

Assignment-8: Morphological Image Irocessing

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Introduction

The morphological operations include:

- **Erosion:** Erosion removes pixels on object boundaries.
- **Dilation:** Dilation adds pixels on the object boundaries.
- **Opening:** The opening operation erodes an image and then dilates the eroded image, using the same structuring element for both operations.
- **Closing:** The closing operation dilates an image and then erodes the dilated image, using the same structuring element for both operations.

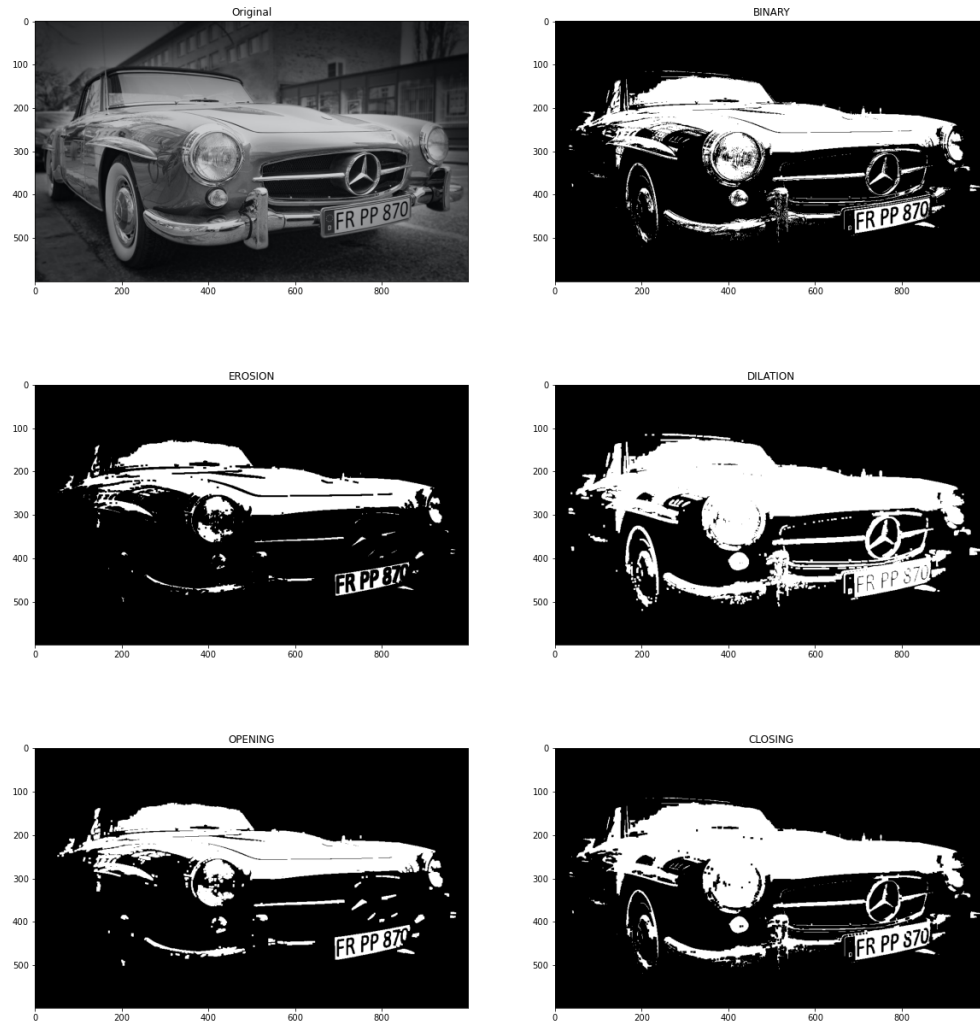
The number of pixels added or removed from the object in an image depends on the shape and size of the structuring element used to process the image. The structuring element is a matrix of 1's and 0's.



