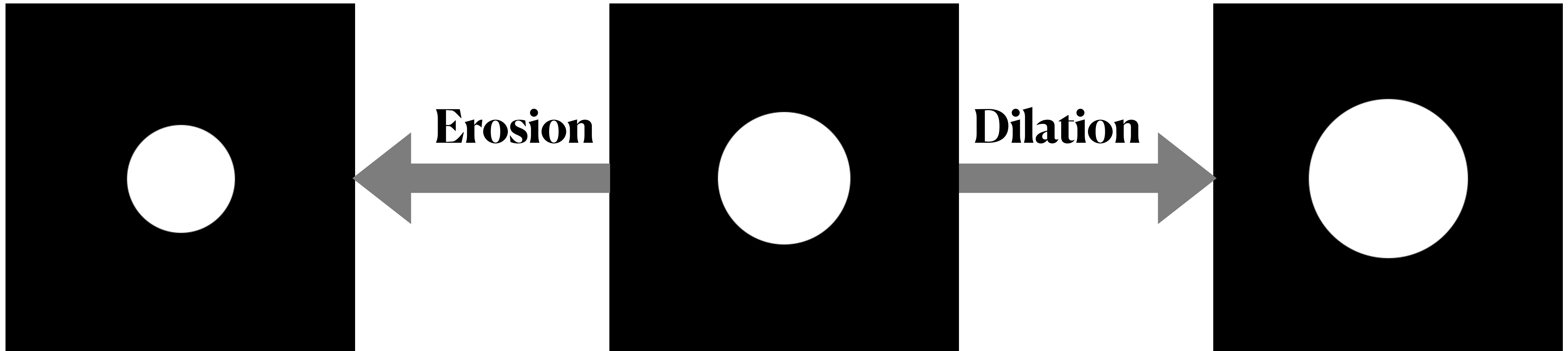


# Morphological Filters

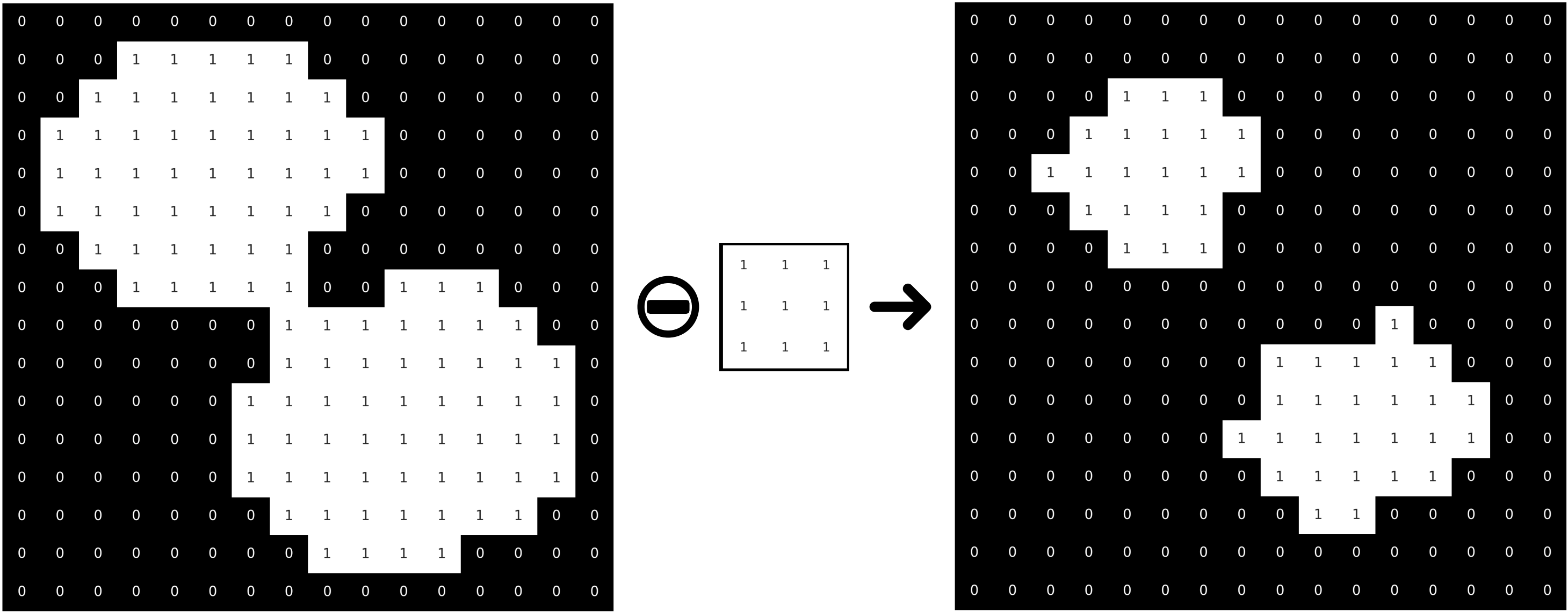
# Two Primary Morphological Operations

**Erosion**

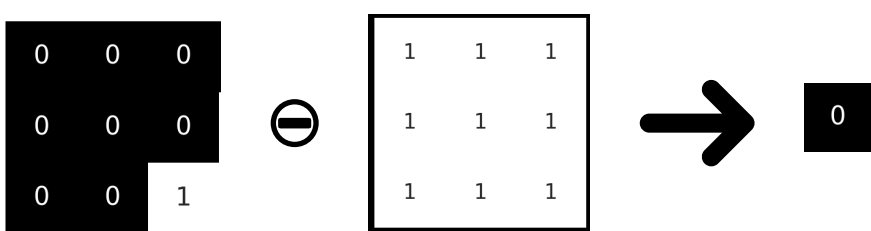
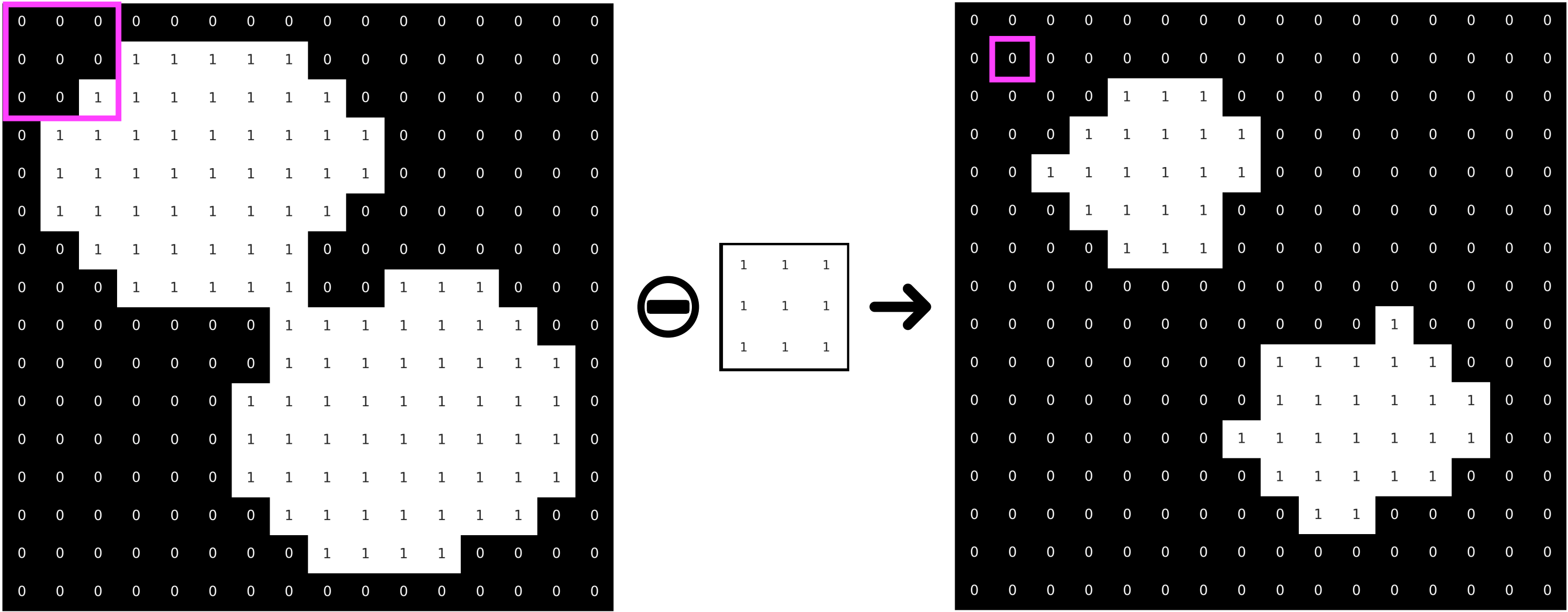
**Dilation**



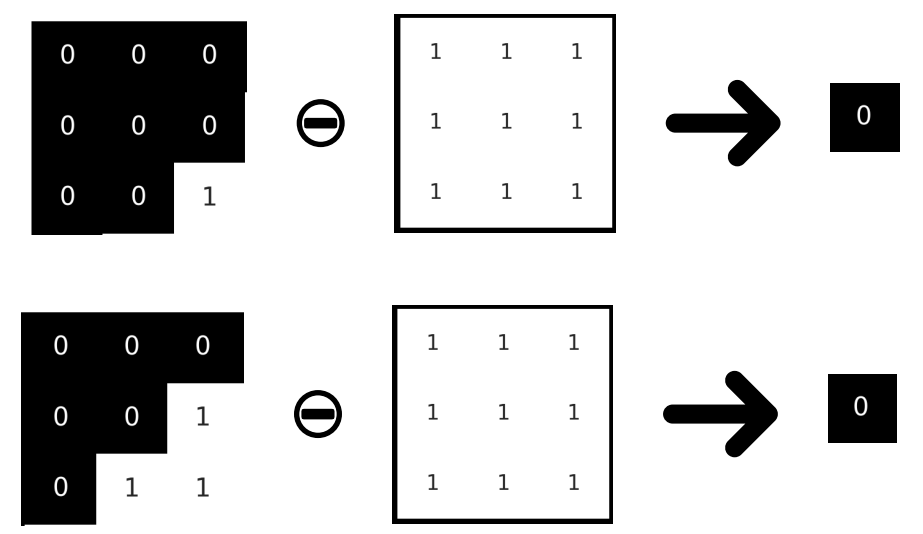
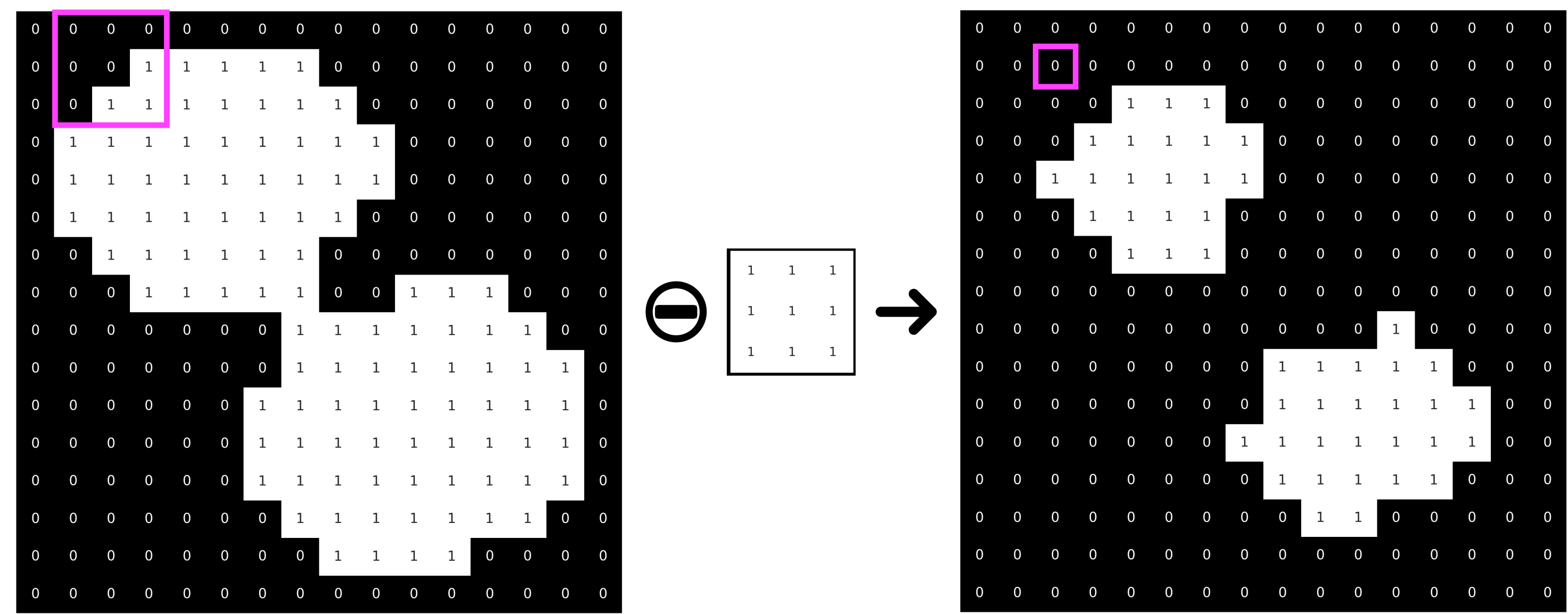
# Erosion Operation



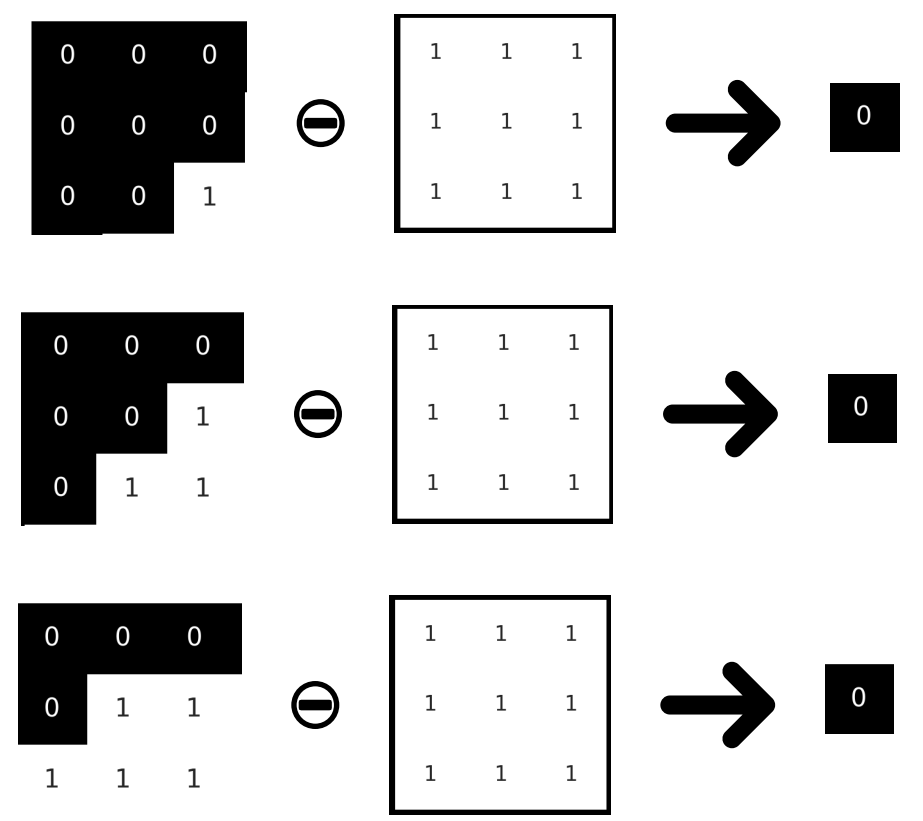
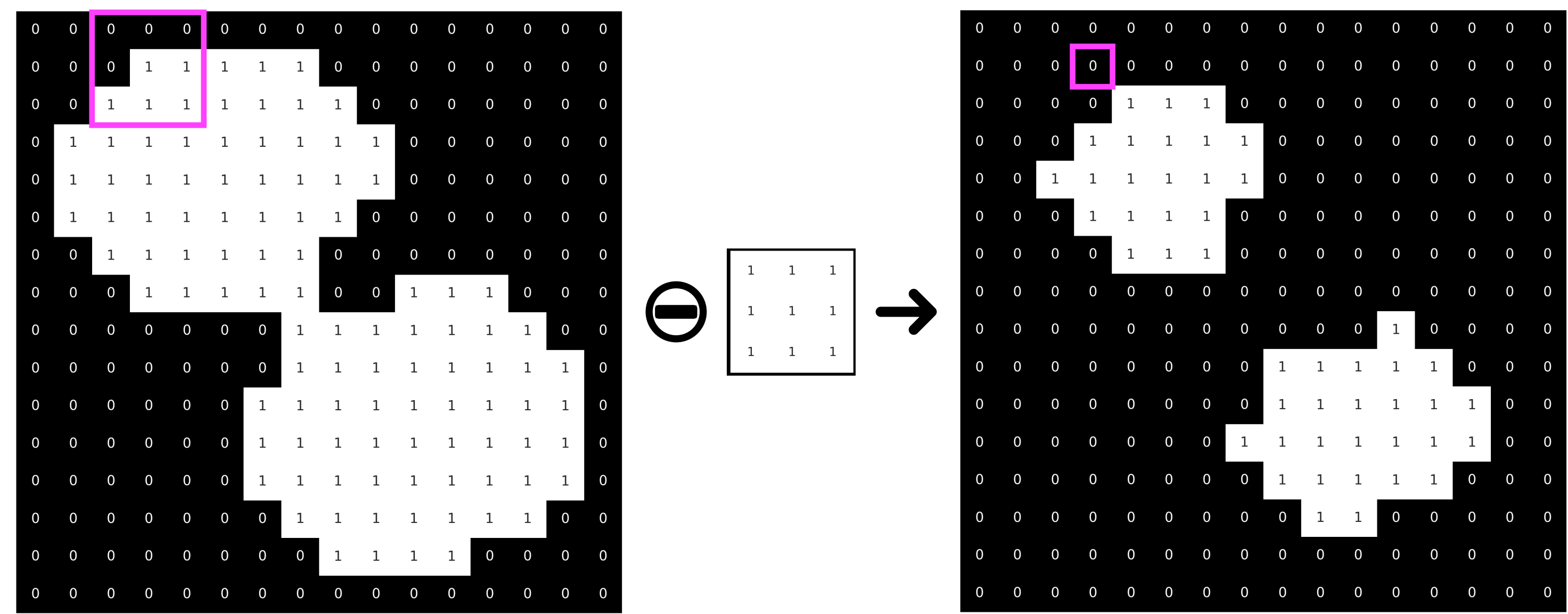
# Erosion Operation



