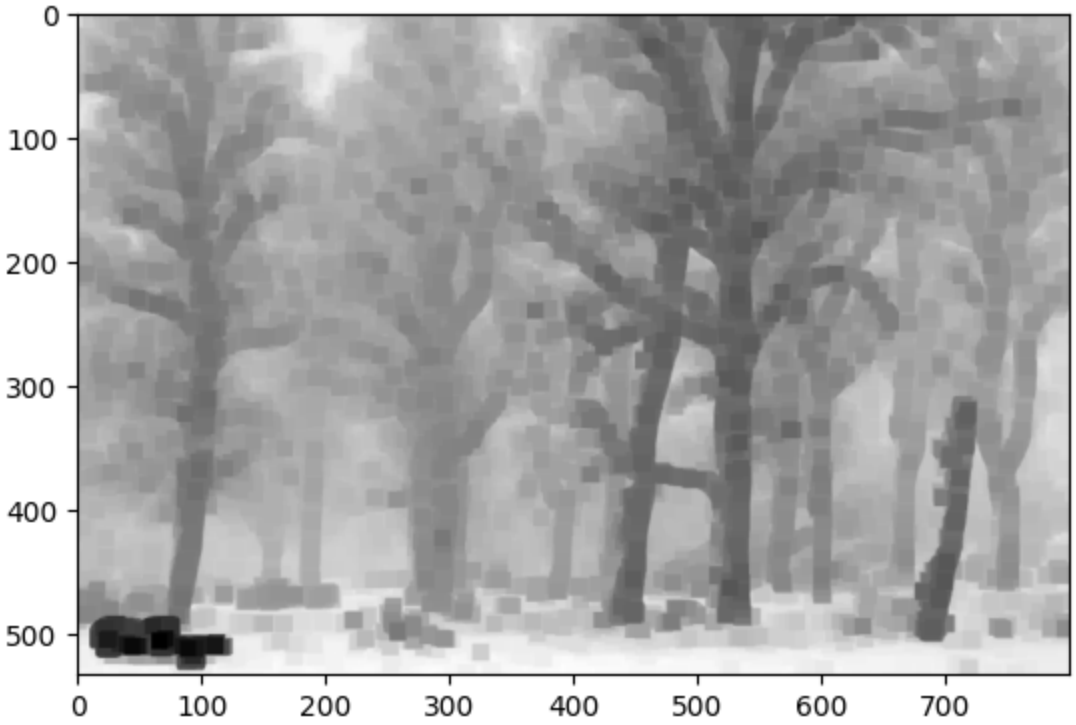
Out[19]:
```
<matplotlib.image.AxesImage at 0x7c8c7d3151b0>
```



In [20]:
```
erosion=cv2.erode(img_gray,kernel,iterations=3)
print(erosion.shape)
plt.imshow(erosion,cmap='gray')
```

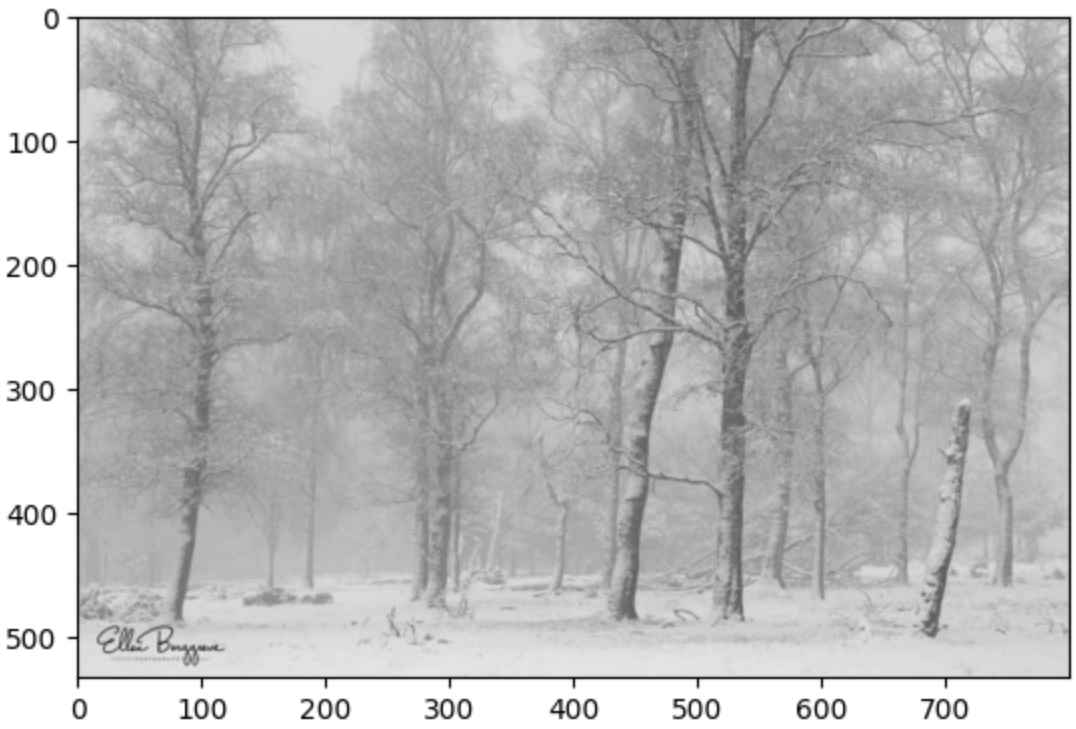
```
(533, 800)
<matplotlib.image.AxesImage at 0x7c8c7d387130>
```

Out[20]:



