MP2 - Morphological Operators
Logan Boswell

Overview

This MP is focused on developing functions for implementing the dilation, erosion, opening, closing, and boundary morphological operators. In order to implement these operators, a function is written for each operator. Each function takes in an image and a structuring element as arguments.

Dilation

For this operation, new white pixels are added based on the structuring element centered at each white pixel in the original image, so the number of white pixels is increased. In my dilation function, the np.argwhere() function is used to determine a list of locations for all of the white pixels. Once this list is determined, I loop through each of these locations and change the values of the surrounding pixels based on the structuring element.

Erosion

For this operation, white pixels are removed based on the structuring element centered at each white pixel in the original image. Only pixels that have the correct neighboring white pixels that match the structuring element are kept in the image. In my erosion function, the np.argwhere() function is used to determine a list of locations for all of the white pixels and a completely black image is defined. Once this list is determined, I loop through each of these locations and check if the sum of the values of the neighboring pixels based on the dimensions of the structuring element match the sum of the values of the structuring element. If the two sums are the same, I change the value of the pixel at the current location in the black image.

Opening

This operation consists of combining the dilation and erosion operations. In my opening function, the erosion function is called first and then its output image is used when calling the dilation function, resulting in the opened image.
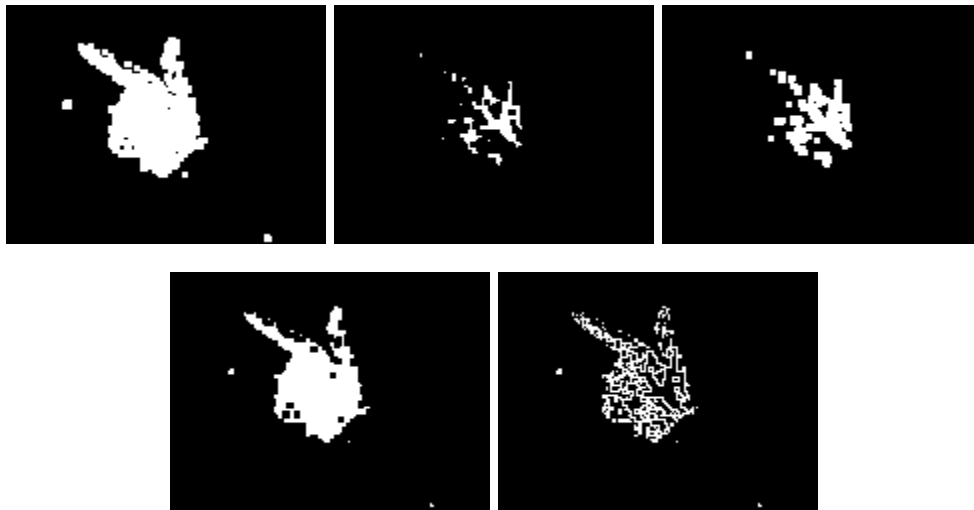
Closing

This operation consists of combining the dilation and erosion operations. In my closing function, the dilation function is called first and then its output image is used when calling the erosion function, resulting in the closed image.
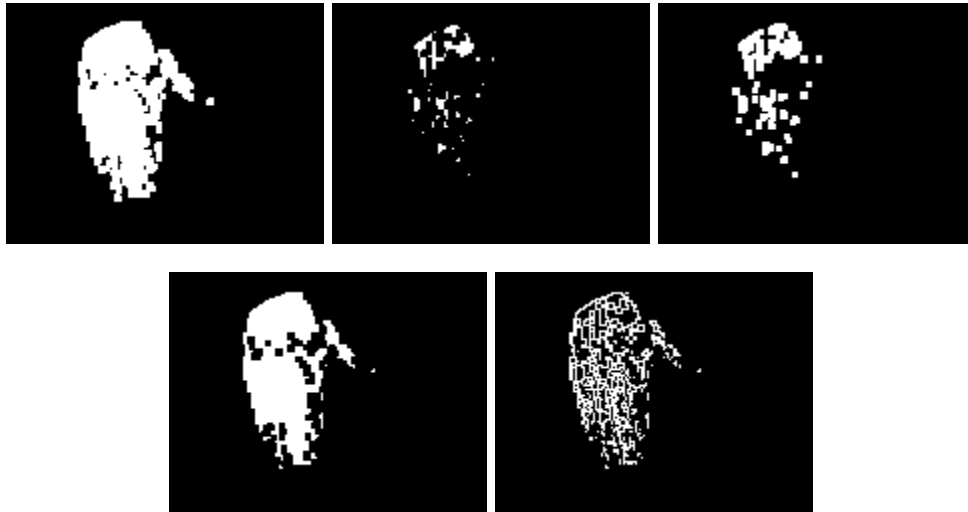
Boundary