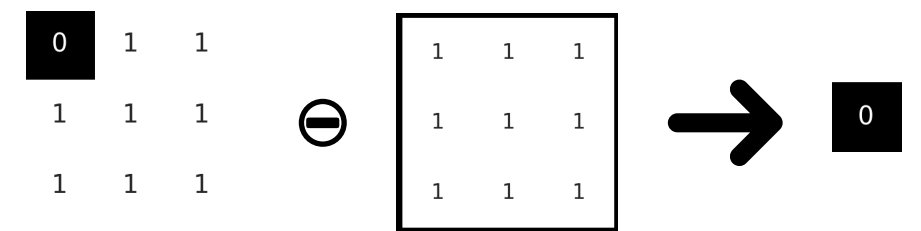
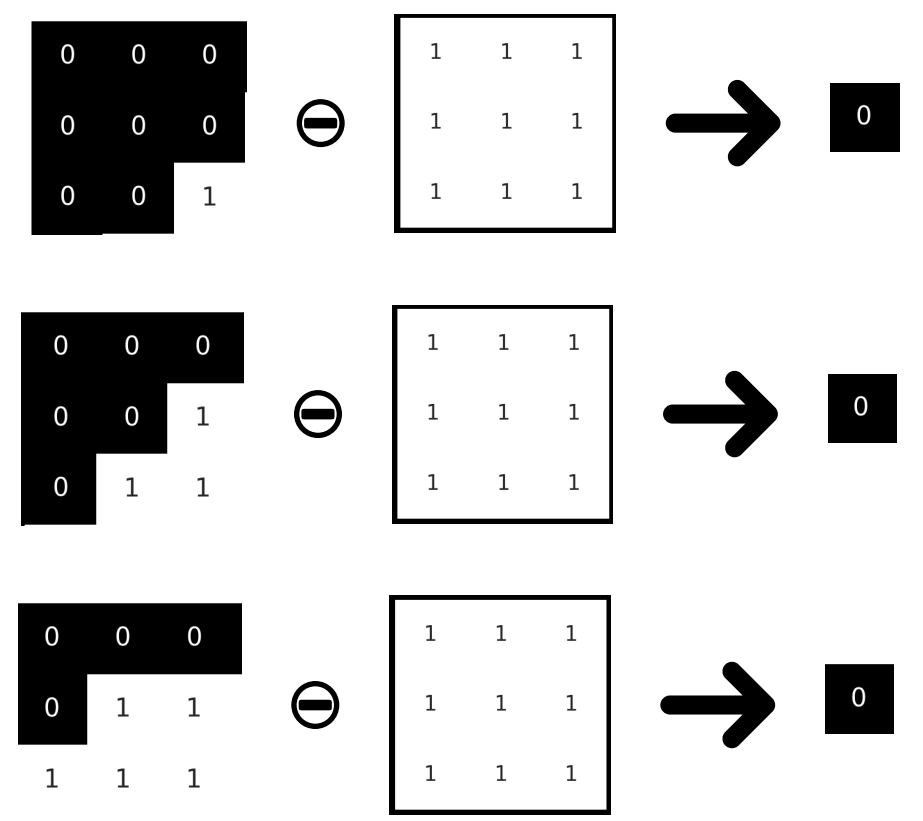
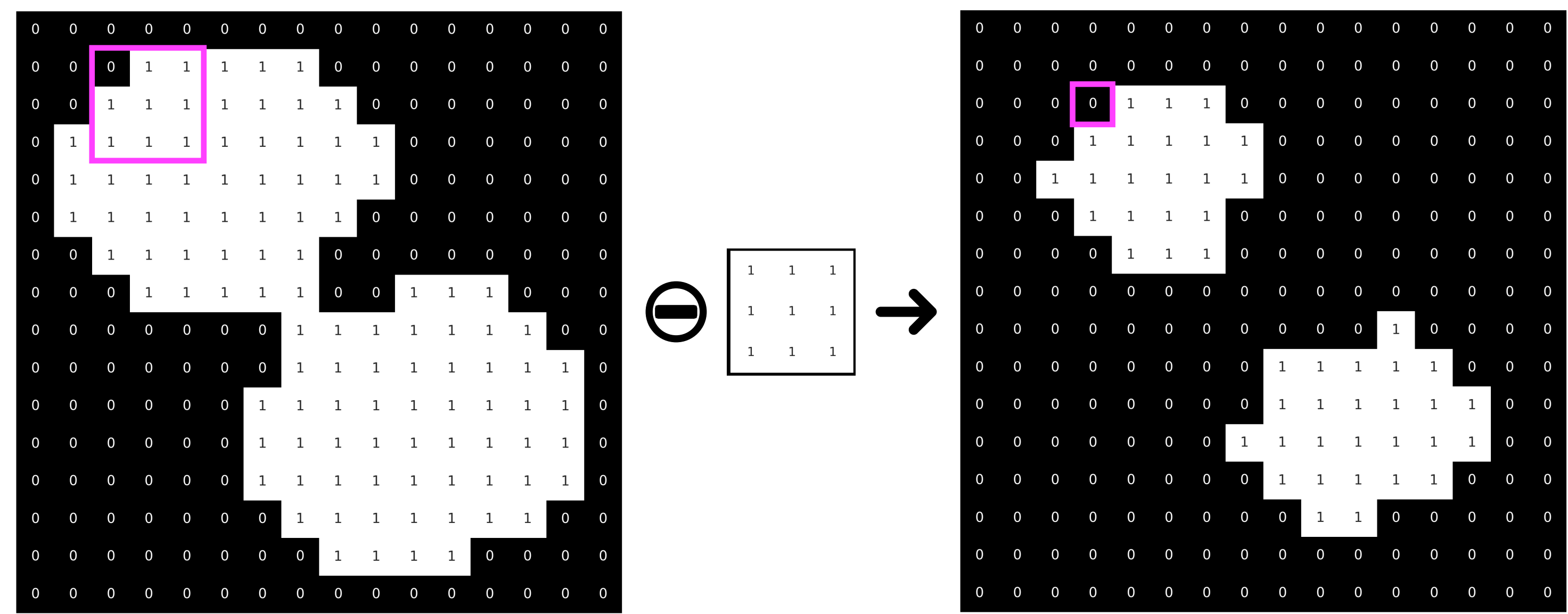
# Erosion Operation



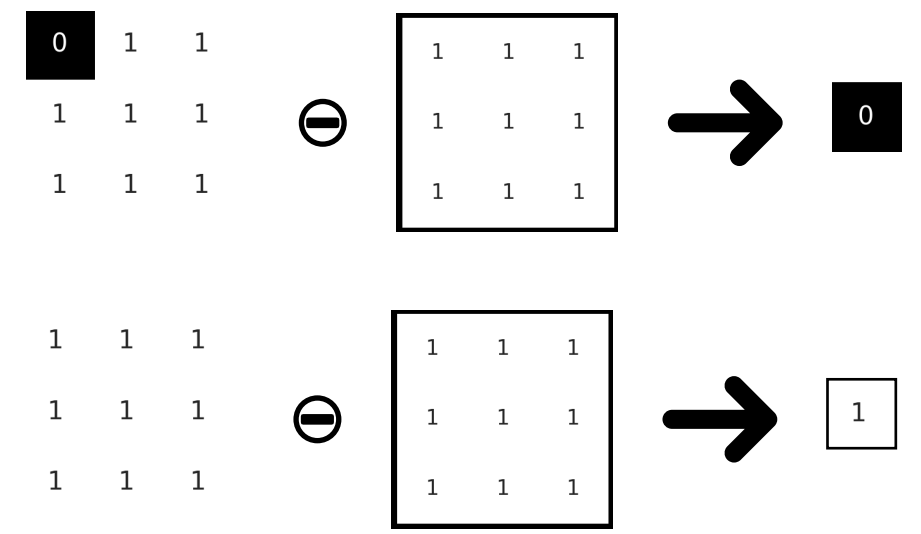
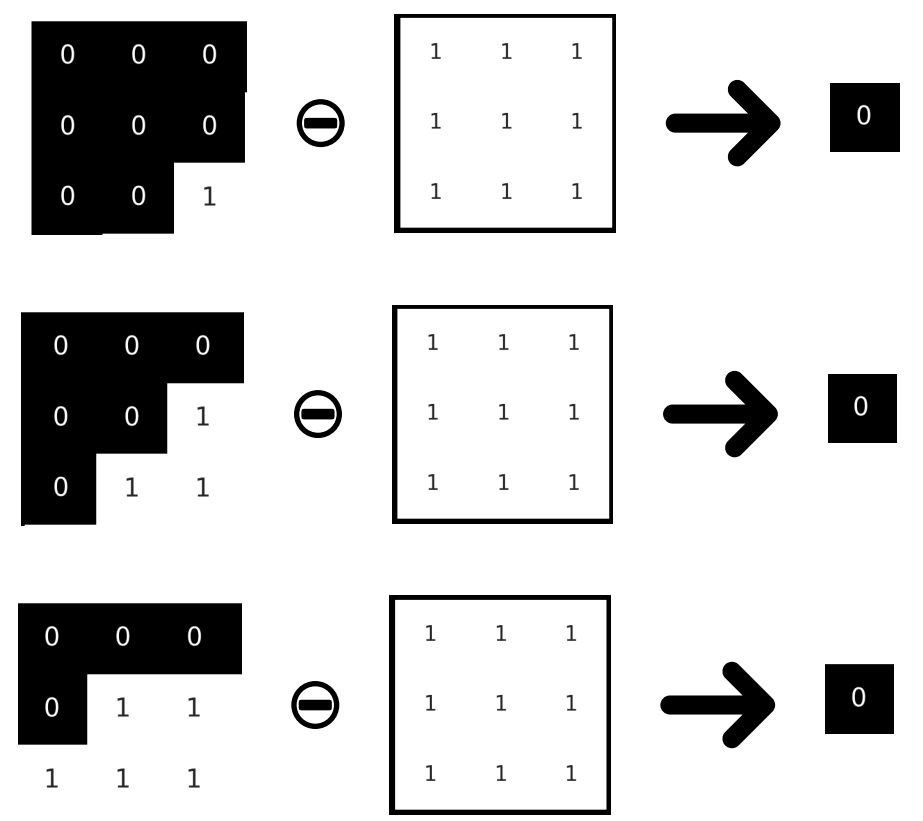
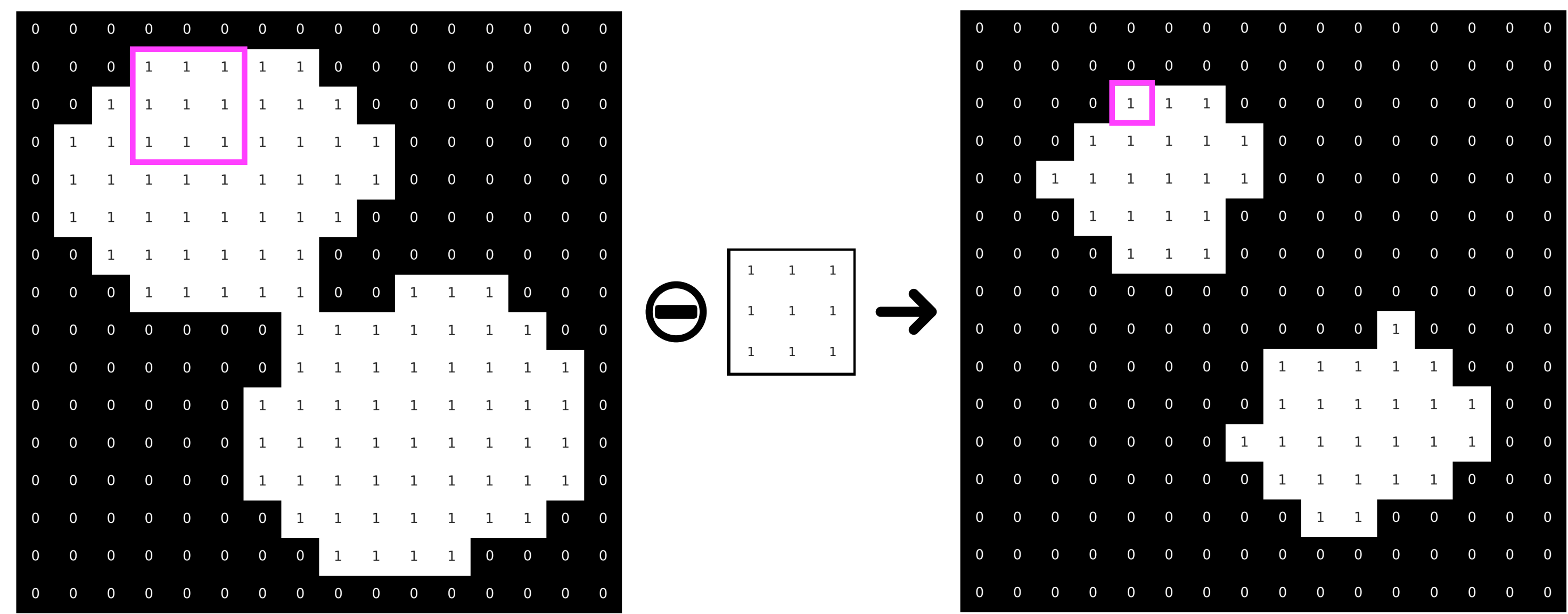
# Erosion Operation



# Erosion Operation

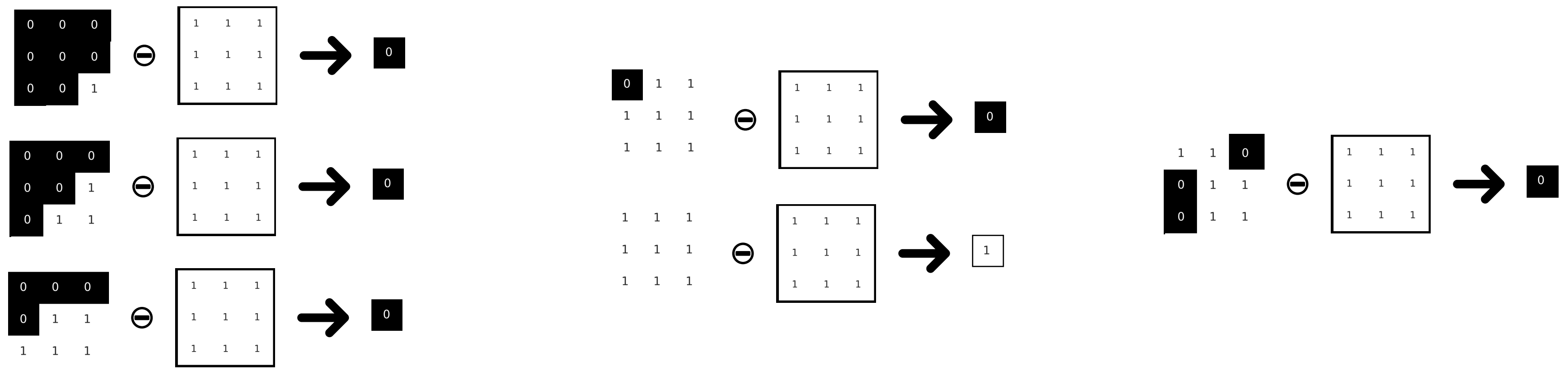
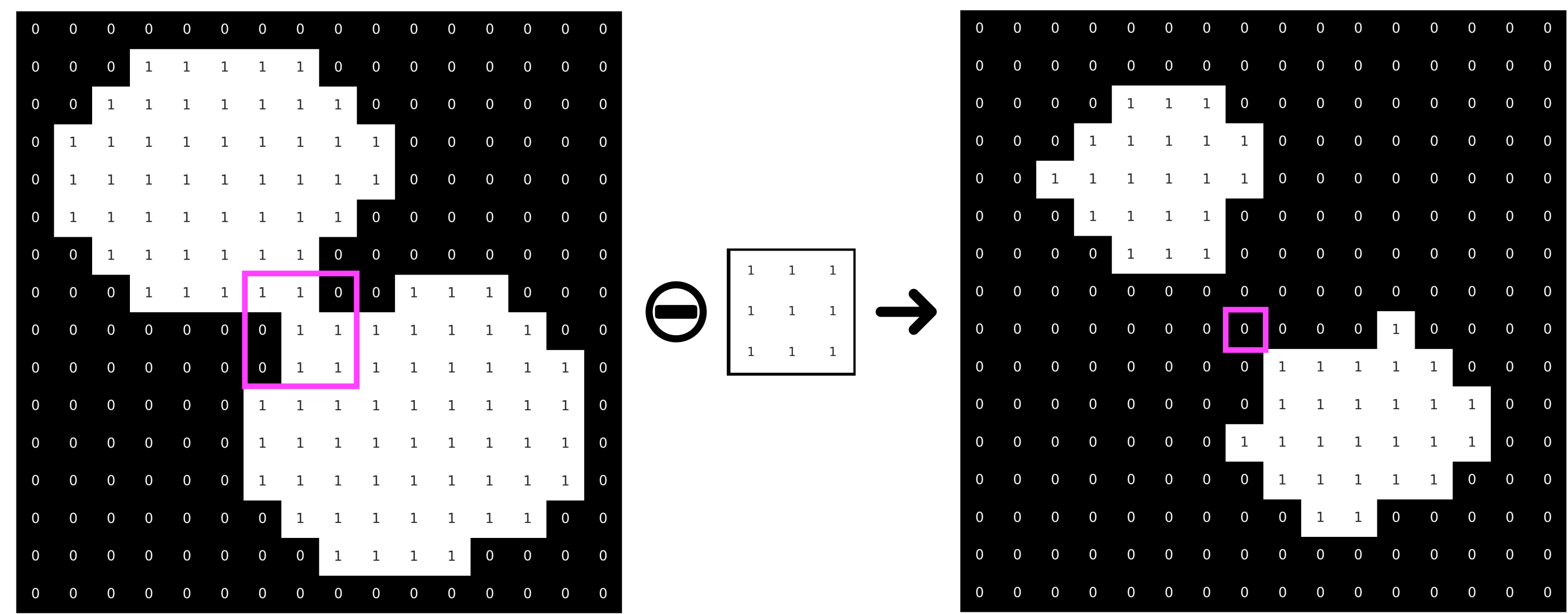