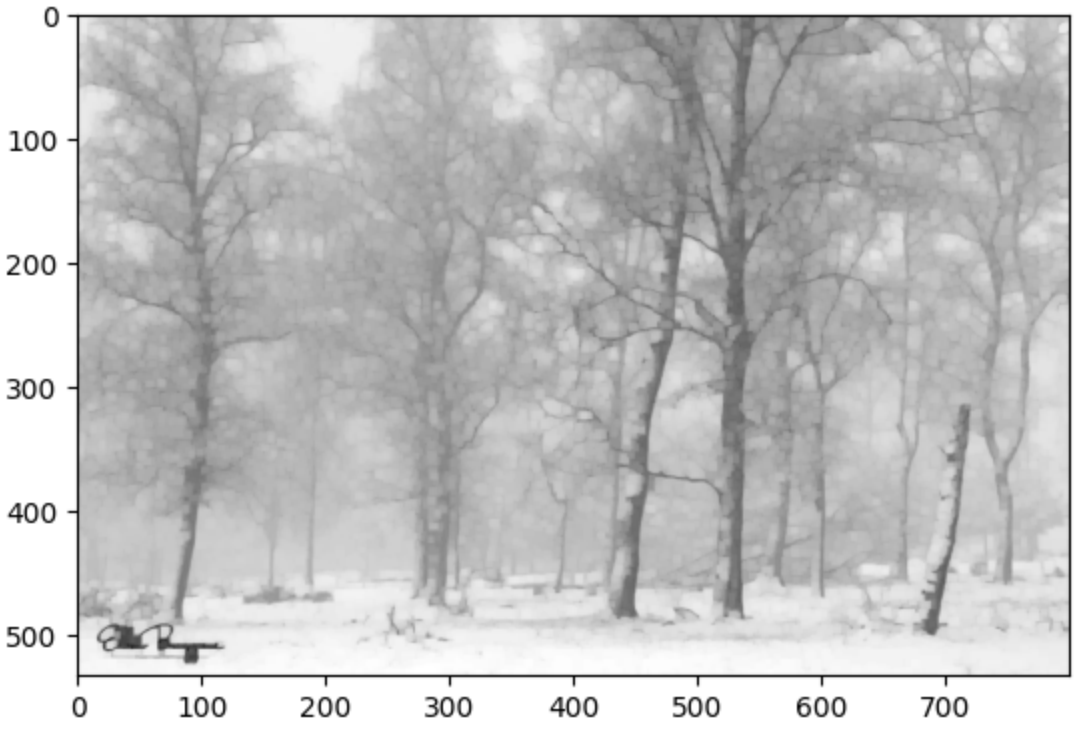
In [22]:
```
img=cv2.imread('piclowcontrast.jpg')
img_gray=cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(img_gray, cmap='gray')
```

Out[22]: <matplotlib.image.AxesImage at 0x7c8c7d3f5d20>



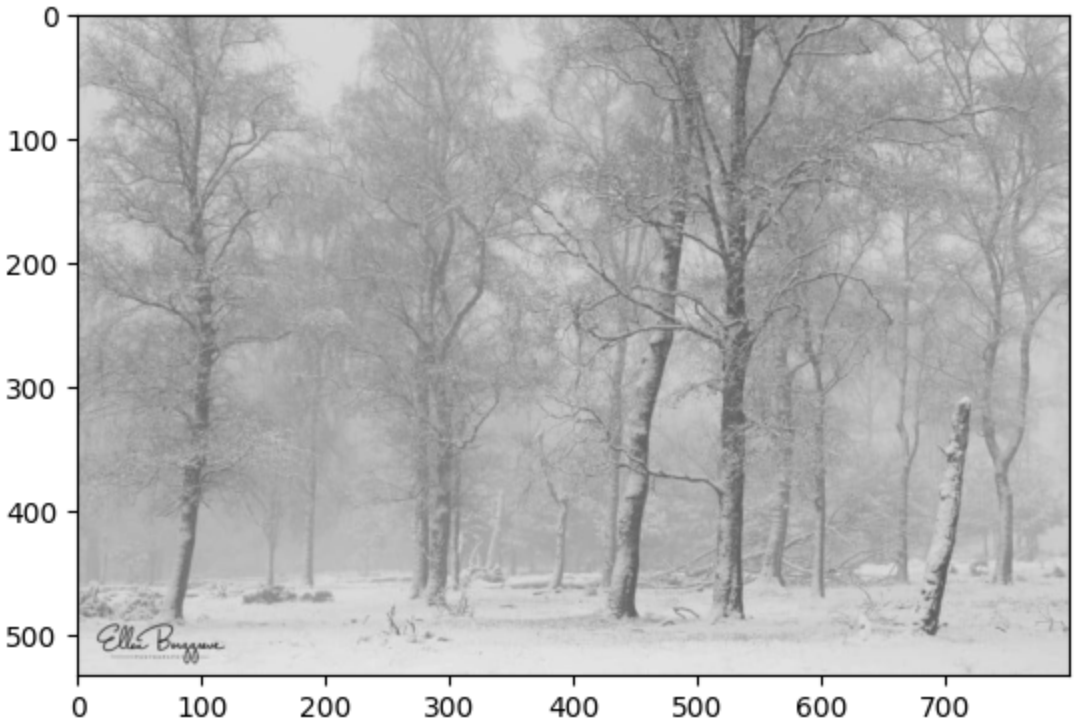
In [23]:
```
opening =cv2.morphologyEx(img_gray, cv2.MORPH_OPEN, kernel)
plt.imshow(opening, cmap ='gray')
```

