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MSAI 495 Computer Vision
MP #2

Morphological Operators Report

In this assignment we implement five basic morphological operations: *erosion, dilation, opening, closing, and boundary.* These functions are useful for masking noisy bitwise images for downstream image processing tasks.

All operators work by passing a small (3x3, 5x5, etc.) kernel over all pixels in a bitwise image. Whether or not the pixel in the resulting image at the center of the kernel is marked with a 1 is how the operations differ. This also depends on the composition of the kernel, but in this assignment the kernel is a square with all 1s. Erosion requires all pixels in the kernel to be 1, while dilation only requires 1 pixel in the kernel to be 1. In general, erosion removes sparse pixel collections while dilation expands sparse pixel collections. Opening and closing are compositions of these operations, where opening is the erosion then a dilation, while closing is a dilation followed by an erosion. These have the effect of smoothing the boundaries of the image. Specifically, opening removes thin rays from a cluster of 1s, while closing removes small collections of 0s when surrounded by 1s. Finally, the boundary is the difference between an image and the eroded image, where difference means bitwise subtraction. This boundary function is sensitive to noise, so we chain these operations to deviates.

After producing a representative image with each function written, to produce a proper boundary for the hand images, we began by limiting ourselves to two intermediate operations before the boundary calculation. After some trial and error with the functions and kernel sizes, the best results were found with a closing operation with a 9x9 kernel, followed by an opening operation with a 5x5 kernel. The resulting boundaries of the hand images are shown below.