

HOMework 2 U2

MORPHOLOGICAL OPERATIONS 2

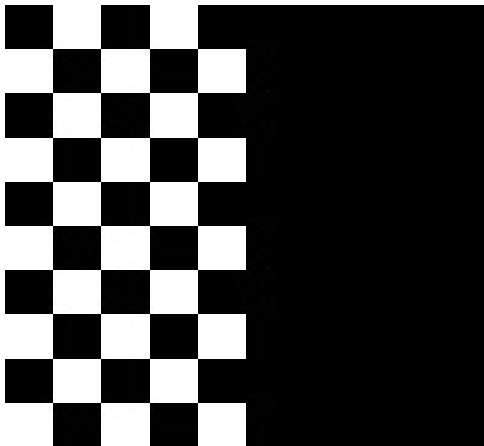
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Abstract—In this report, we documented the first of three homework assignments related to morphological transformations. Particularly, in this activity we used two important OpenCV commands: Dilation and Erode.

Index Terms—OpenCV, Erode, Dilate, Bitwise-or, Morphology.

1 PROBLEM TO SOLVE

From the following image:



Perform a hit-or-miss transform on the half checkerboard image.

Answer this question before you test it:

- Which pattern do you detect by performing a hit and miss with this interval on the half checkerboard image?

Then, answer the following:

- Did it match?
- What happens in the middle of the checkerboard pattern?
- How should the structuring elements be designed in order to detect the top left corner of all the white squares?

2 CODING PROCESS

Similar to previous exercises, first we imported the libraries necessary for the program with the commands:

```
import cv2 as cv
import numpy as np
```

In order to implement or morphological operation, we need to be able to read the values of our input image. Thus, we used the following line:

```
img_dimensions = image[ 0:100, 0:50, 2 ]
```

The following step was the recognition of the kernel matrix patterns. Previous to the activity, the teacher gave us the following image to recognize the correct patterns.

$$s_1 : \begin{bmatrix} 0 & 0 & 0 \\ 1 & 1 & 0 \\ 0 & 1 & 0 \end{bmatrix}, \quad s_2 : \begin{bmatrix} 0 & 1 & 1 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix}.$$

Taking into consideration the nature of the Hit or Miss operation, we can say the first structuring element of the image above can be considered as a "Hit" operation, in other words, a value of 1. The second structuring element is the "Miss" operation, in contrast with the

first operation, the "Miss" operation can be considered as a value of -1. We created our Kernel matrix based on this analogy, the results are:

$$\begin{bmatrix} 0 & -1 & -1 \\ 1 & 1 & -1 \\ 0 & 1 & 0 \end{bmatrix}$$

Then, we apply the morphological operation "Hit or Miss" with the following code line:

```
output_image = cv.morphologyEx(
    img_dimentions, cv.MORPH_HITMISS,
    kernel_matrix)
```

Finally, we print results:

```
cv.imshow("Kernel", kernel_matrix)
cv.imshow("Original_Image", image)
cv.imshow("Hit or Miss", output_image)
```

3 QUESTIONS

3.1 BEFORE COMPLETE THE EXERCISE: WHICH PATTERN DO YOU DETECT BY PERFORMING A HIT AND MISS WITH THIS INTERVAL ON THE HALF CHECKERBOARD IMAGE?

In order to solve our exercise, first we have to define the values of the Kernel matrix. I consider the best option to solve this image is having a matrix:

$$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -1 & 1 \\ 0 & 1 & 0 \end{bmatrix}$$

3.2 AFTER COMPLETE THE EXERCISE: DID IT MATCH?

After completing the exercise, we realized the final results and it did not match in comparison to what we originally thought. There were a lot of differences because the original analytic process was very different.

3.3 WHAT HAPPENS IN THE MIDDLE OF THE CHECKERBOARD PATTERN?

In the middle of the output results, we were able to identify some white squares left. This can be explained due to the precision of the morphological operation, we can iterate once more or the times needed in order to make reduce the number of squares.

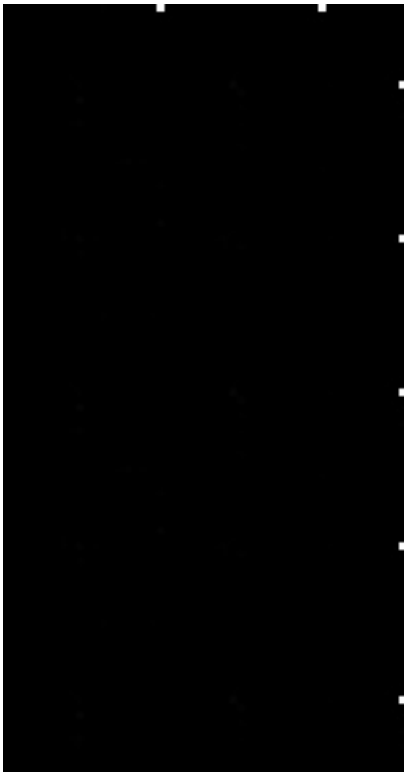
3.4 HOW SHOULD THE STRUCTURING ELEMENTS BE DESIGNED IN ORDER TO DETECT THE TOP LEFT CORNER OF ALL THE WHITE SQUARES?

I consider the answer depends on the patterns we are able to identify in our input image and the Kernel matrix. If we identify the pattern in our input image correctly, then we can use these same patterns in our Kernel matrix and have the desired results.

4 RESULTS:



Kernel Matrix



Output Results

REFERENCES

- [1] "OpenCV: Hit-or-Miss", Docs.opencv.org, 2020. [Online]. Available: https://docs.opencv.org/master/db/d06/tutorial_hitOrMiss.html. [Accessed: 16- Oct- 2020].



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