# Erosion Operation

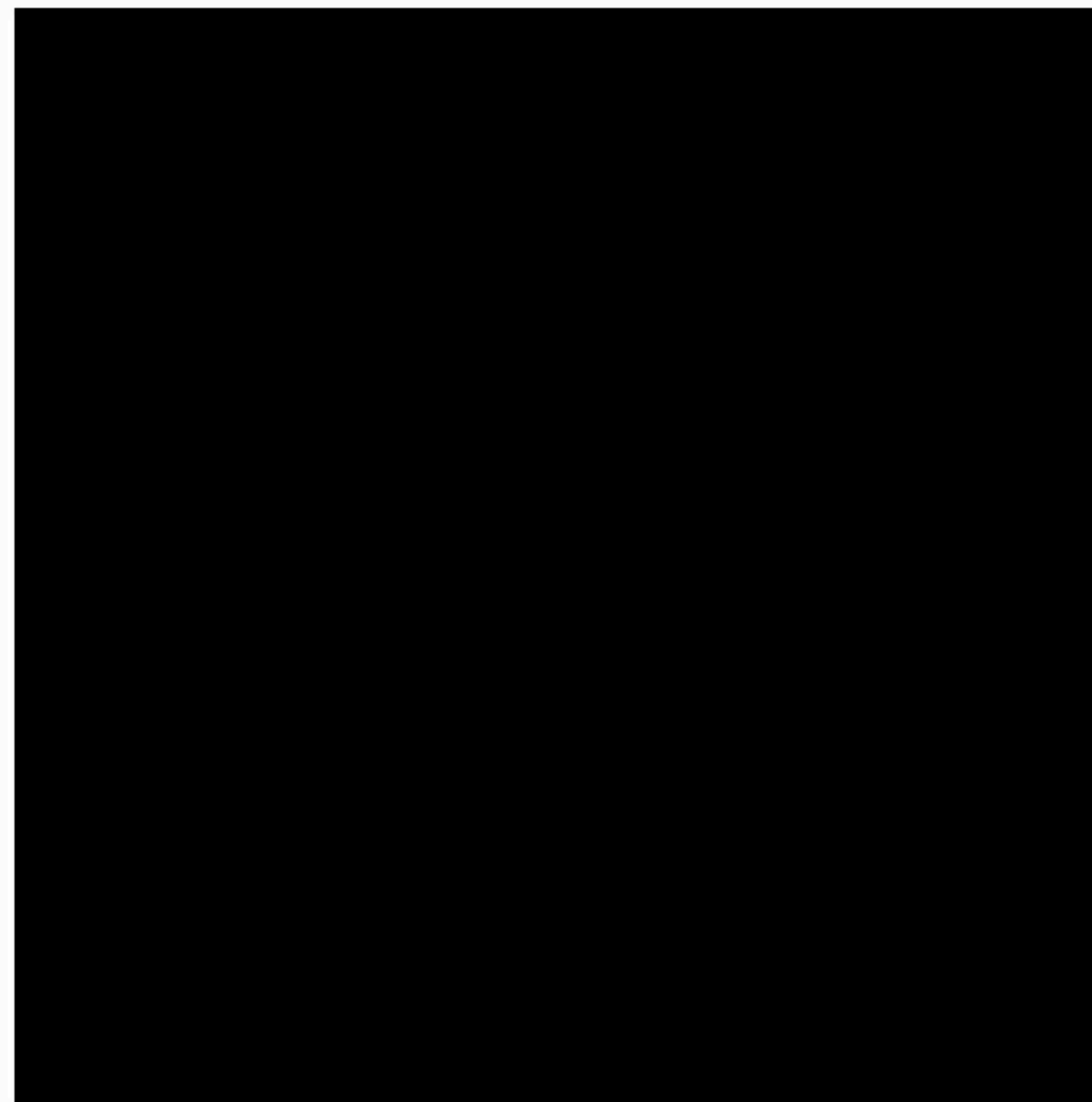
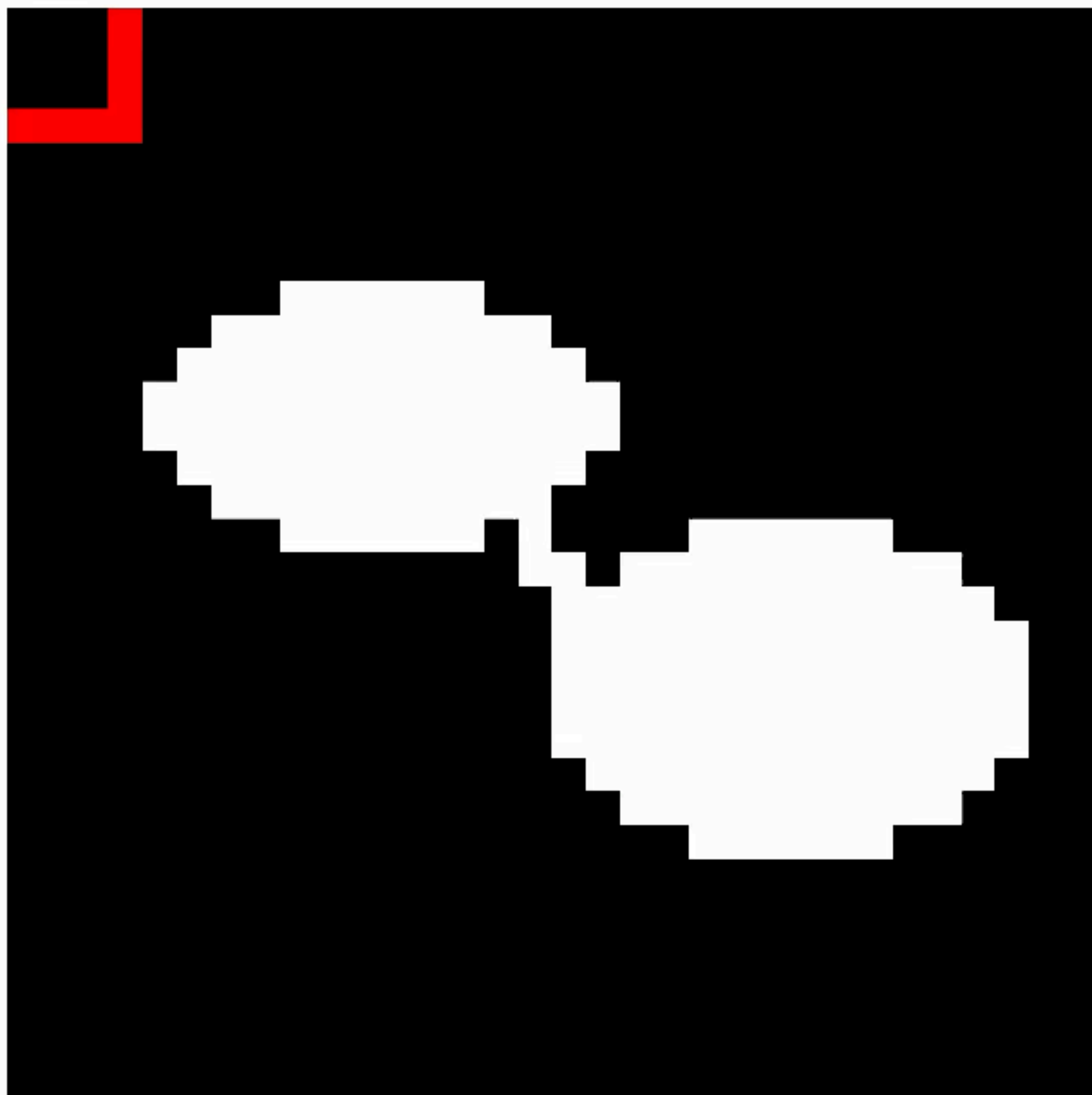




# Erosion Operation

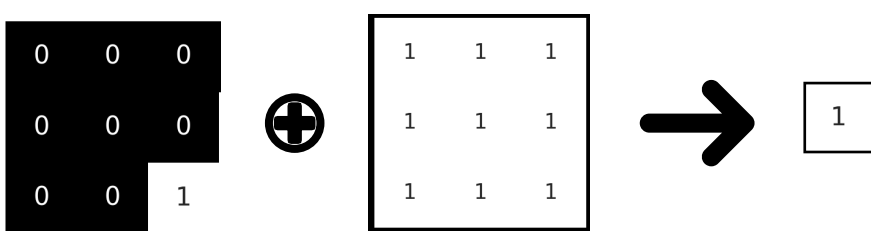
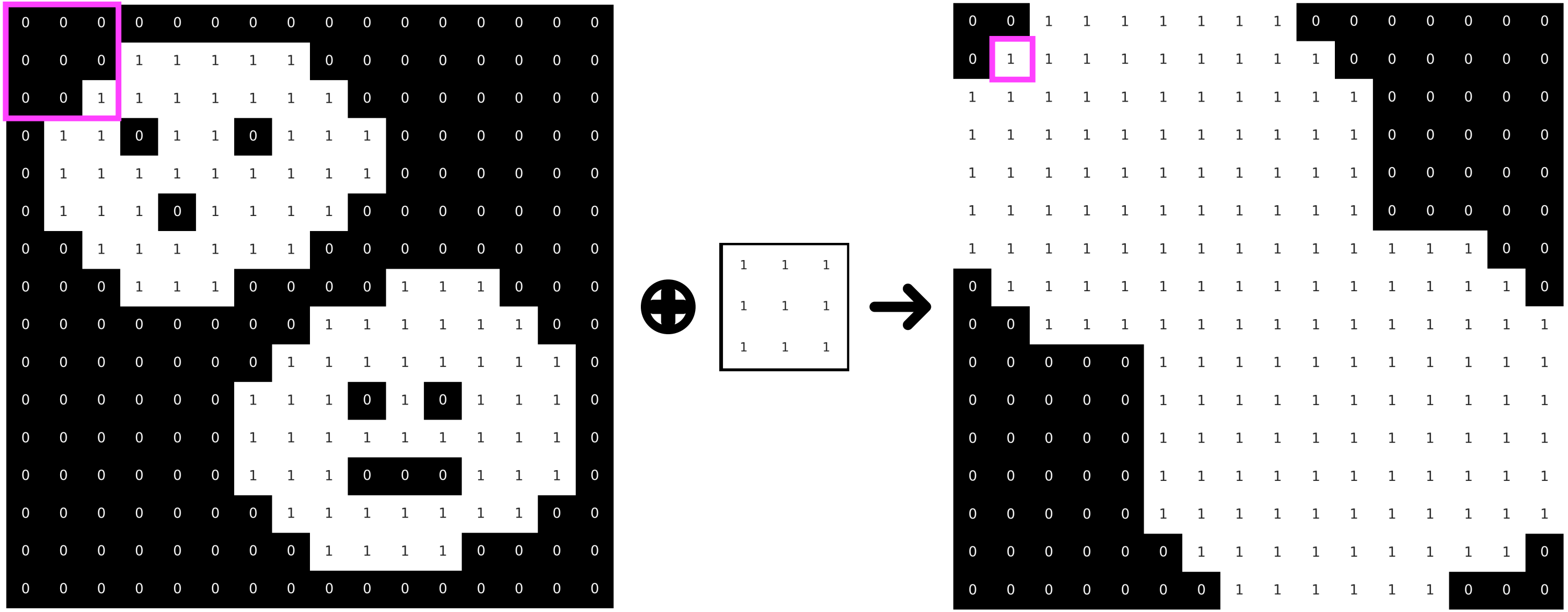


# Erosion - The Movie

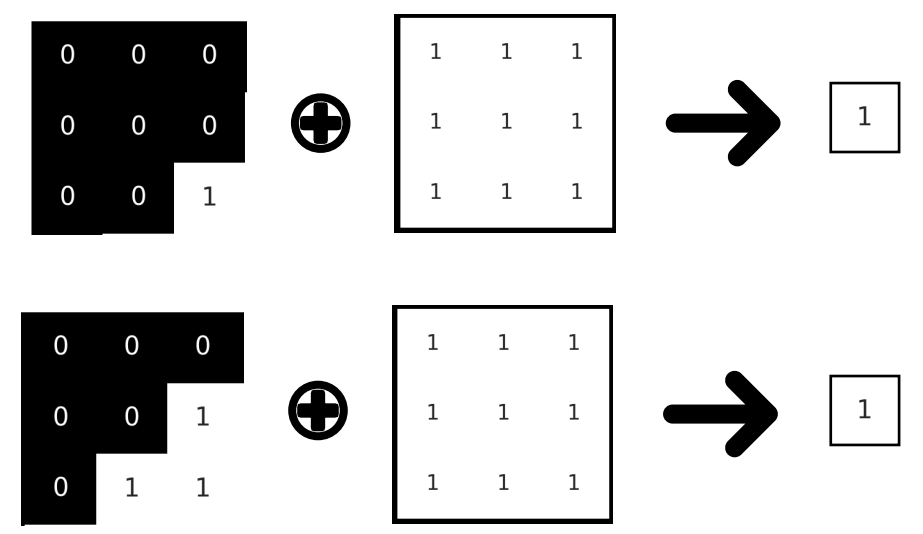
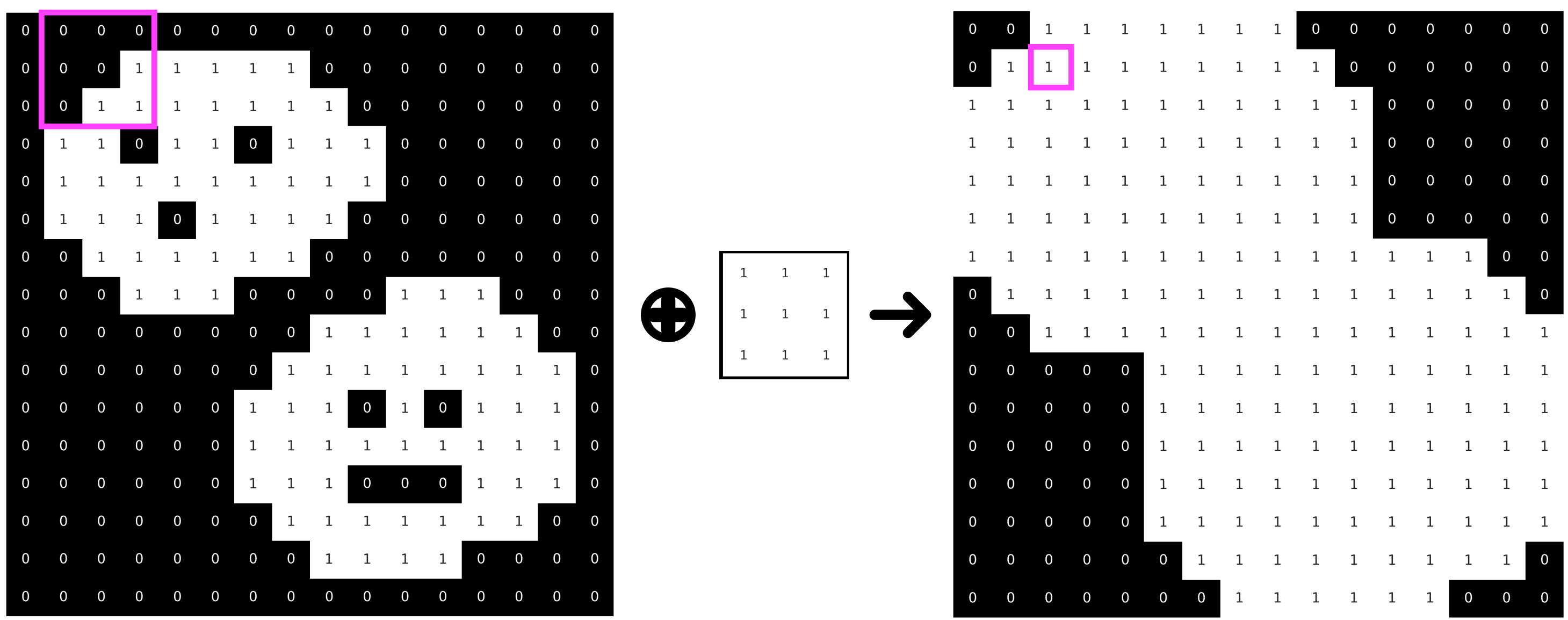