This operation is based on the erosion operation. In order to obtain the boundary image, an eroded image is generated using the eroded operation and this image is subtracted from the original image.
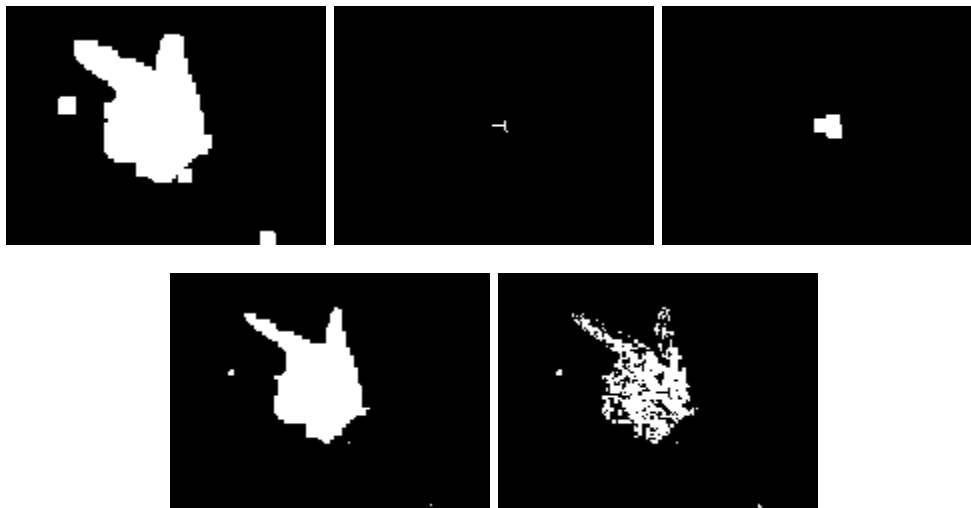
Results

Here are the testing results with the gun.bmp image and a 3x3 structuring element. The images in order from the top left are dilation, erosion, opening, closing, and boundary.

Here are the testing results with the palm.bmp image and a 3x3 structuring element. The images in order from the top left are dilation, erosion, opening, closing, and boundary.

Here are the testing results with the gun.bmp image and a 7x7 structuring element. The images in order from the top left are dilation, erosion, opening, closing, and boundary.

Here are the testing results with the palm.bmp image and a 7x7 structuring element. The images in order from the top left are dilation, erosion, opening, closing, and boundary.
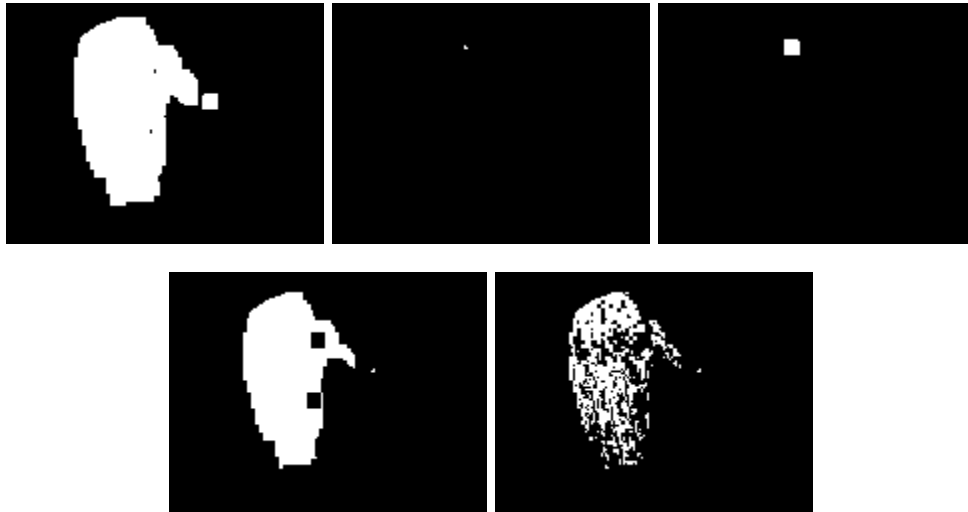
Here are the best boundary images I achieved for the gun and palm.