Out[23]: <matplotlib.image.AxesImage at 0x7c8c7d282fe0>



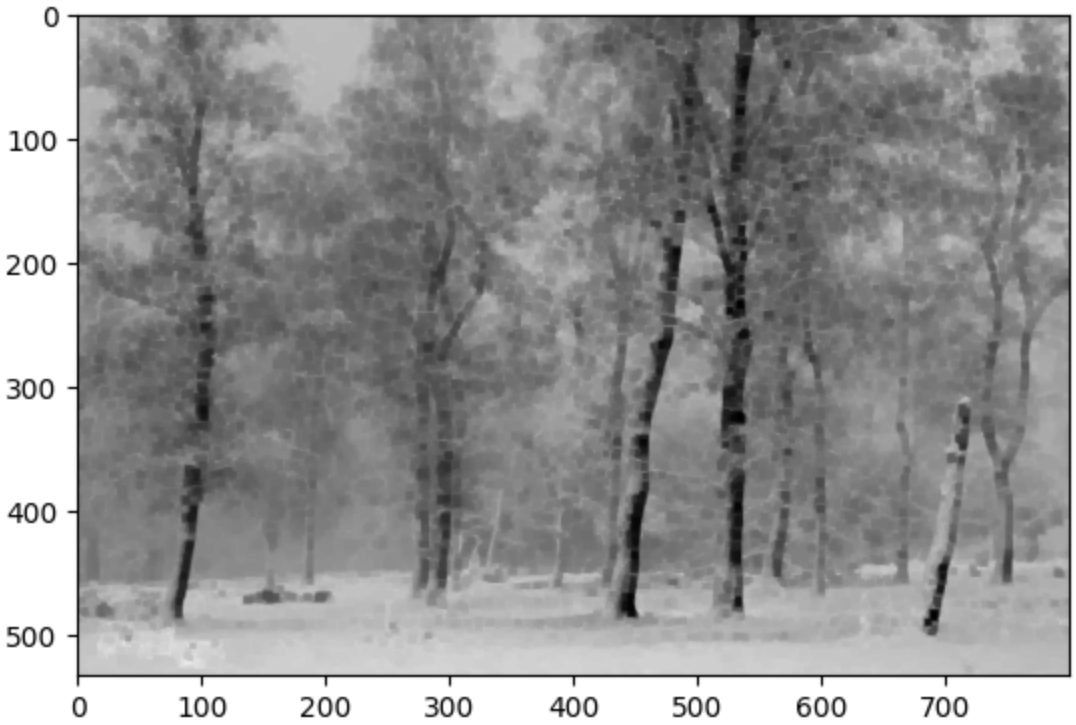
In [24]:
```
img=cv2.imread('piclowcontrast.jpg')
img_gray=cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(img_gray, cmap='gray')
```

Out[24]: <matplotlib.image.AxesImage at 0x7c8c7d2f5bd0>



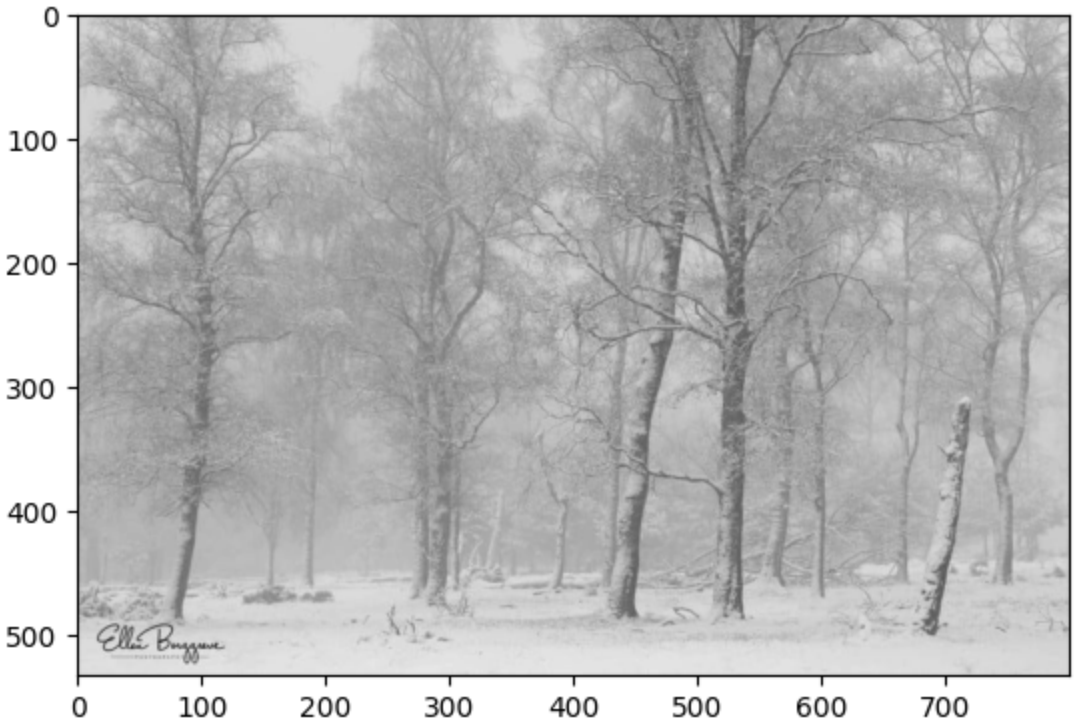
In [25]:
```
closing = cv2.morphologyEx(img_gray, cv2.MORPH_CLOSE, kernel)
plt.imshow(closing, cmap ='gray')
```