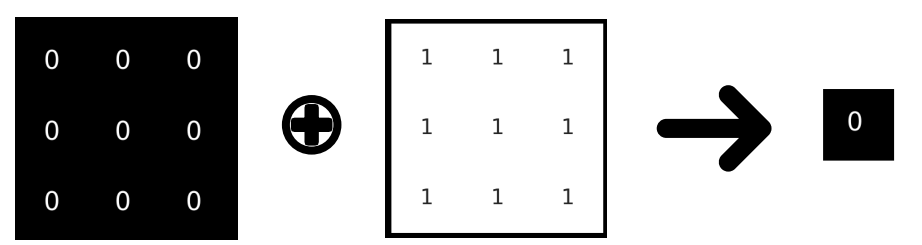
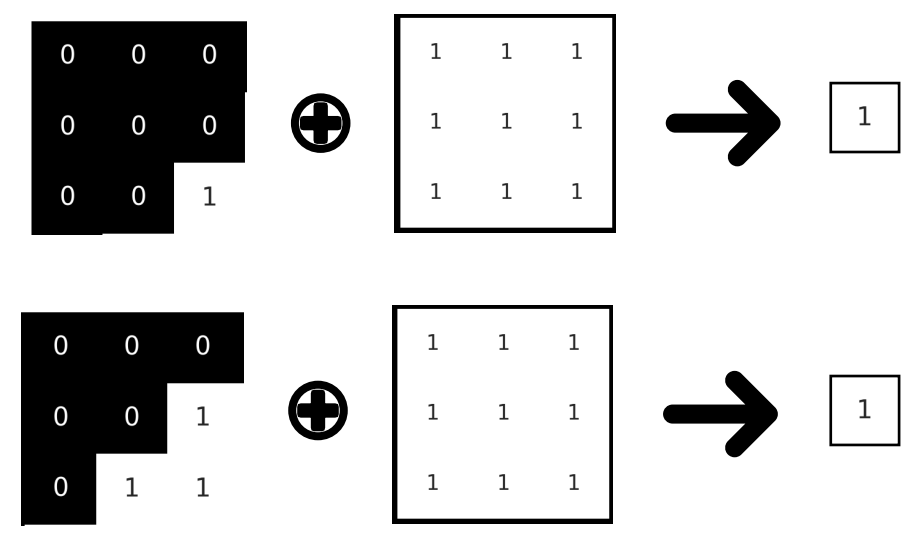
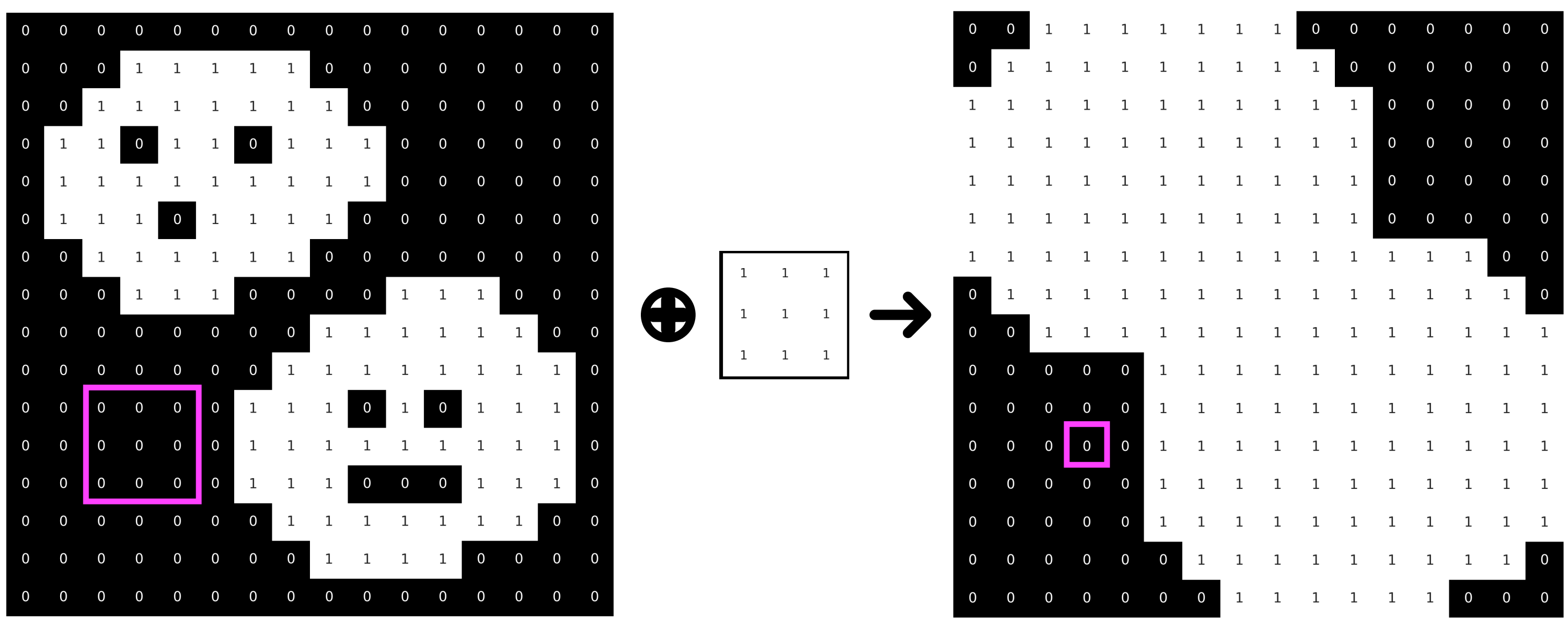
# Dilation Operation