we'll now apply these three operations on this image

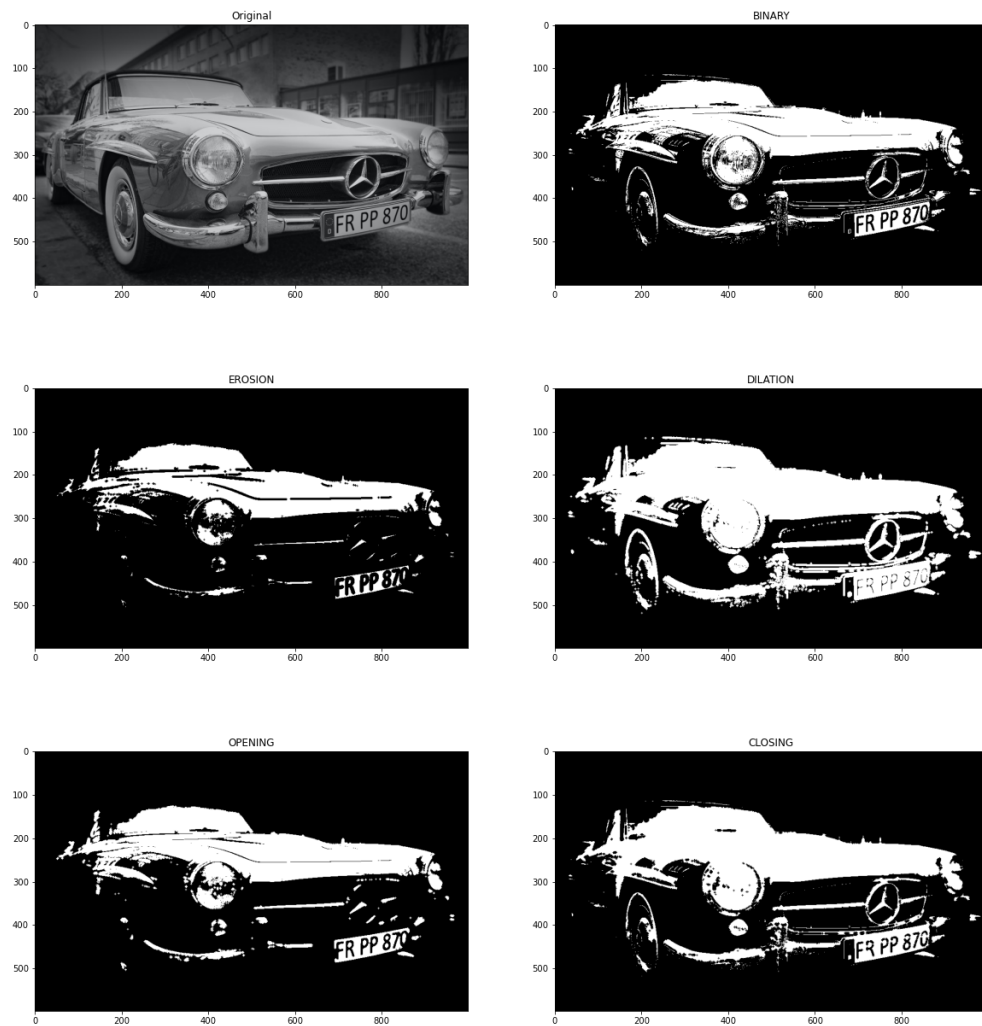
Implementation

```
1 import cv2
2 import matplotlib.pyplot as plt
3 import numpy as np
4
5 def main():
6     img_path = 'images/car.jpg'
7     img = plt.imread(img_path)
8     gray = cv2.cvtColor(img, cv2.COLOR_RGB2GRAY)
9
10    thresh = 128
11    binary = cv2.threshold(gray, thresh, 255, cv2.THRESH_BINARY)[1]
12    kernel = cv2.getStructuringElement(cv2.MORPH_RECT, (4,4))
13    # kernel = np.array([[0, 1, 1, 1, 0],
14    #                     [1, 0, 0, 0, 1],
15    #                     [1, 0, 0, 0, 1],
16    #                     [1, 0, 0, 0, 1],
17    #                     [0, 1, 1, 1, 0]], dtype='uint8')
18
19    erosion = cv2.erode(binary, kernel, iterations=1)
20    dilation = cv2.dilate(binary, kernel, iterations=1)
21    opening = cv2.morphologyEx(binary, cv2.MORPH_OPEN, kernel)
22    closing = cv2.morphologyEx(binary, cv2.MORPH_CLOSE, kernel)
23
24    def plot_img(img_set, title_set):
25        n = len(img_set)
26        plt.figure(figsize = (20, 30))
27        for i in range(n):
28            img = img_set[i]
29            ch = len(img.shape)
30
31            plt.subplot(4, 2, i + 1)
32            if (ch == 3):
33                plt.imshow(img_set[i])
34            else:
35                plt.imshow(img_set[i], cmap='gray')
36            plt.title(title_set[i])
37        plt.savefig('./Output.png')
38
39    img_set = [img, binary, erosion, dilation, opening, closing]
40    title_set = ['Original', 'BINARY', 'EROSION', 'DILATION', 'OPENING', 'CLOSING']
41    plot_img(img_set, title_set)
42
43    if __name__ == '__main__':
44        main()
```



Here in this figure we can see that after applying structuring element of rectangular 4×4 matrix, Erosion reduces the white pixels. On the other hand Dilation increases white pixels.

we can apply some other kernels too to see the changes in the output image. here's other outputs,



This is what we get after applying structuring element of arrow 5*5 matrix.