Out[25]: <matplotlib.image.AxesImage at 0x7c8c7d4eca00>



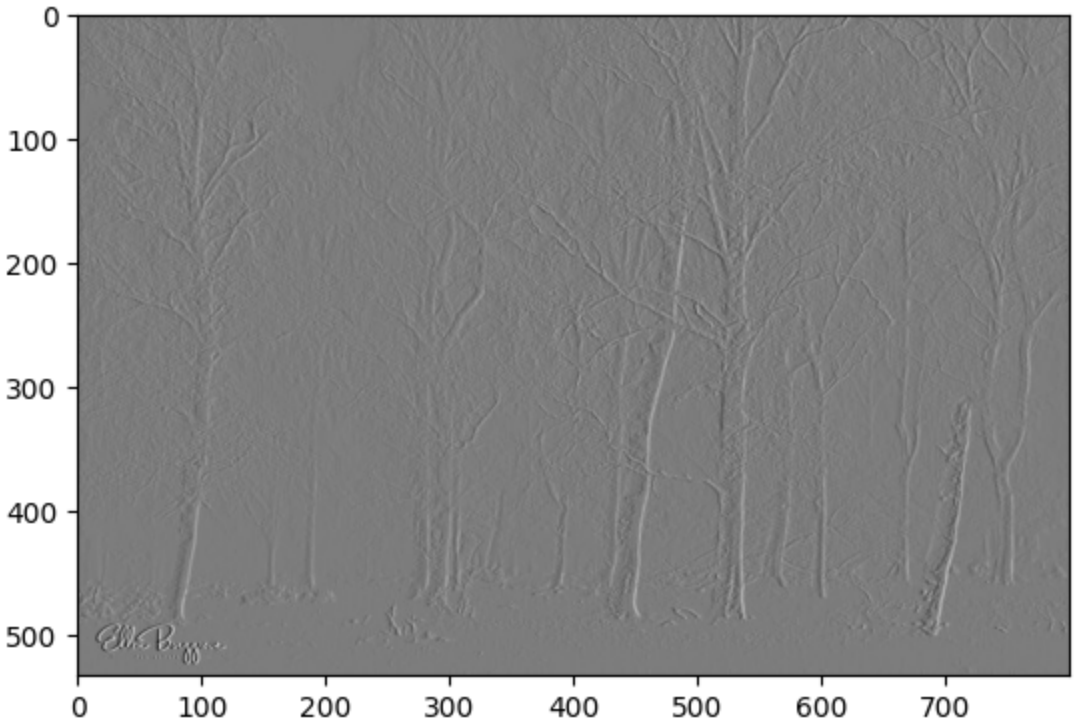
In [26]:
```
img=cv2.imread('piclowcontrast.jpg')
img_gray=cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(img_gray, cmap='gray')
```

Out[26]: <matplotlib.image.AxesImage at 0x7c8c7dc3a0e0>



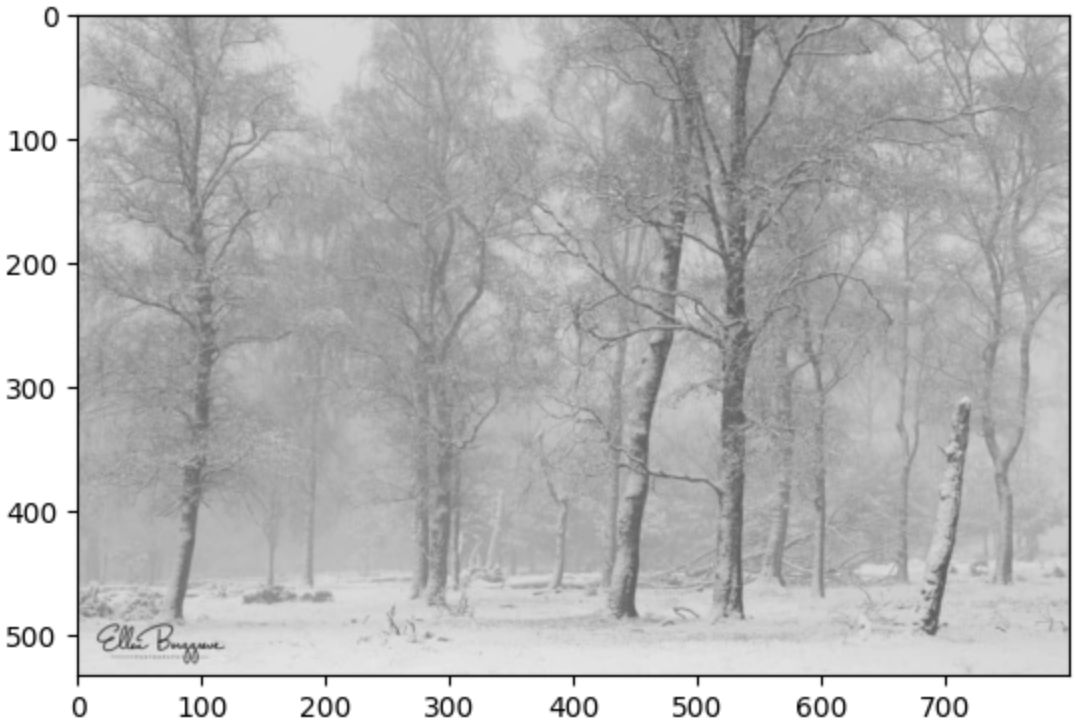
In [27]:
```
sobelx =cv2.Sobel(img_gray, cv2.CV_64F, 1, 0, ksize=1)
plt.imshow(sobelx, cmap = 'gray')
```