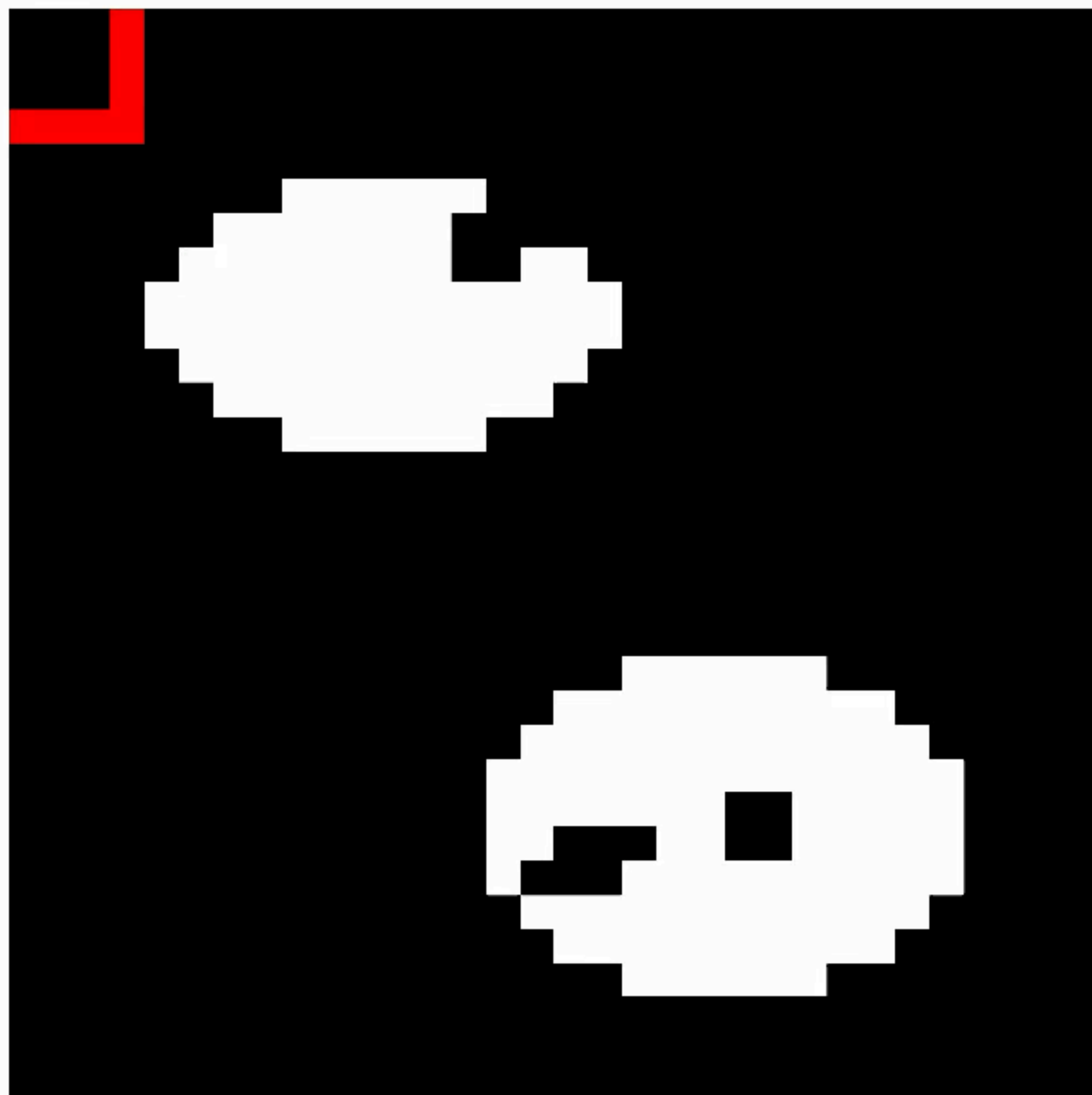
# Dilation Operation



# Dilation Operation



# Dilation - The Movie

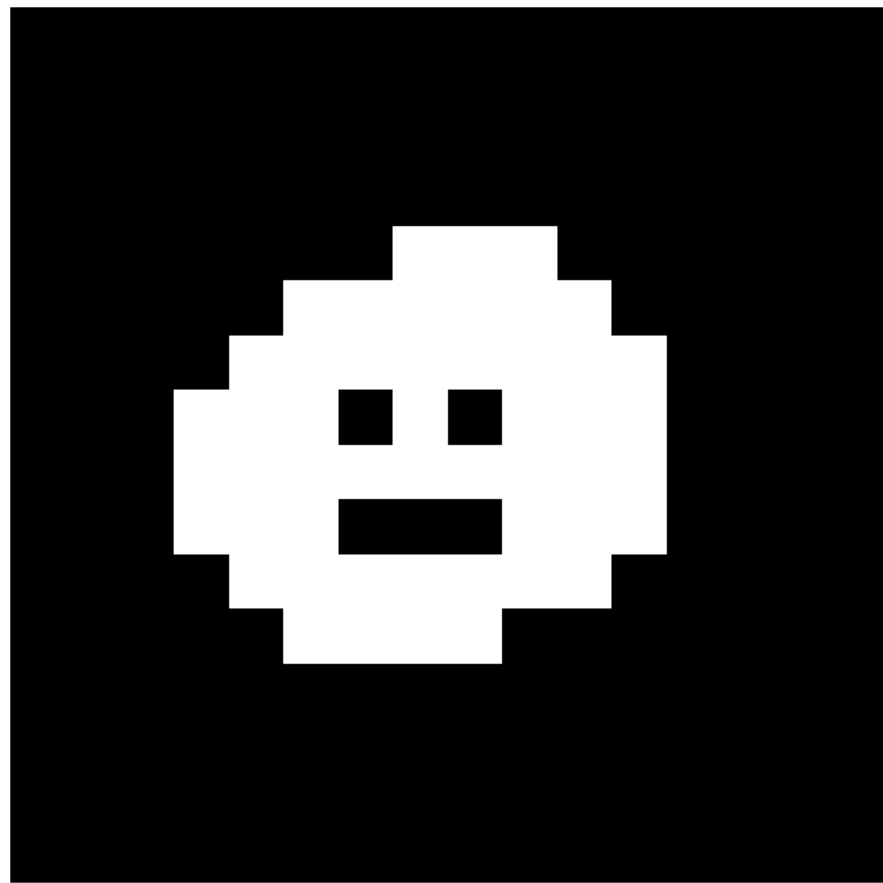


**But wait,  
there is a problem.**

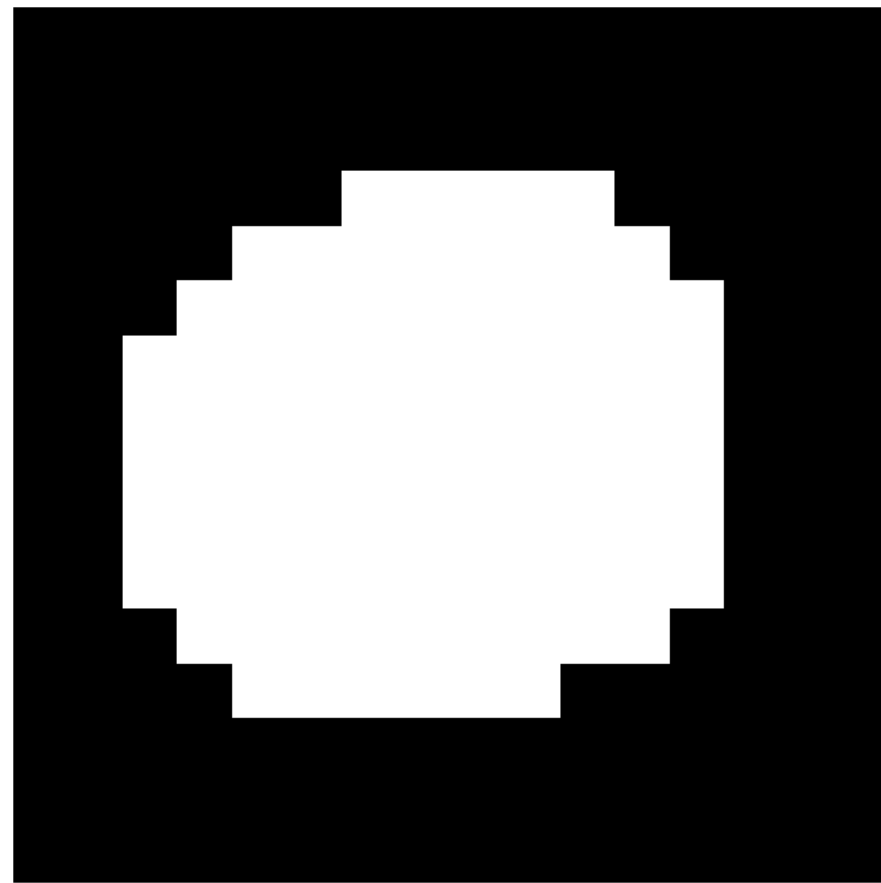


# Together We Stand

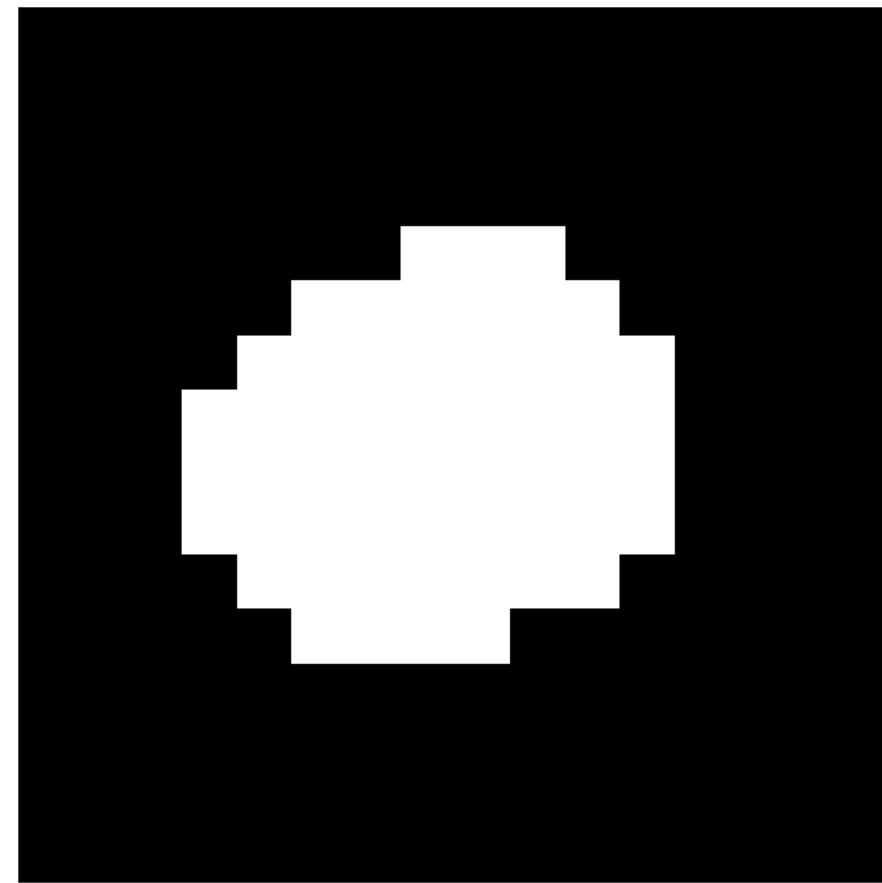
Main image



Dilated image

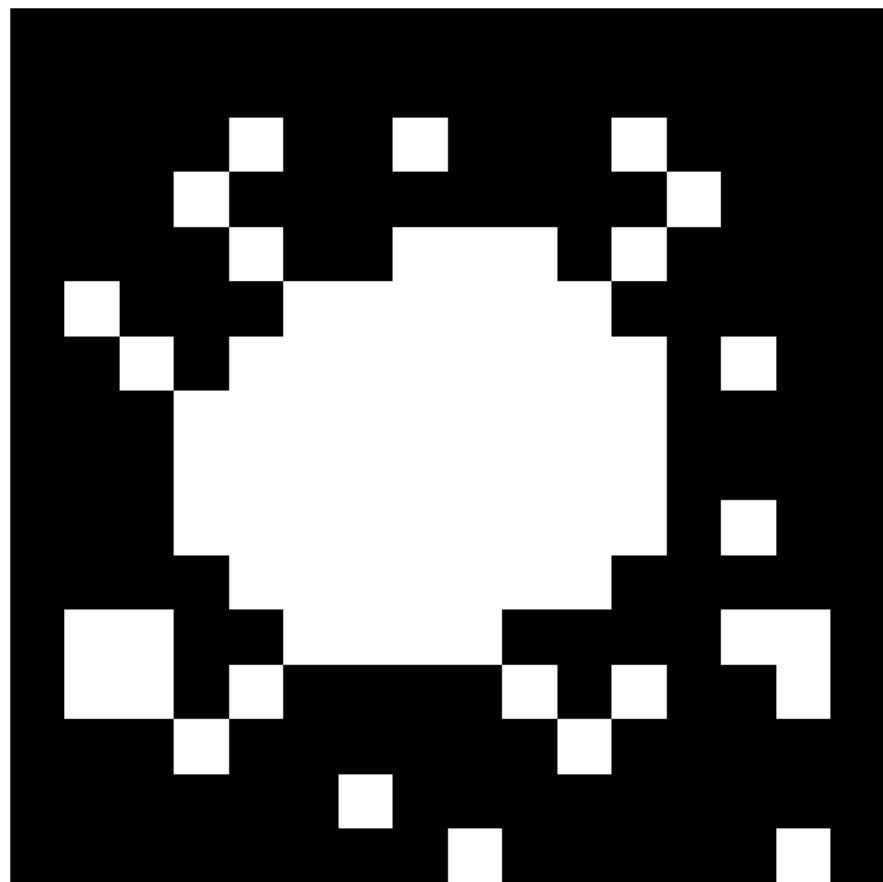


Closed image

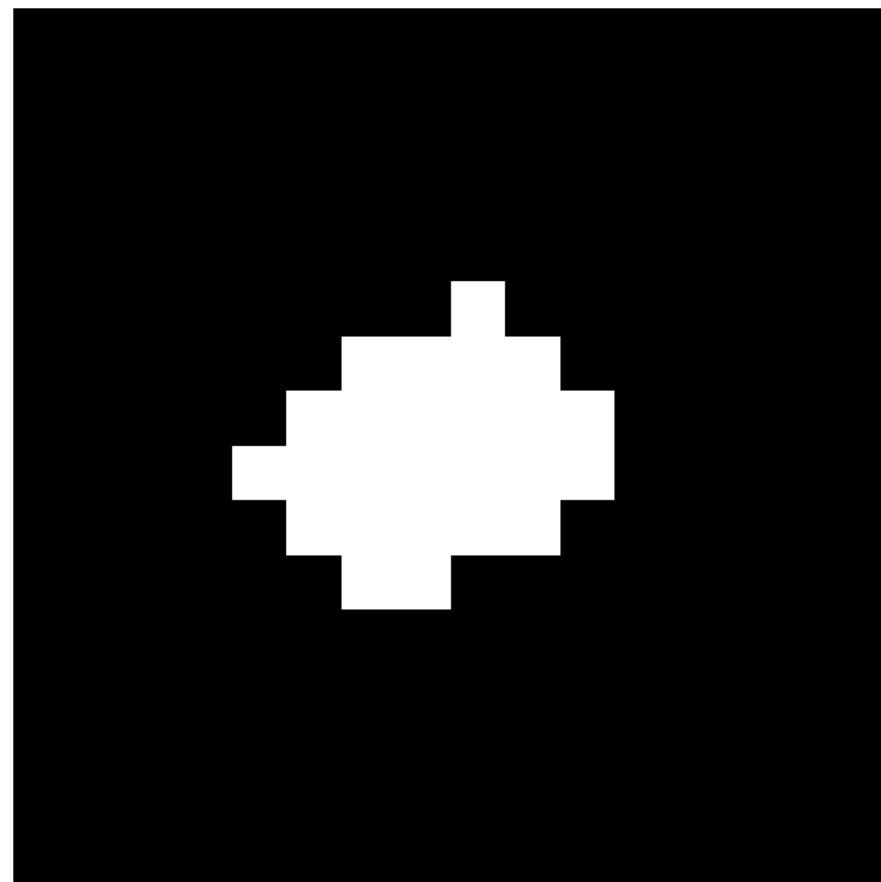


**Closing:**  
Erosion of the dilation.

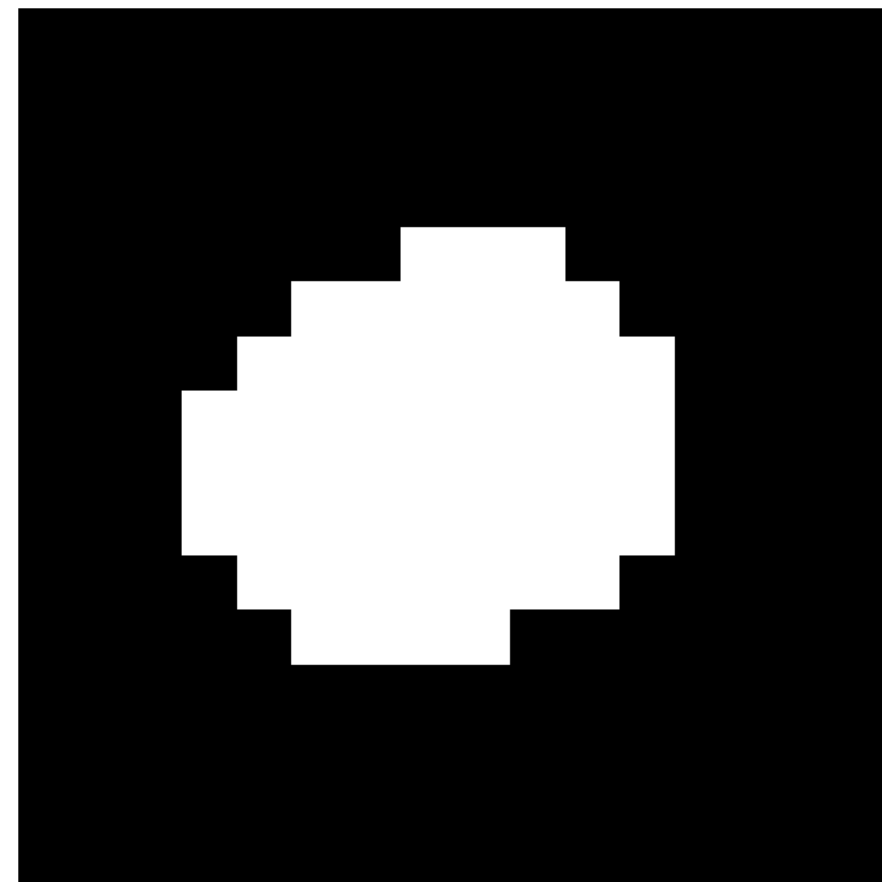
Main image



Eroded image



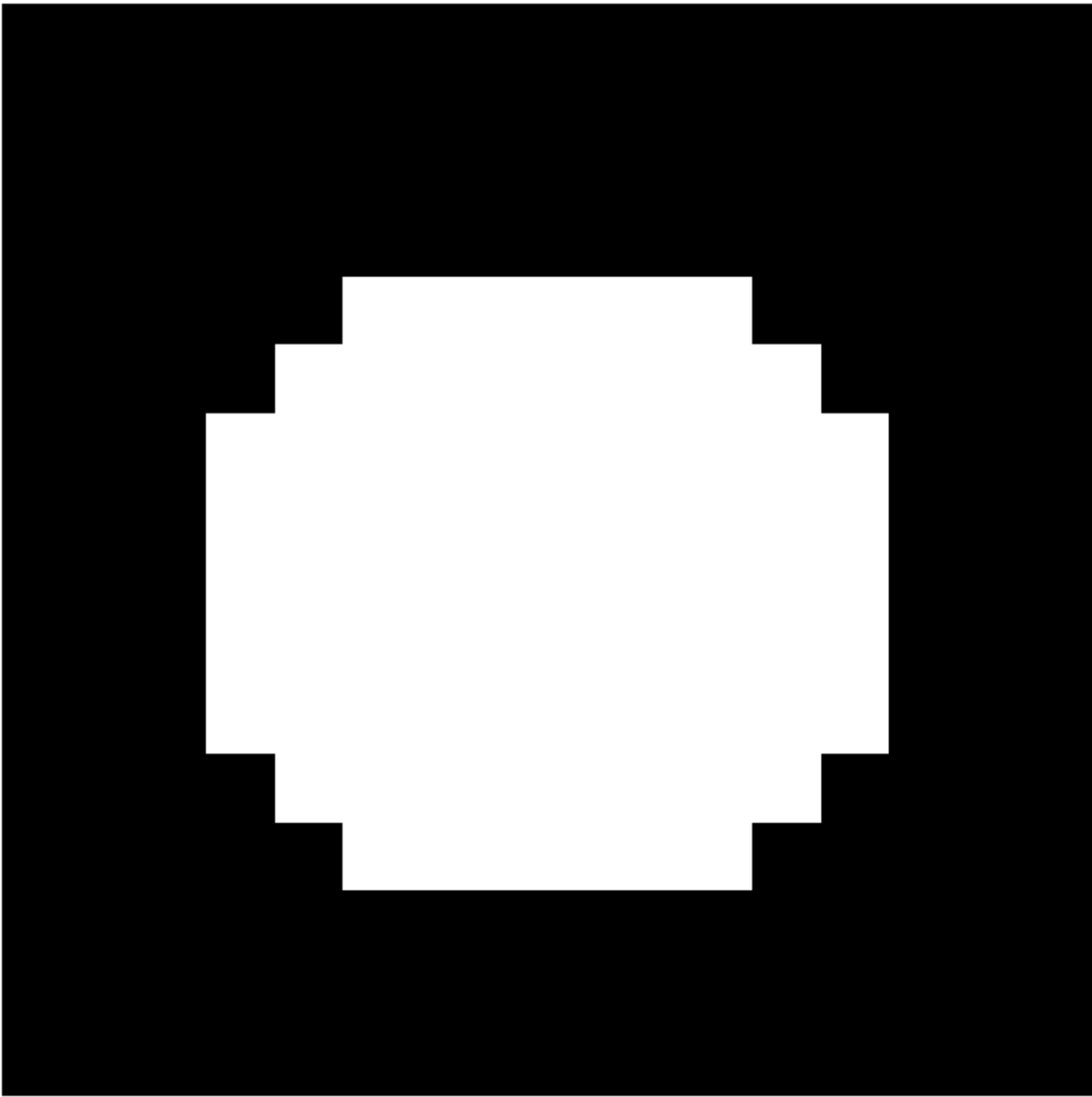