Out[27]: <matplotlib.image.AxesImage at 0x7c8c7dbafa00>



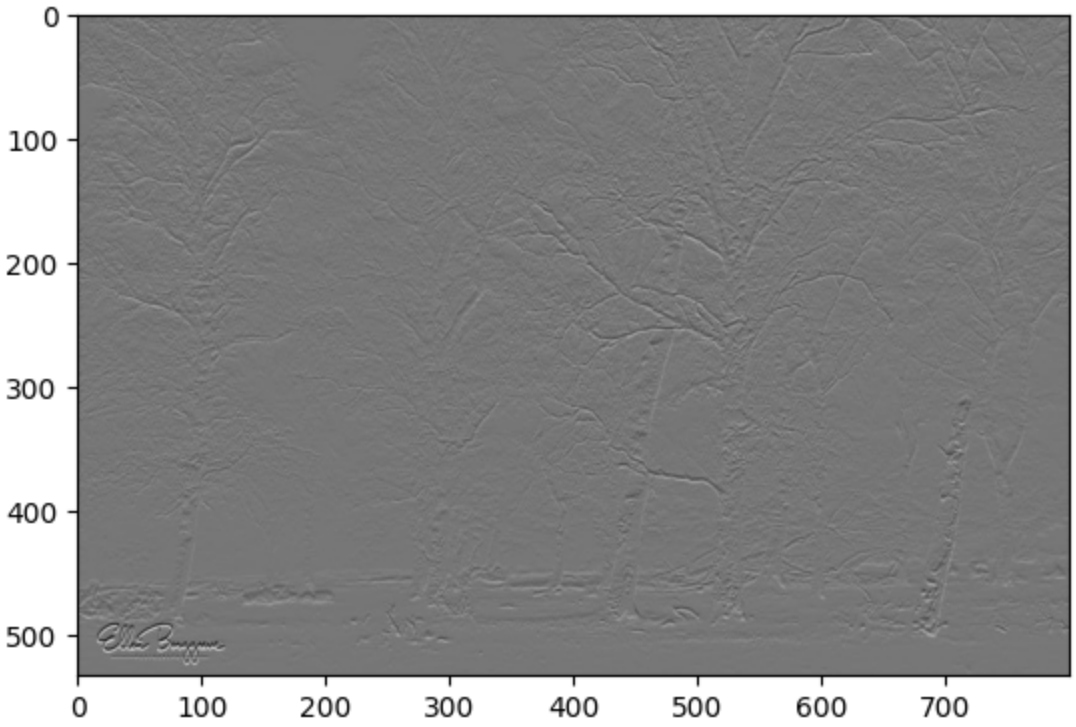
In [28]:
```
img=cv2.imread('piclowcontrast.jpg')
img_gray=cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(img_gray, cmap='gray')
```

Out[28]: <matplotlib.image.AxesImage at 0x7c8c7db19e40>



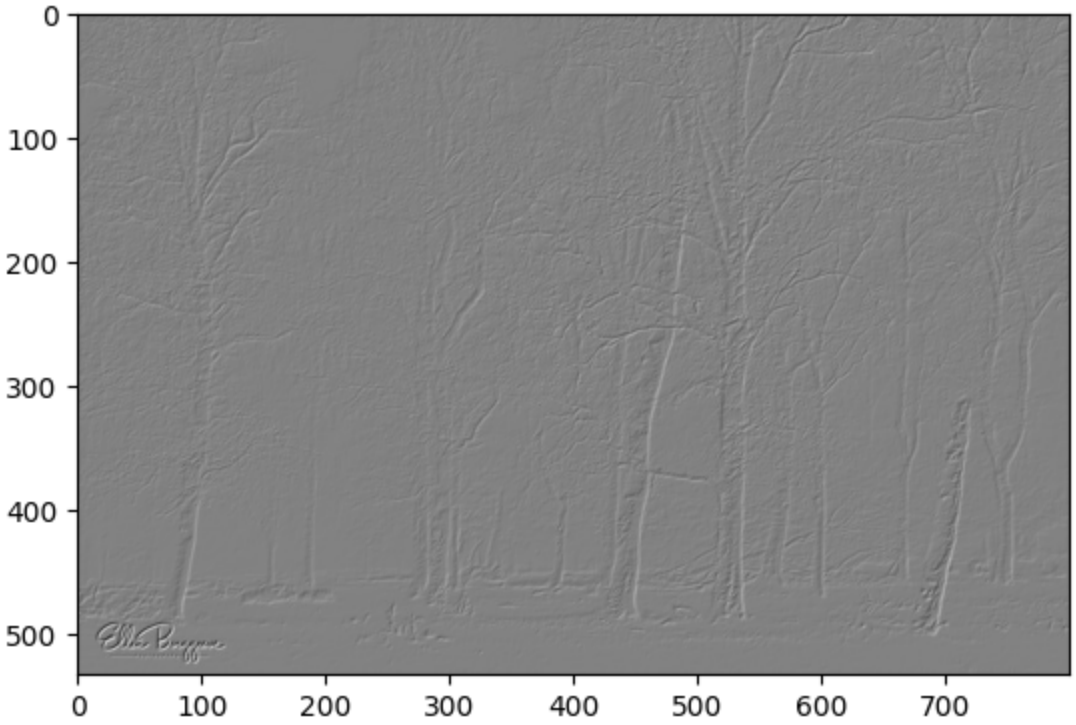
In [29]:
```
sobely =cv2.Sobel(img_gray, cv2.CV_64F, 0, 1, ksize=1)
plt.imshow(sobely, cmap = 'gray')
```

Out[29]: <matplotlib.image.AxesImage at 0x7c8c7dc57fa0>



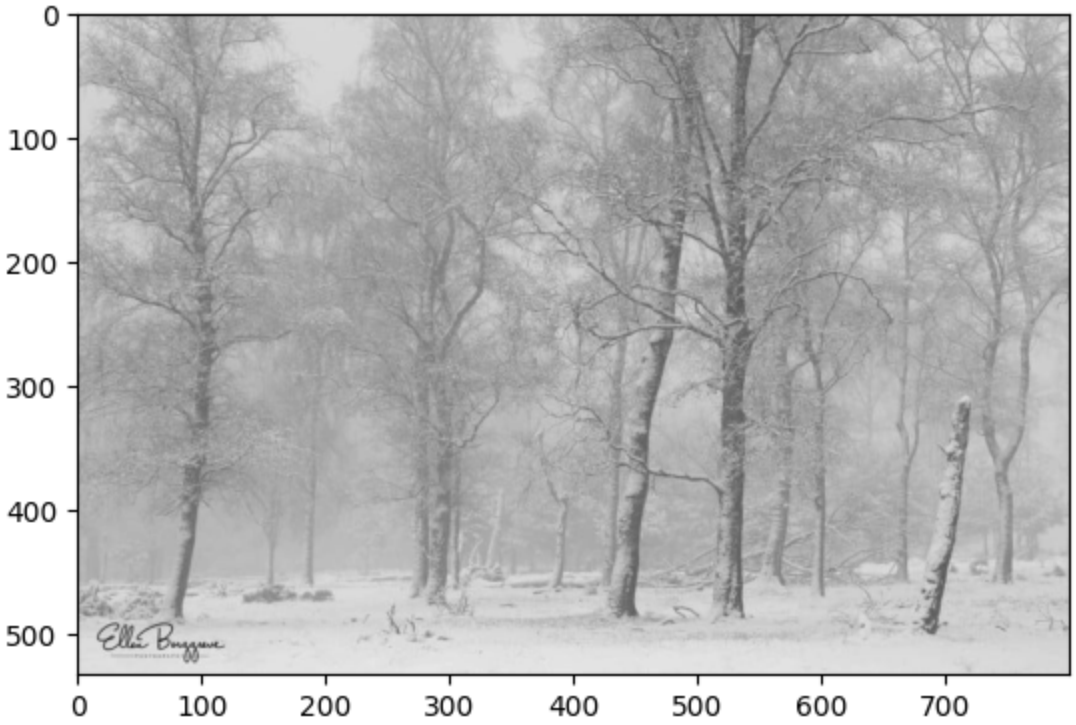
In [30]:
```
dst =cv2.addWeighted (sobelx, 0.5, sobely, 0.5, 0.8)
plt.imshow(dst, cmap= 'gray')
print(dst.shape)
```

```
(533, 800)
```