Opened image



**Opening:**  
Dilation of the erosion.

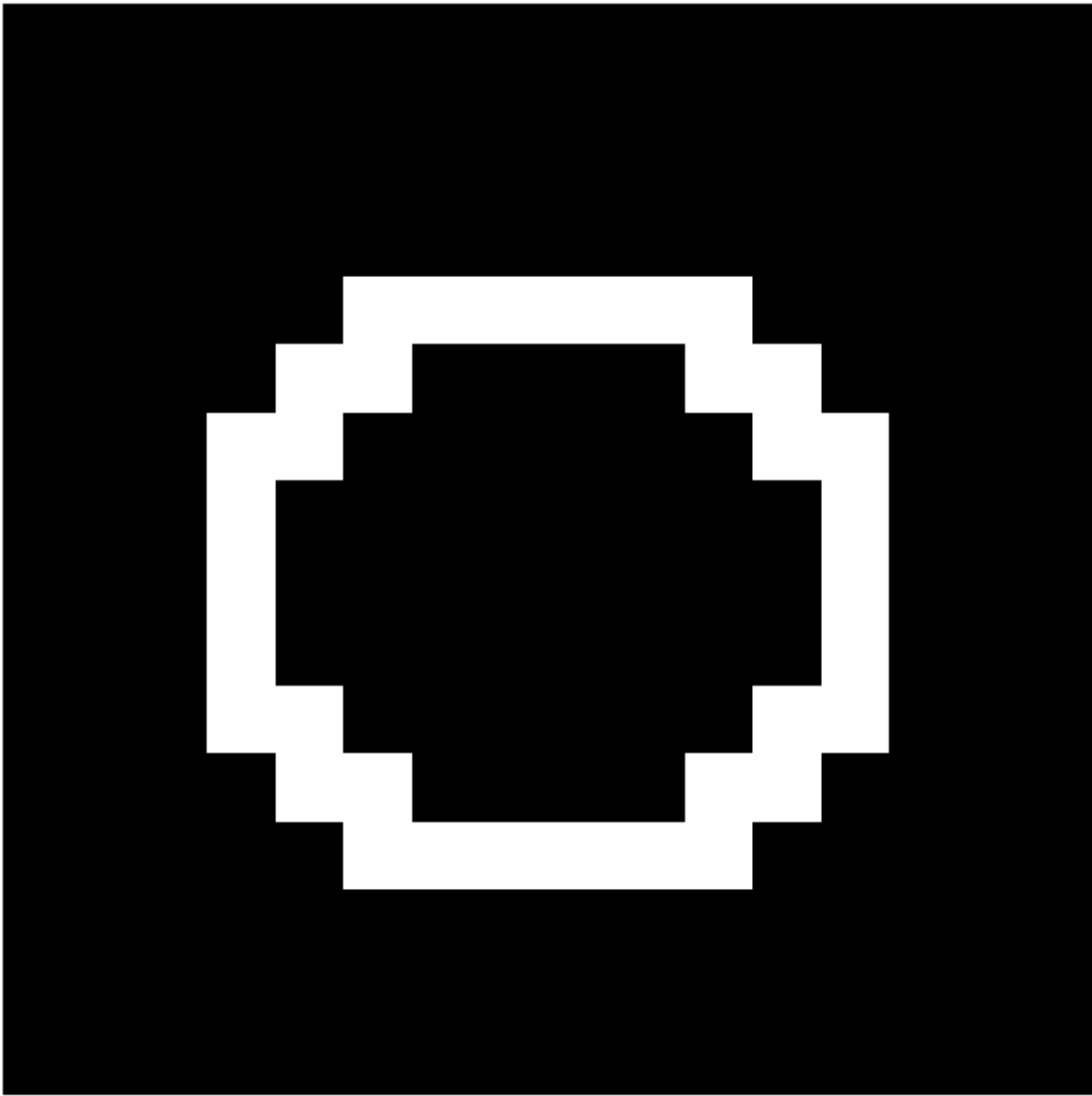
# Bonus Example

Main image



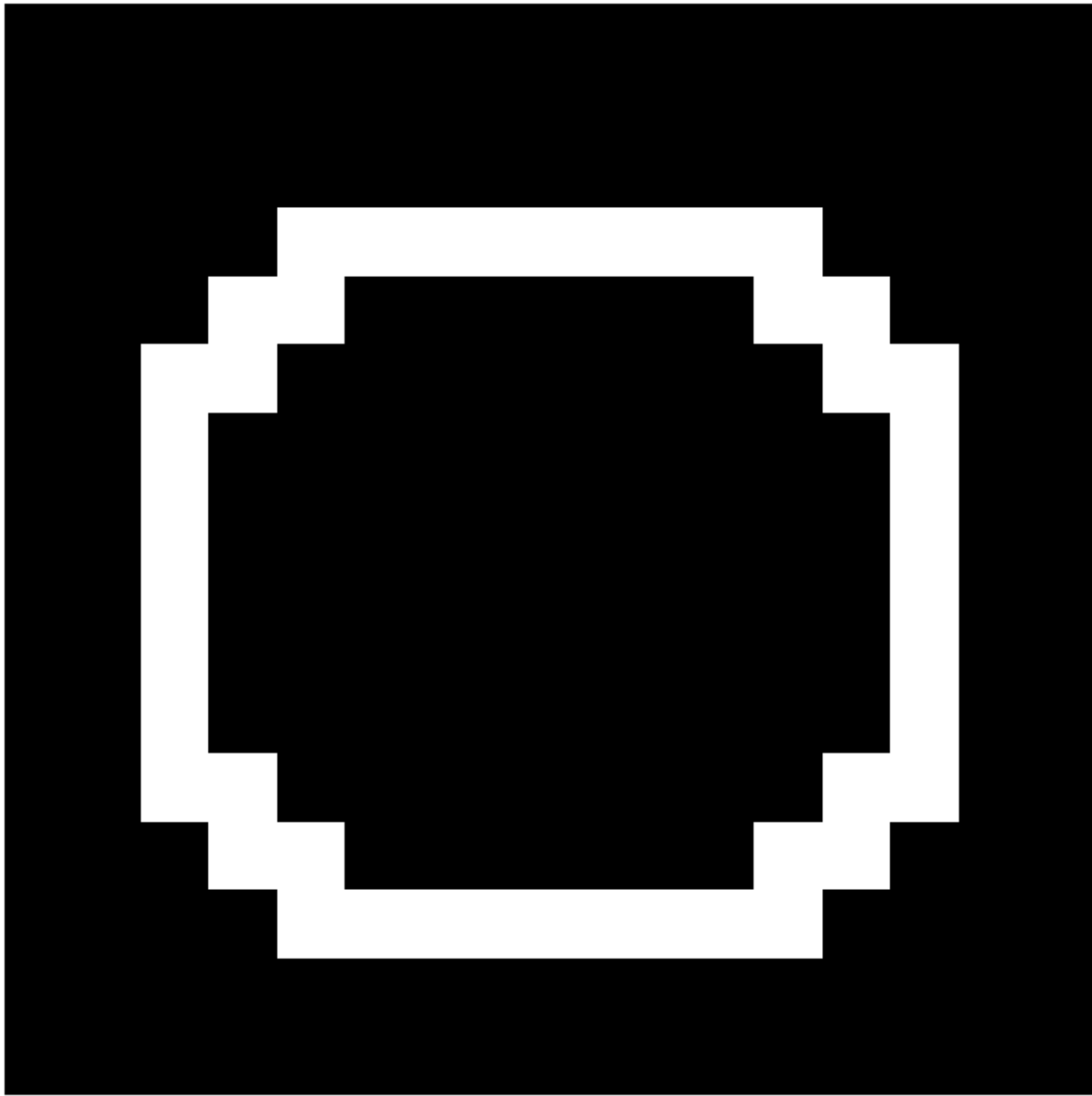
Inner edge

Erode more, dilate less, then subtract

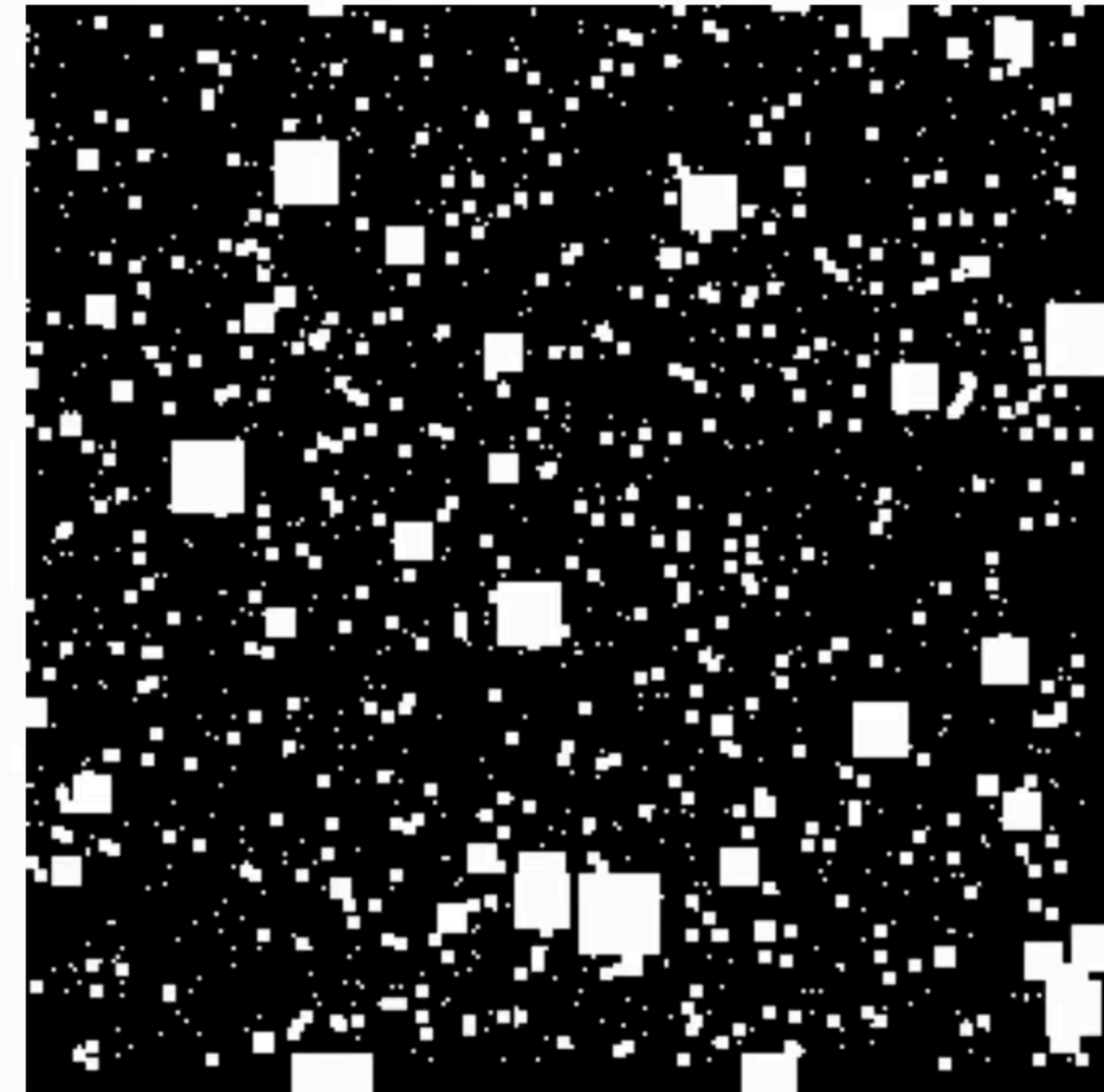


Outer edge

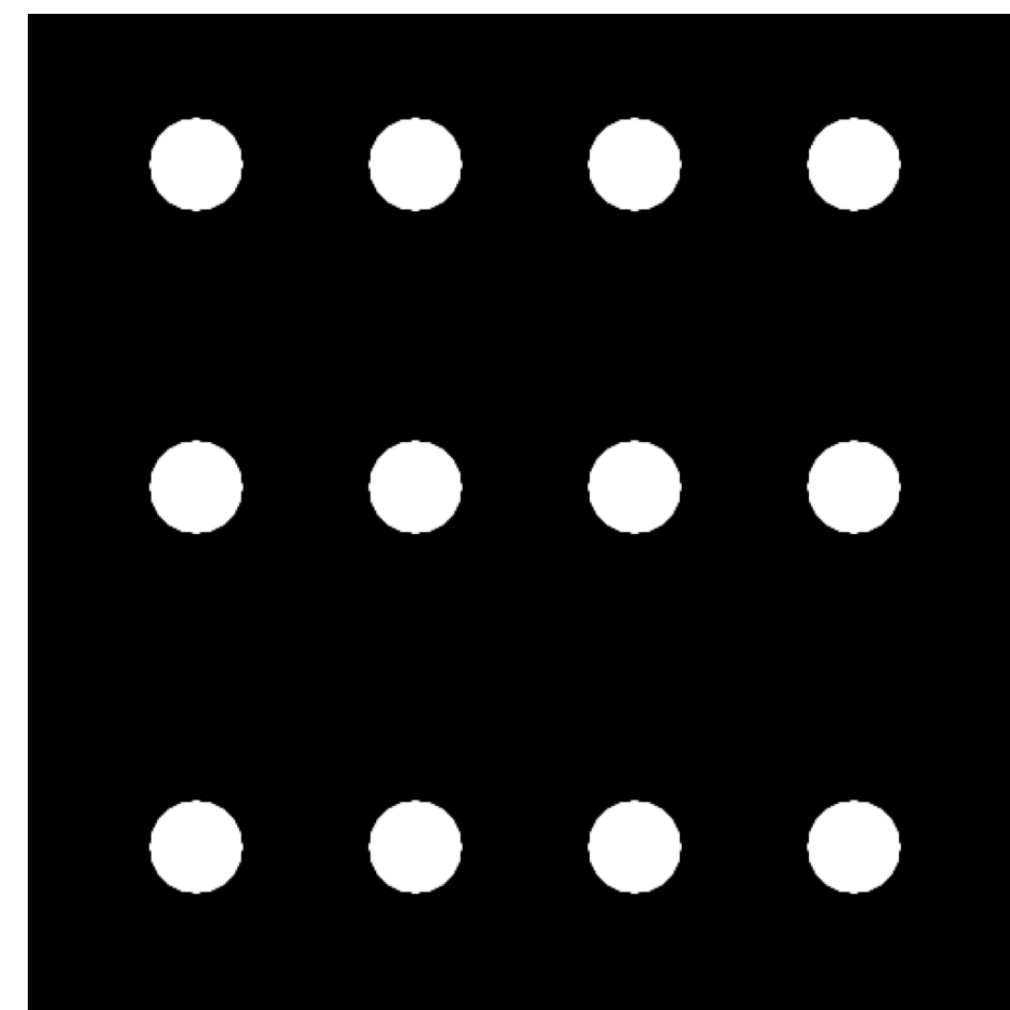
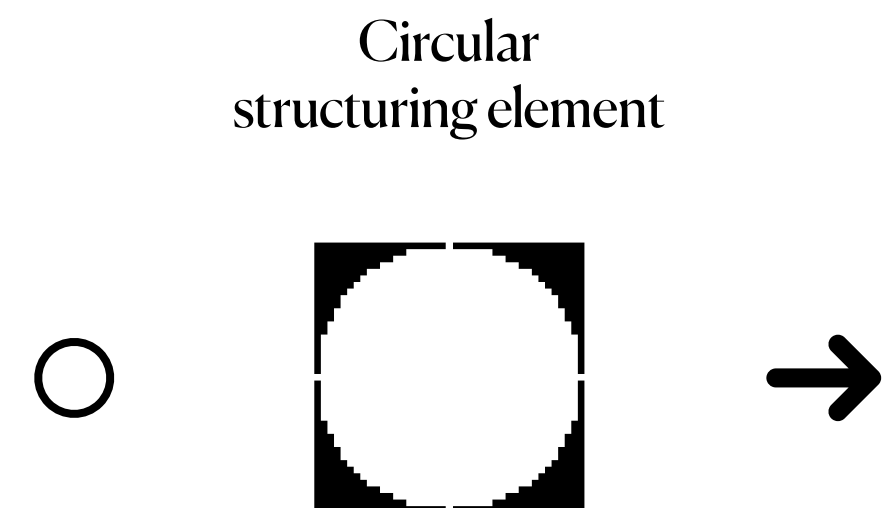
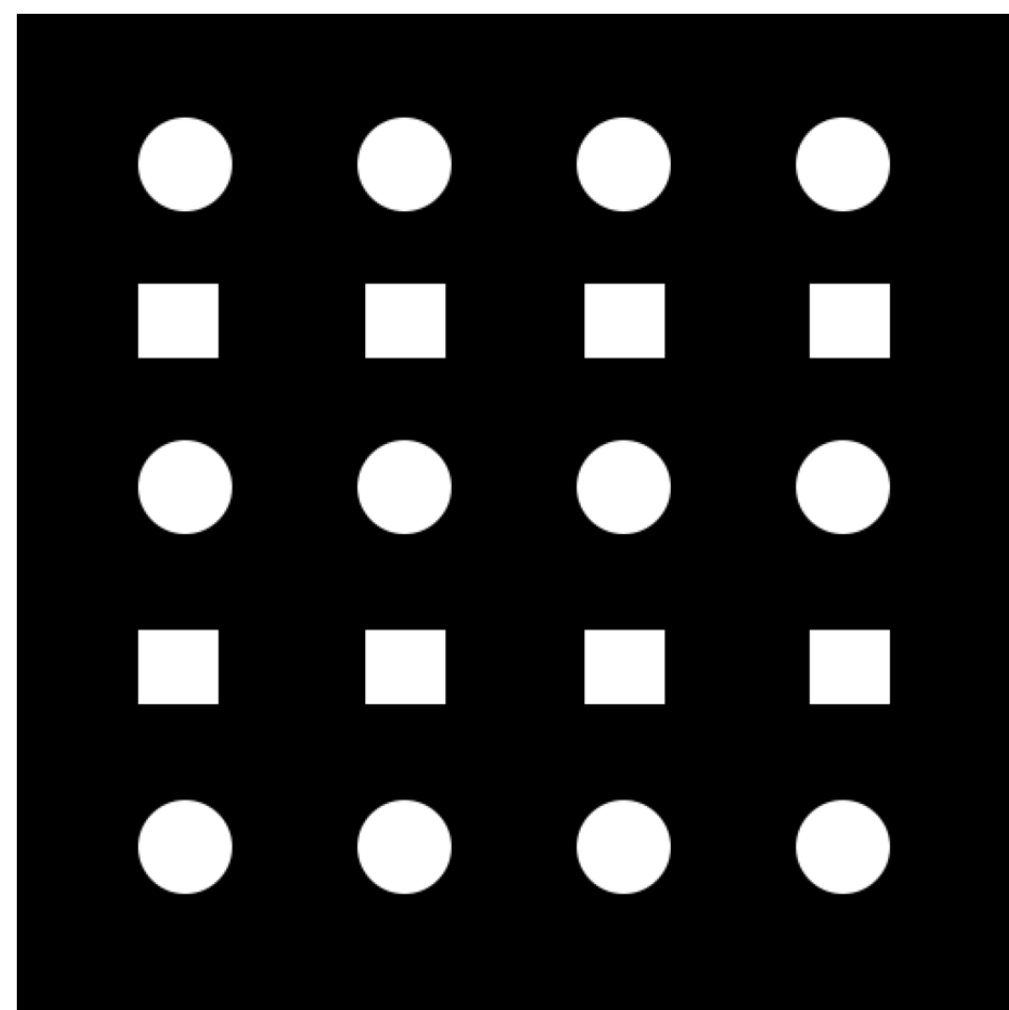
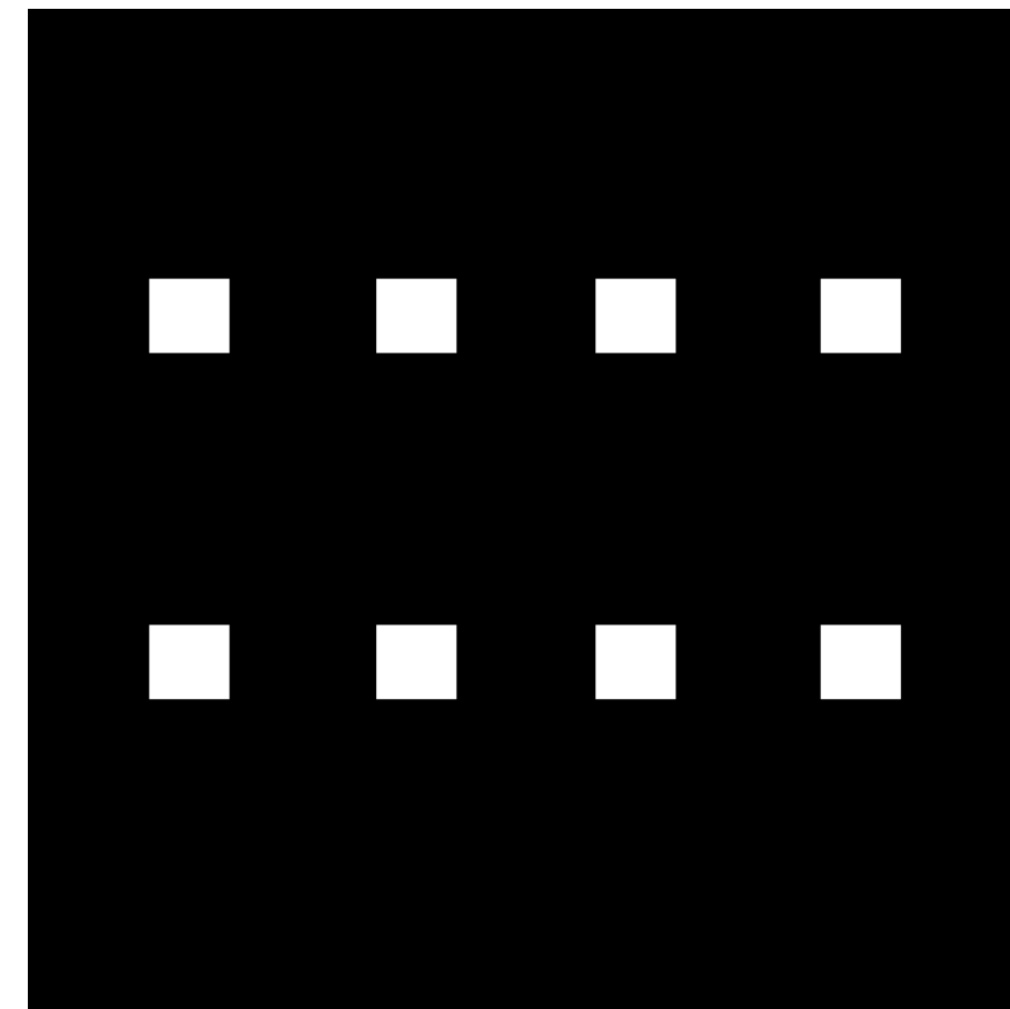
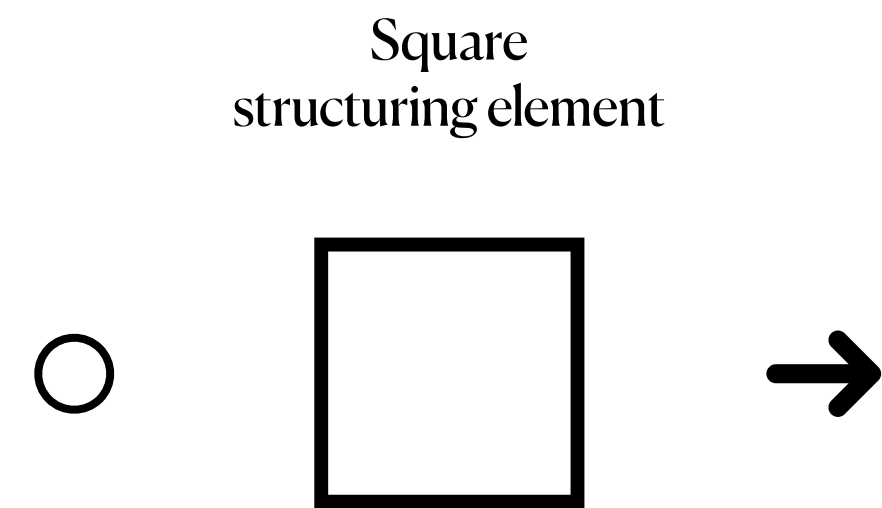
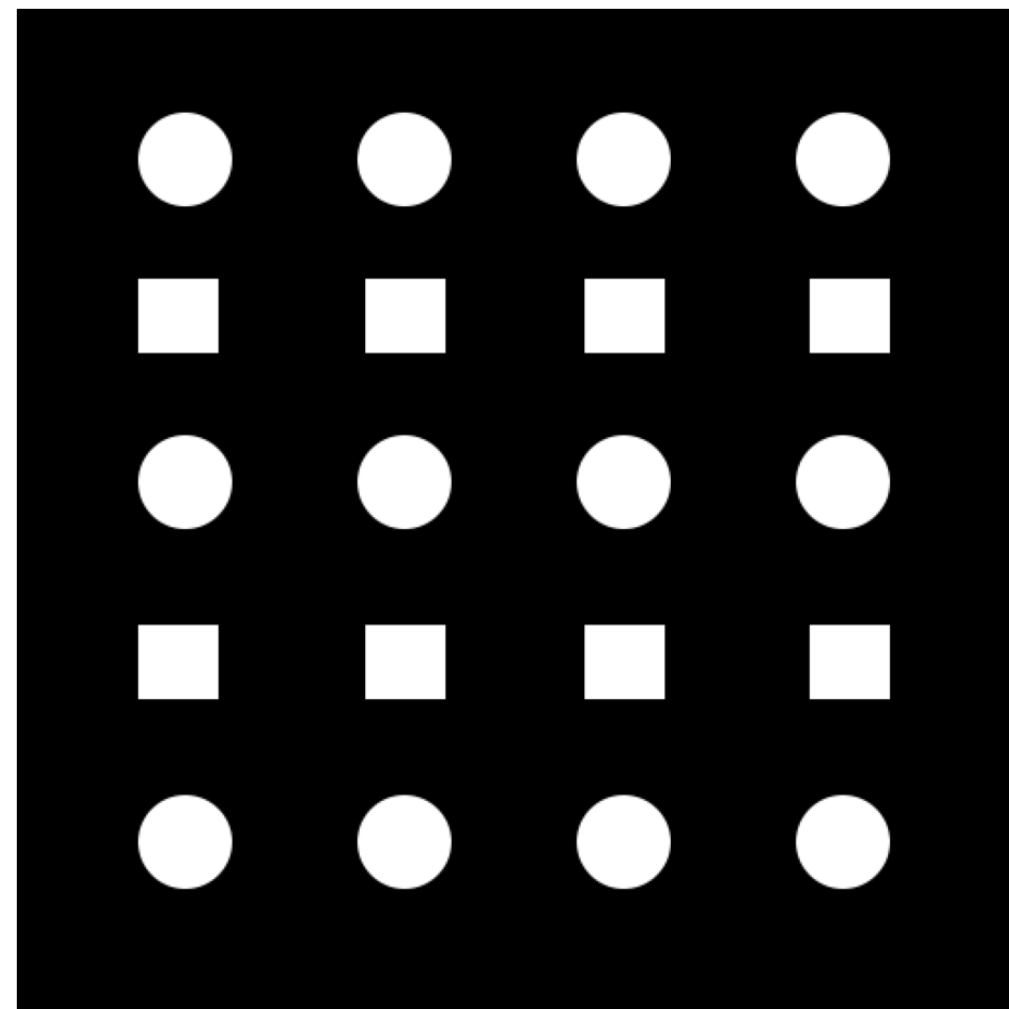
Dilate more, erode less, then subtract