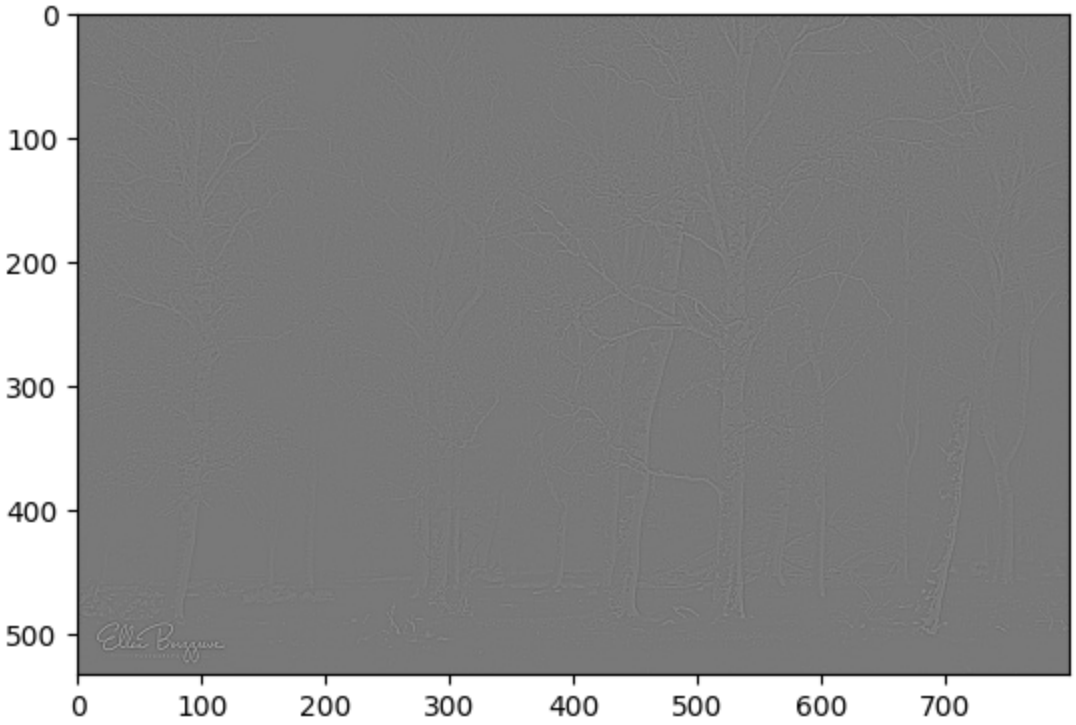
In [31]:
```
img=cv2.imread('piclowcontrast.jpg')
img_gray=cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.imshow(img_gray, cmap='gray')
```

Out[31]:
```
<matplotlib.image.AxesImage at 0x7c8c7d1caaa0>
```



In [32]:
```
laplacian =cv2.Laplacian(img_gray, cv2.CV_64F)
plt.imshow(laplacian, cmap='gray')
```

Out[32]:
```
<matplotlib.image.AxesImage at 0x7c8c7d00b580>
```



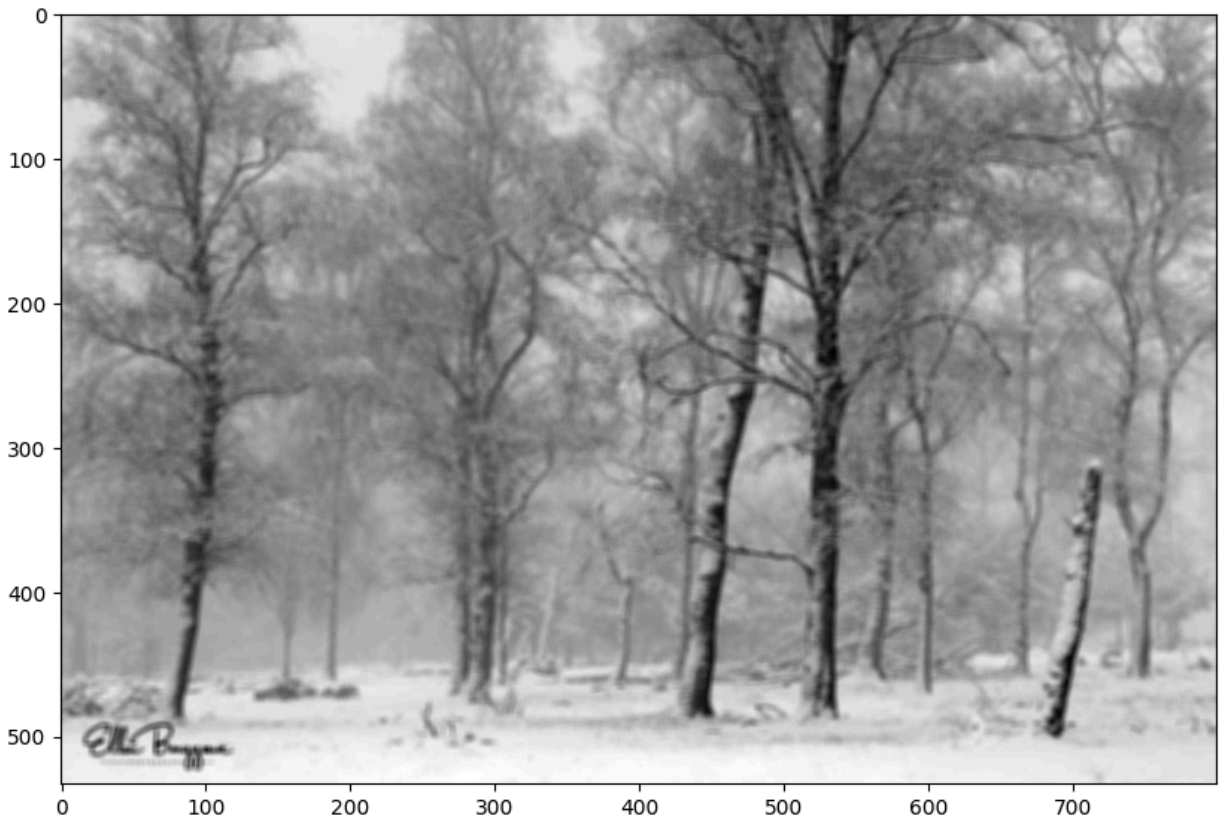
In [33]:
```
img=cv2.imread('piclowcontrast.jpg')
img_gray=cv2.cvtColor(img, cv2.COLOR_BGR2GRAY)
plt.figure(figsize=(10, 10))
plt.imshow(img_gray, cmap ='gray')
```

Out[33]:
```
<matplotlib.image.AxesImage at 0x7c8c7d071540>
```

In [34]:
```
img_blur=cv2.blur(img_gray, (5,5))
plt.figure(figsize =(10, 10))
```

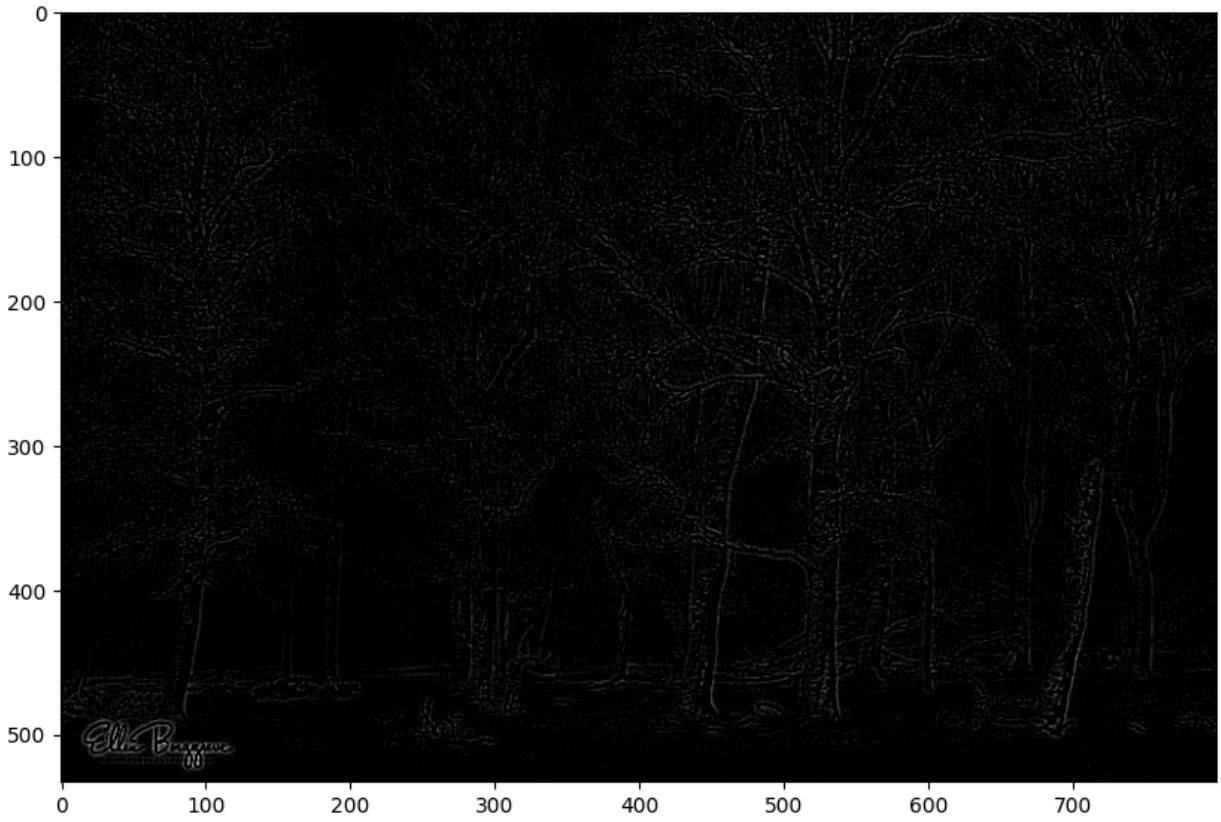
```
plt.imshow(img_blur, cmap= 'gray')
```