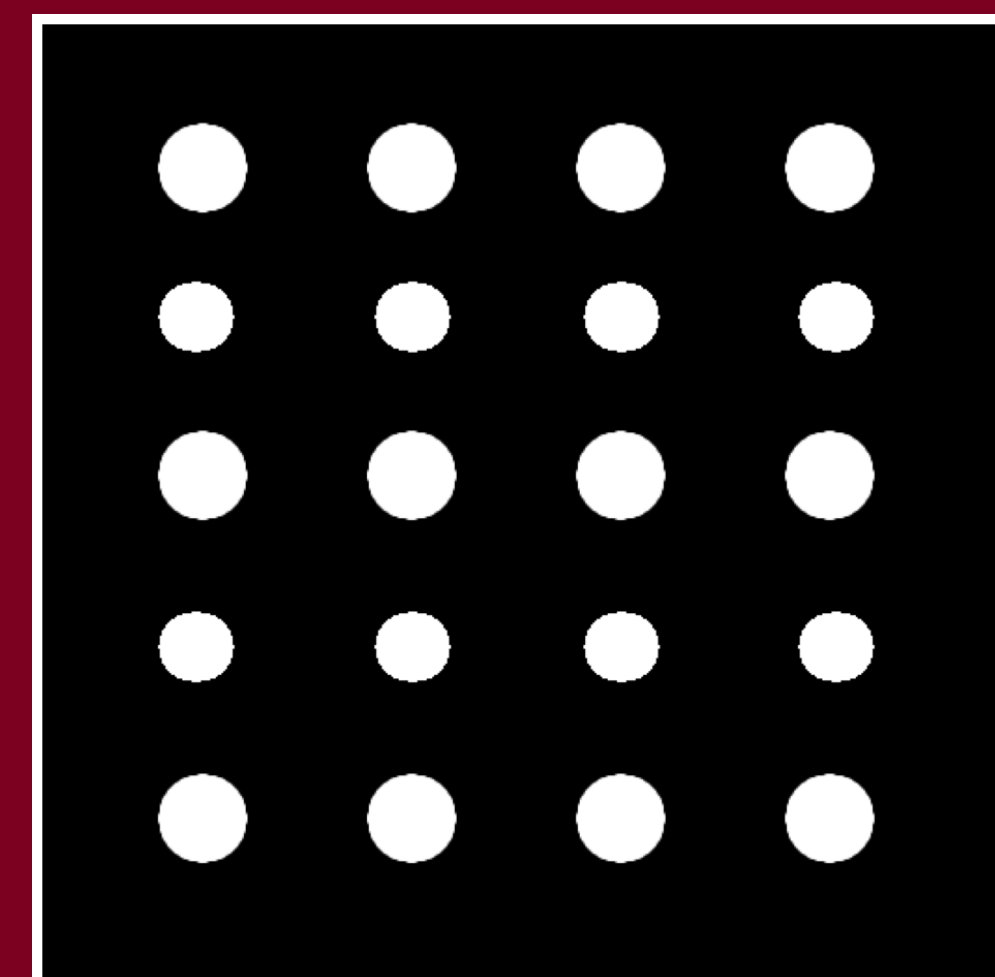
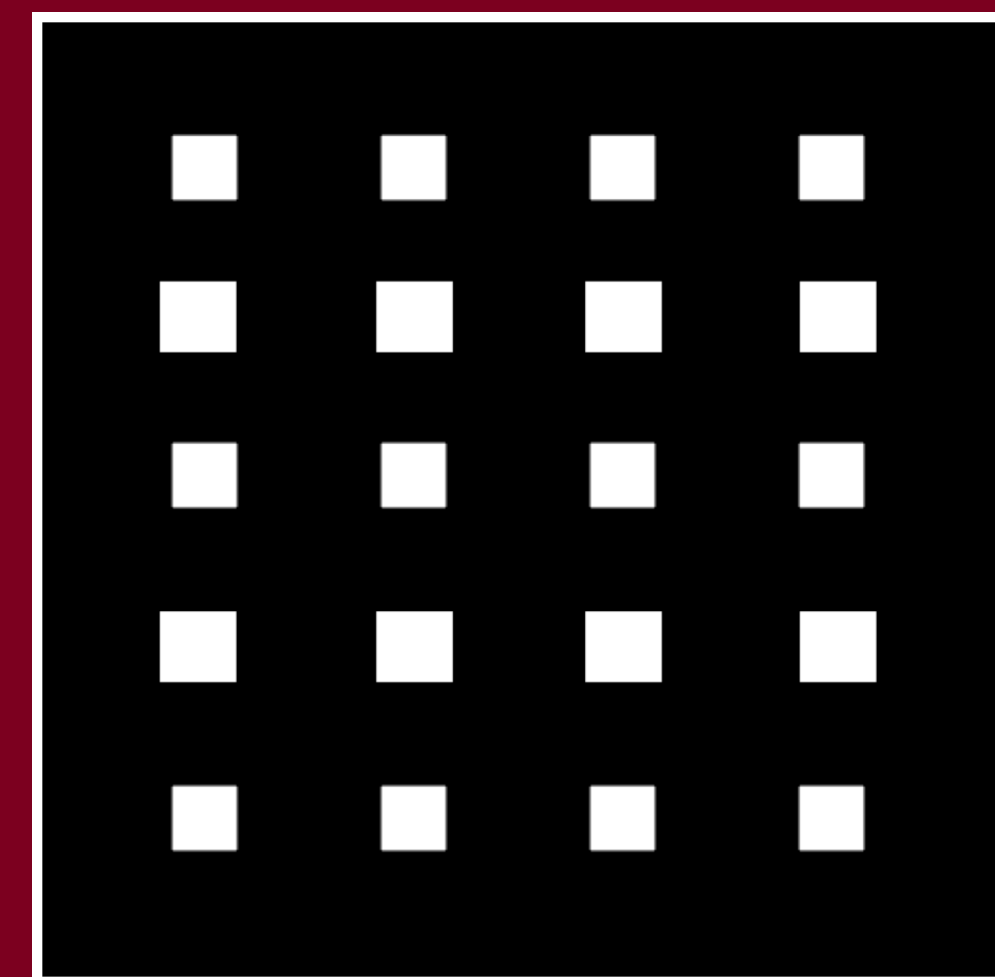
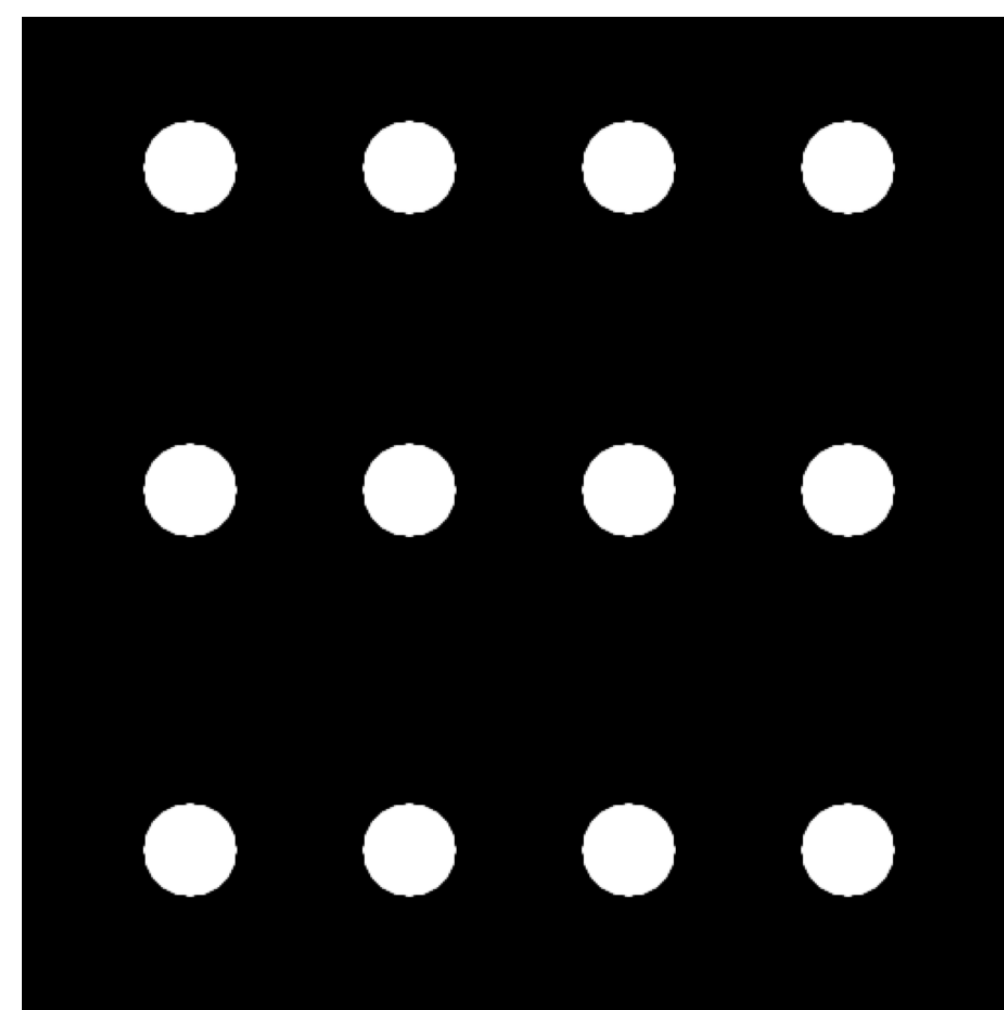
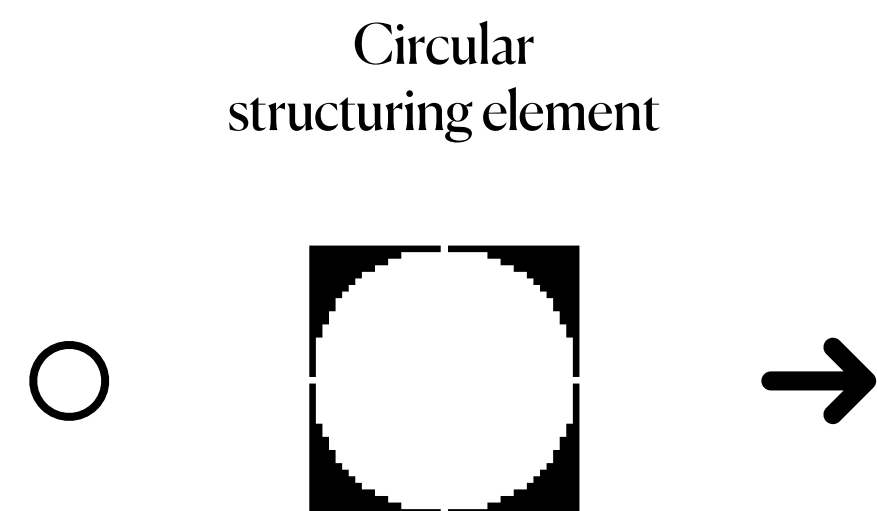
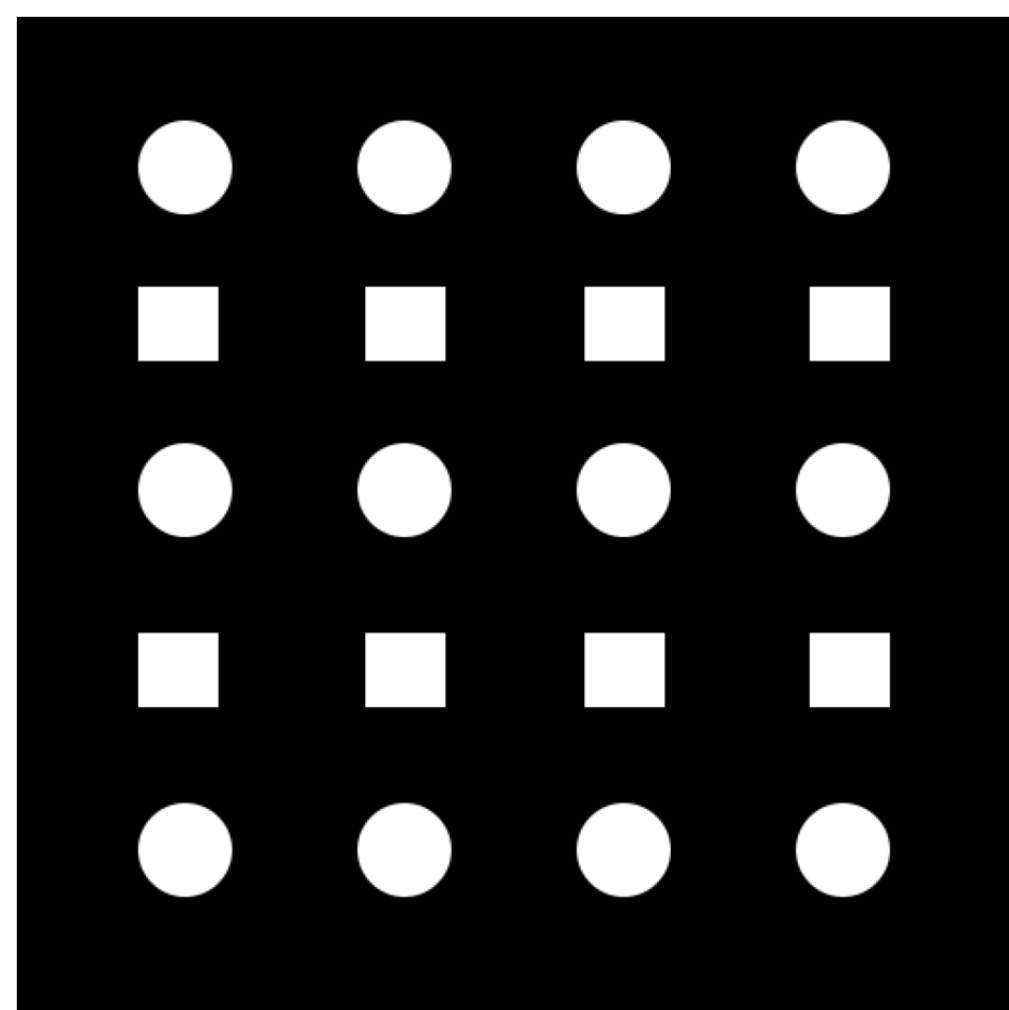
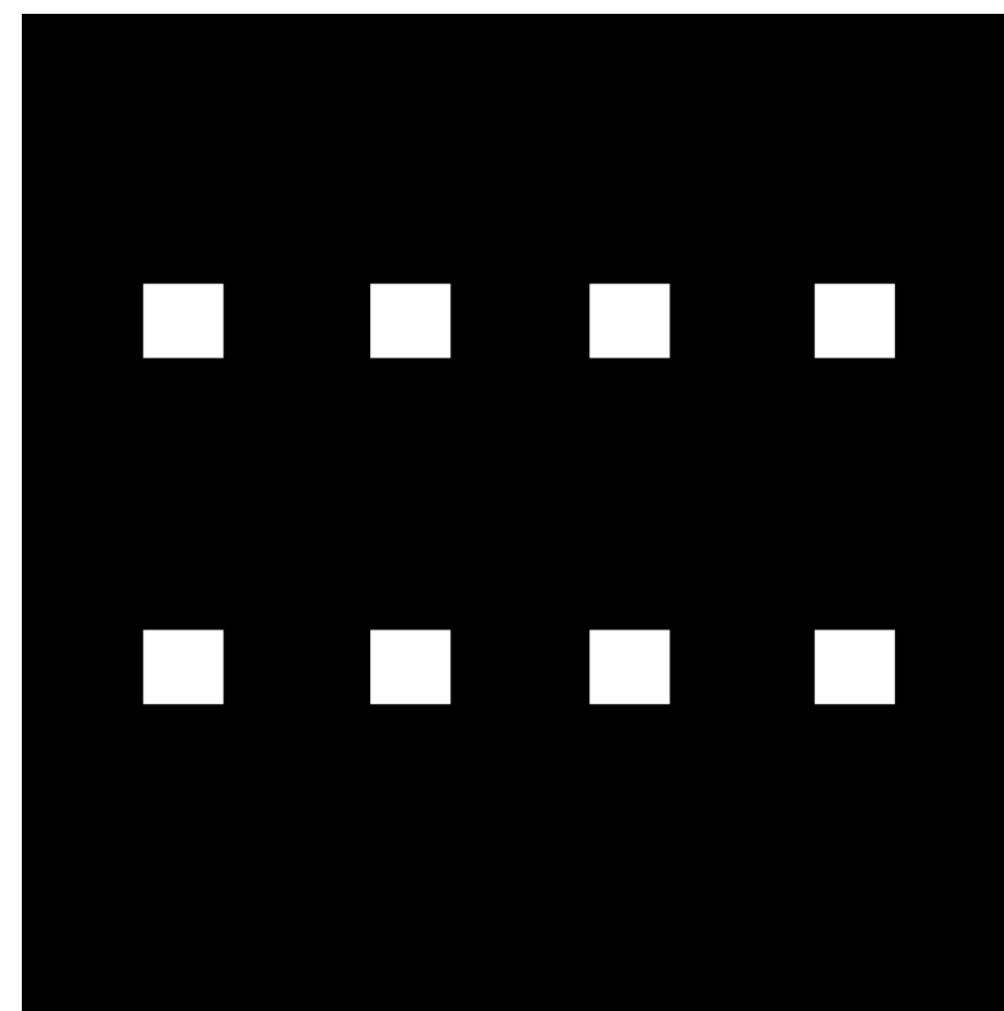
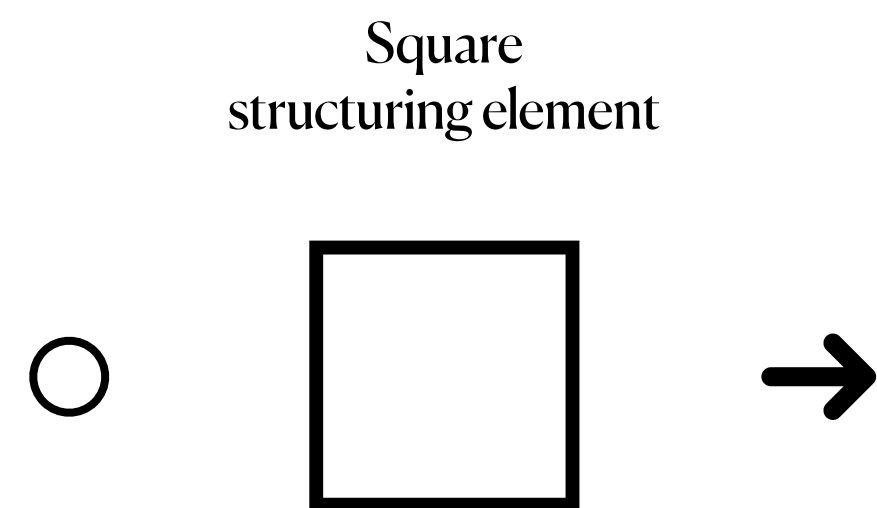
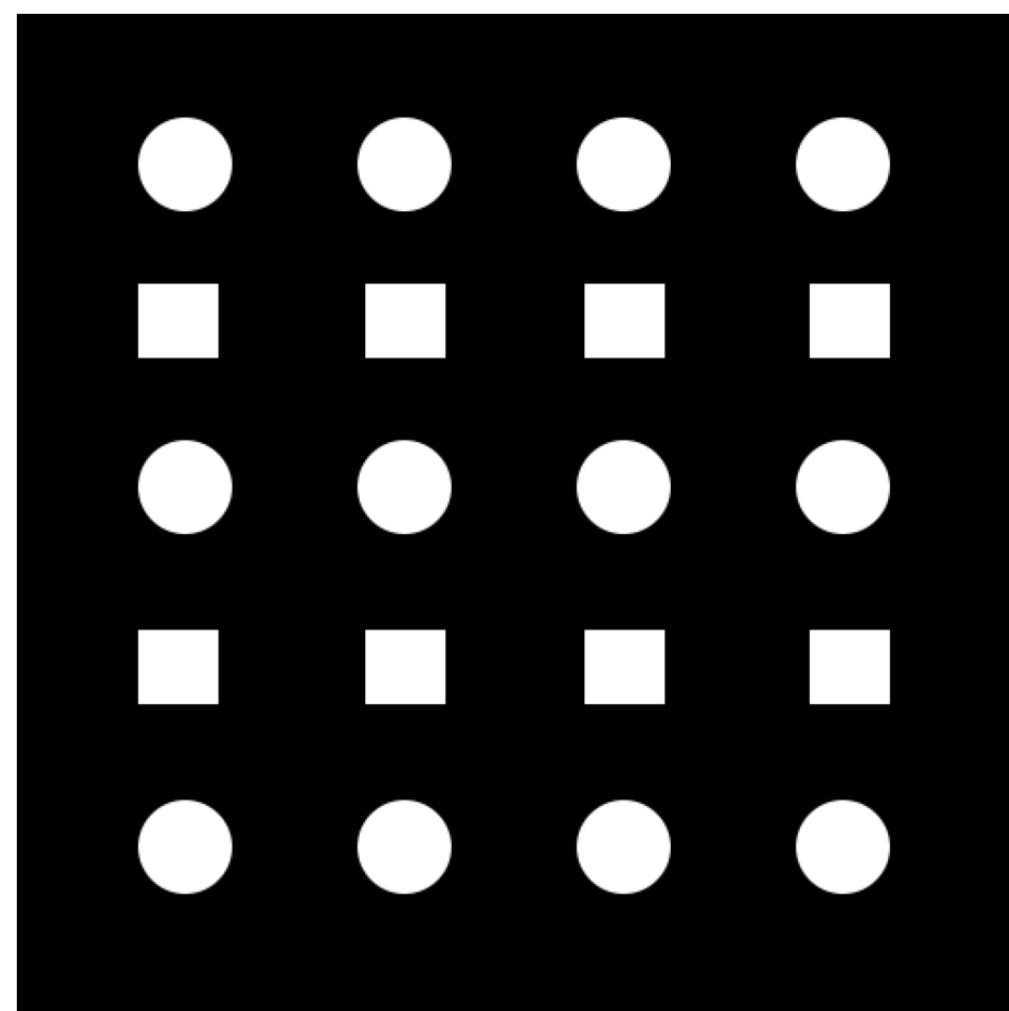
# Structuring Element Size



# Structuring Element Shape

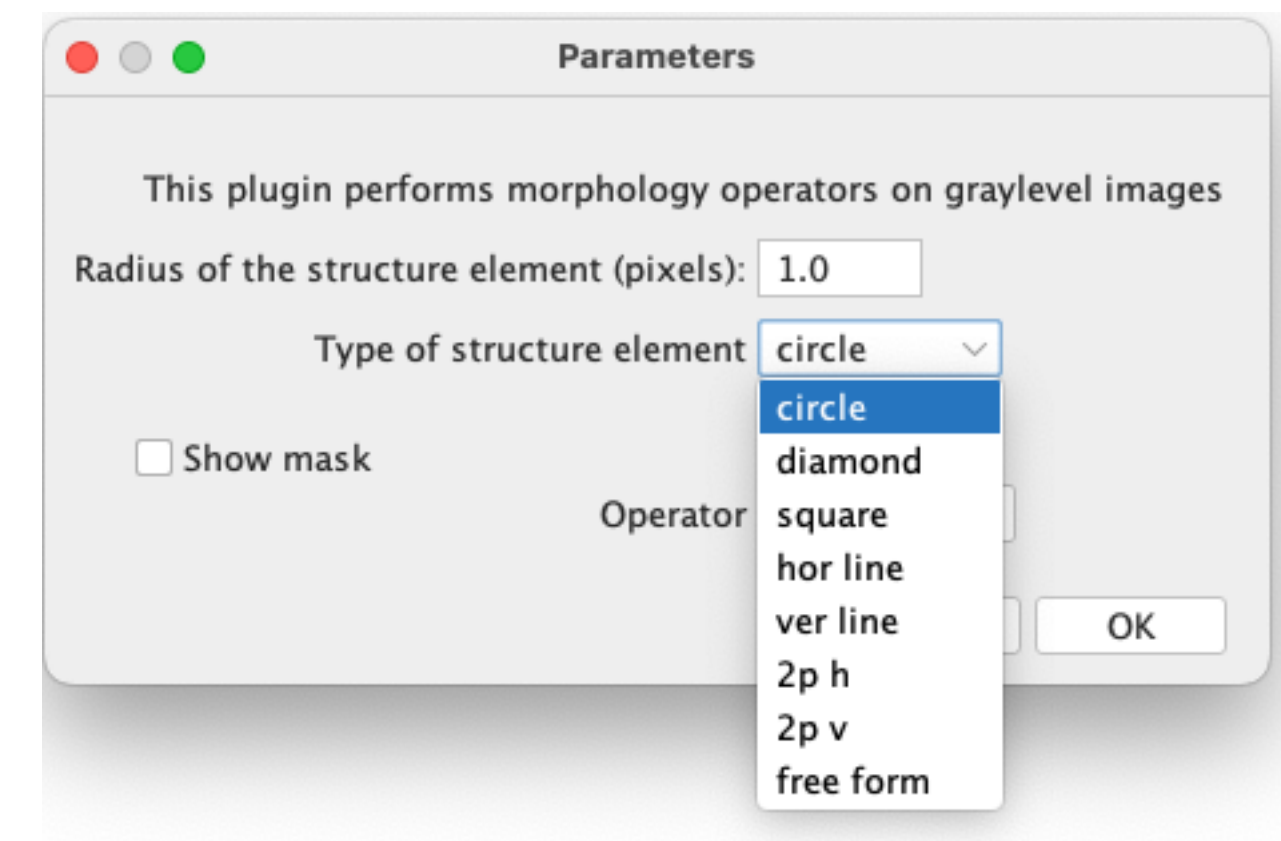
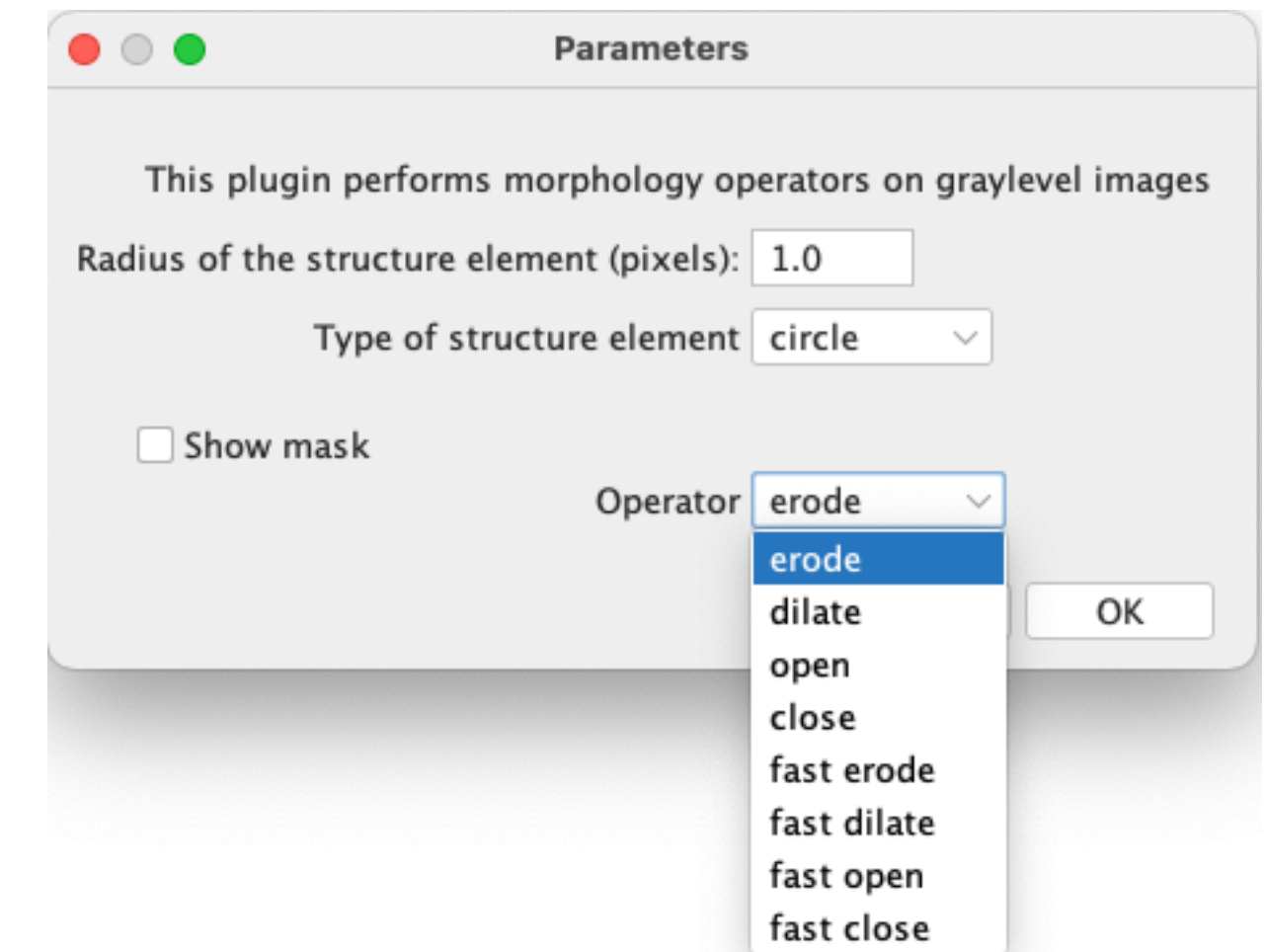
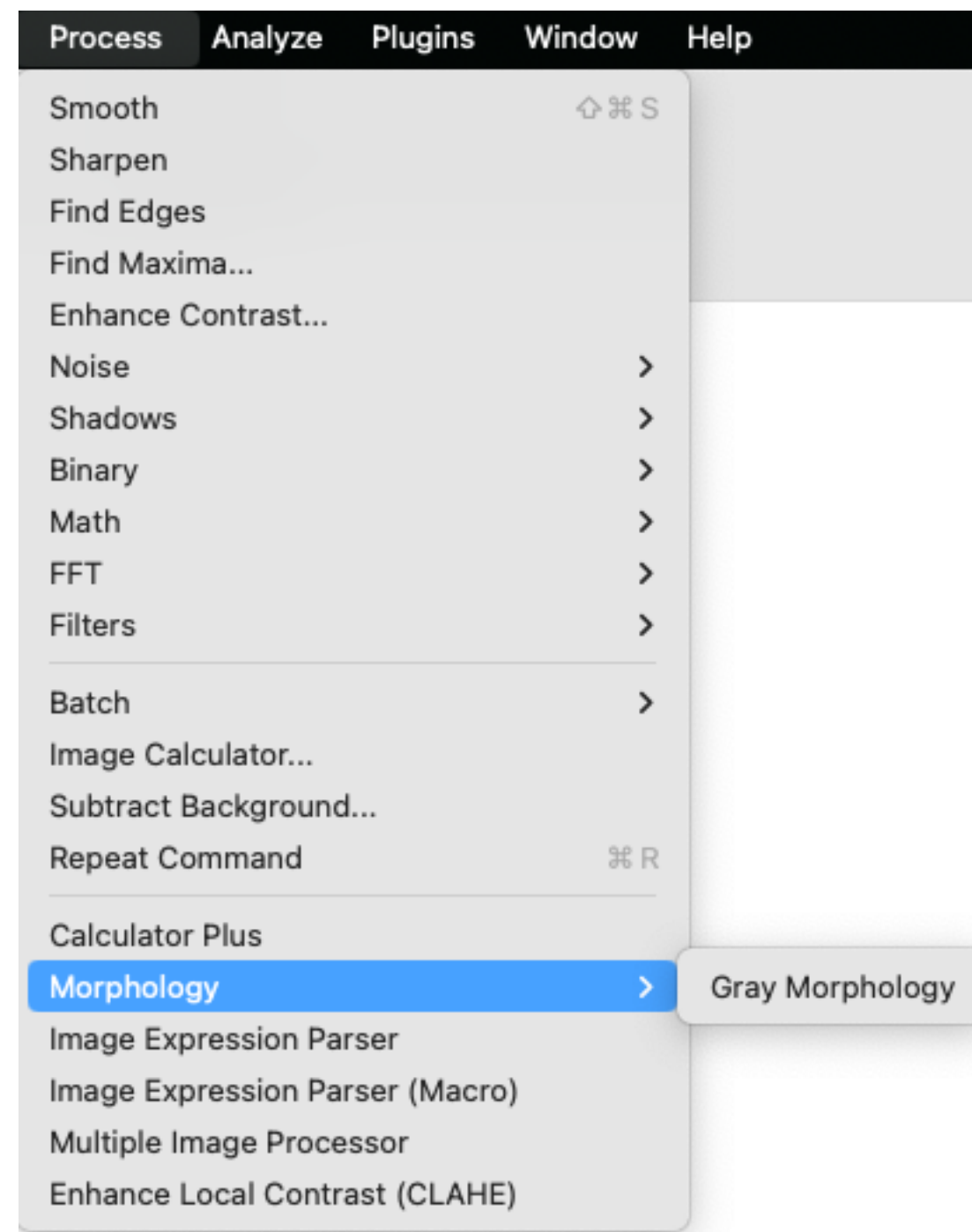
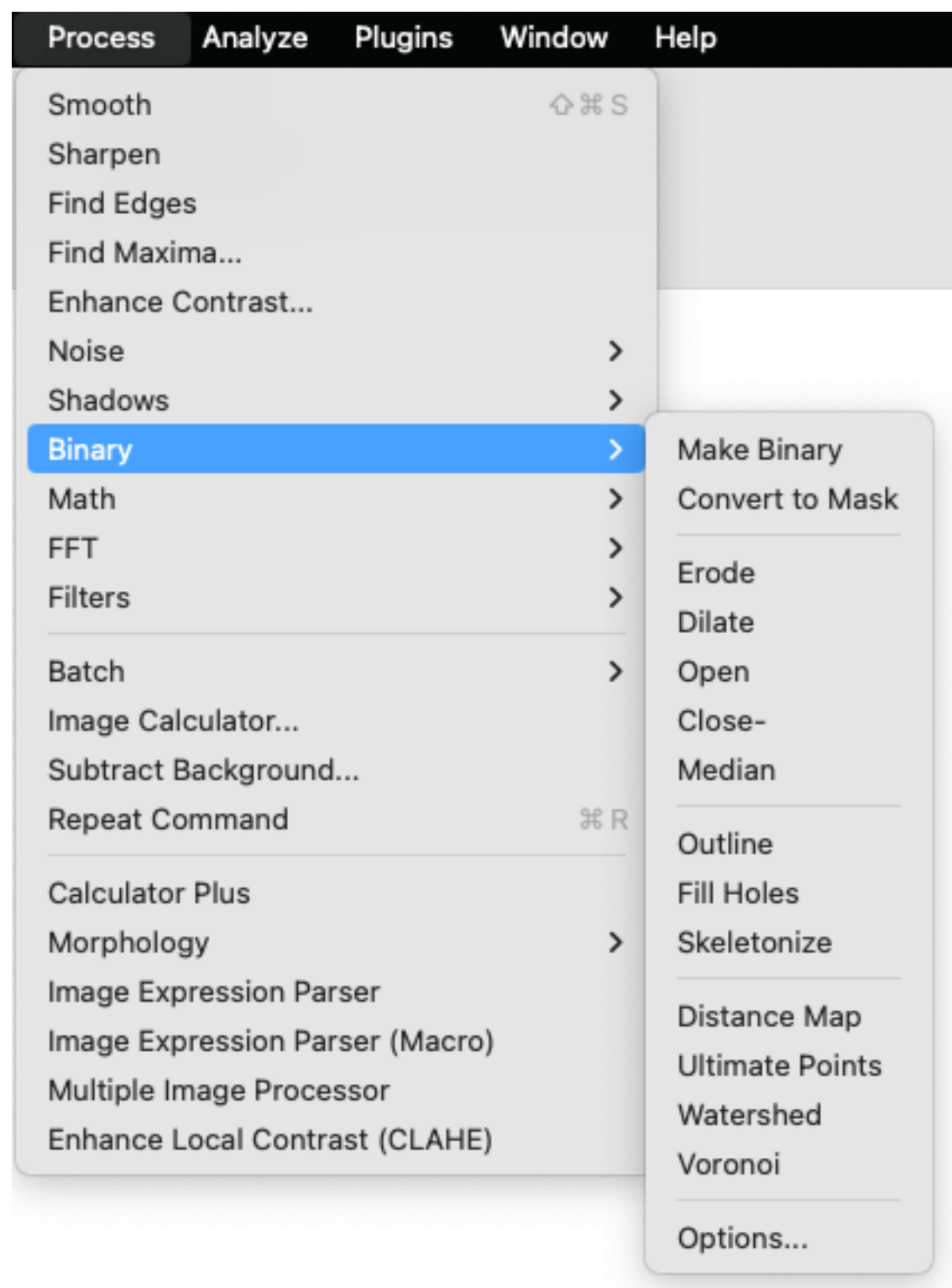


# Structuring Element Shape



**BE CAREFUL!**

# Morphology in Fiji



# Morphology — exercises



**3.4 - Morphological filters - Binary**

**3.5 - Morphological filters - Gray**