Out[34]:
```
<matplotlib.image.AxesImage at 0x7c8c7d0d2fe0>
```



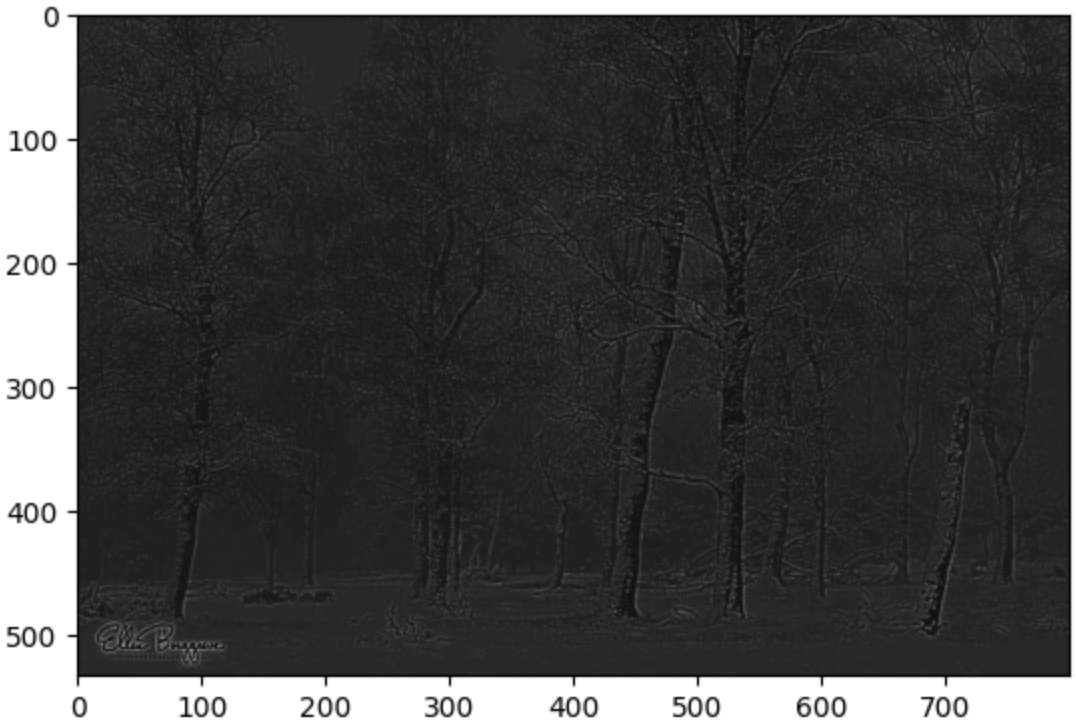
In [35]:
```
diff =cv2.subtract(img_gray, img_blur)
plt.figure(figsize =(10, 10))
plt.imshow(diff, cmap ='gray')
```

Out[35]:
```
<matplotlib.image.AxesImage at 0x7c8c7cf3ebf0>
```



In [36]:
```
final=cv2.addWeighted(img_gray, 0.1, diff, 0.9, 0.0)
plt.imshow(final, cmap='gray')
```

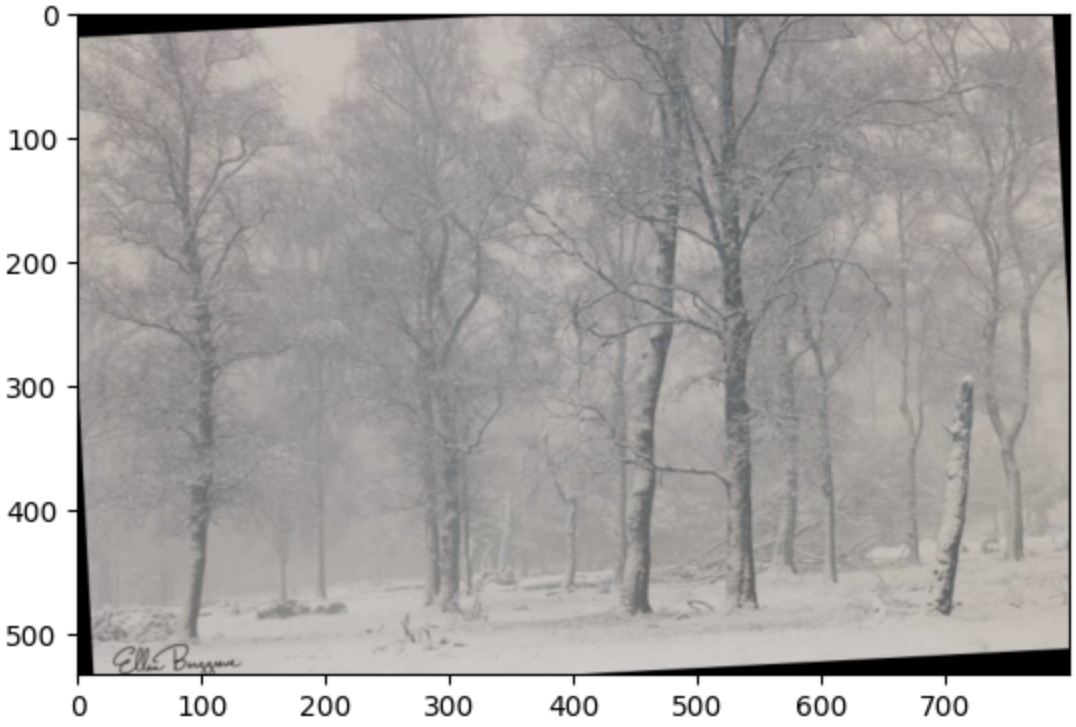
Out[36]:
```
<matplotlib.image.AxesImage at 0x7c8c7cfb9090>
```



In [37]:
```
img = cv2.imread('piclowcontrast.jpg')
(h, w) = img.shape[:2]
(cX, cY) = (w // 2, h // 2)
```

```
M = cv2.getRotationMatrix2D((cX, cY), np.random.randint(-5, 5), 1.0)
rotated = cv2.warpAffine(img, M, (w, h))
plt.imshow(rotated)
```

Out[37]: <matplotlib.figure.AxesImage at 0x7c8c7ce225c0>



In [ ]:
```
!jupyter nbconvert --to html  /content/TaAnhTuan_Lab3.ipynb
```