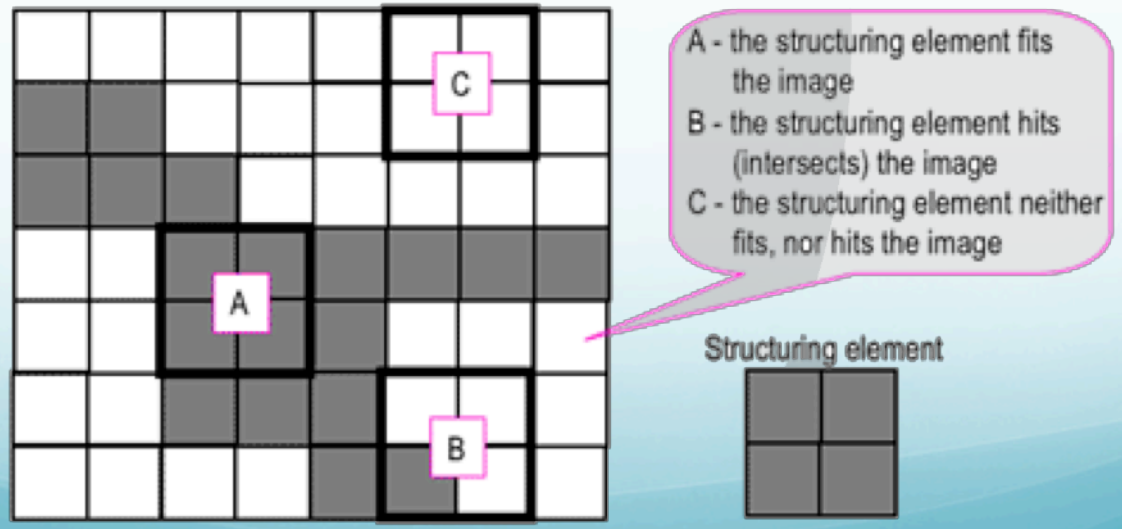
Morphology
Assignment 7

Gwenaelle Cunha Sergio
ABR Lab – BEP
KNU 2014.1

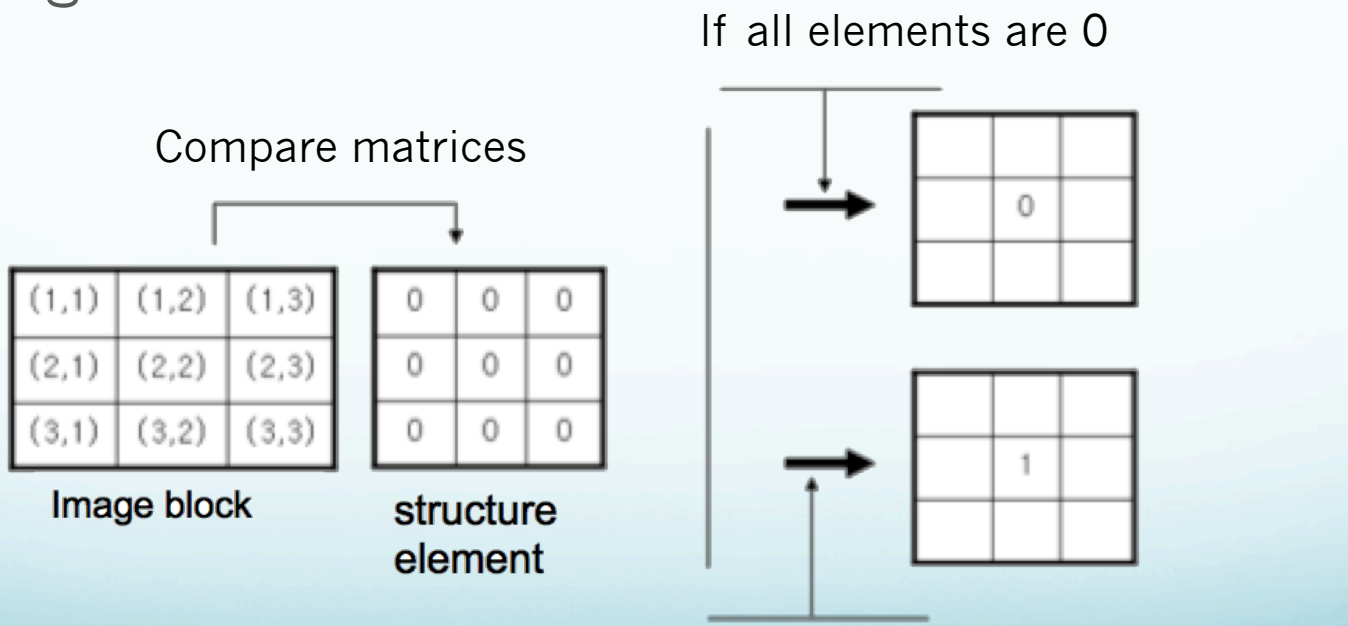
Morphology

- **Analysis** of image shape and structure.
- Based on **Set Theory**
- Pattern of 1's and 0's specify **shape** of the structuring element.
- It is not a sum operation like the masks before, but just a **comparison** of the pixels inside the mask's boundary with its respective pixel in the mask



Dilation

- Expands foreground and shrinks background
- Used to fill holes and connect between cut regions



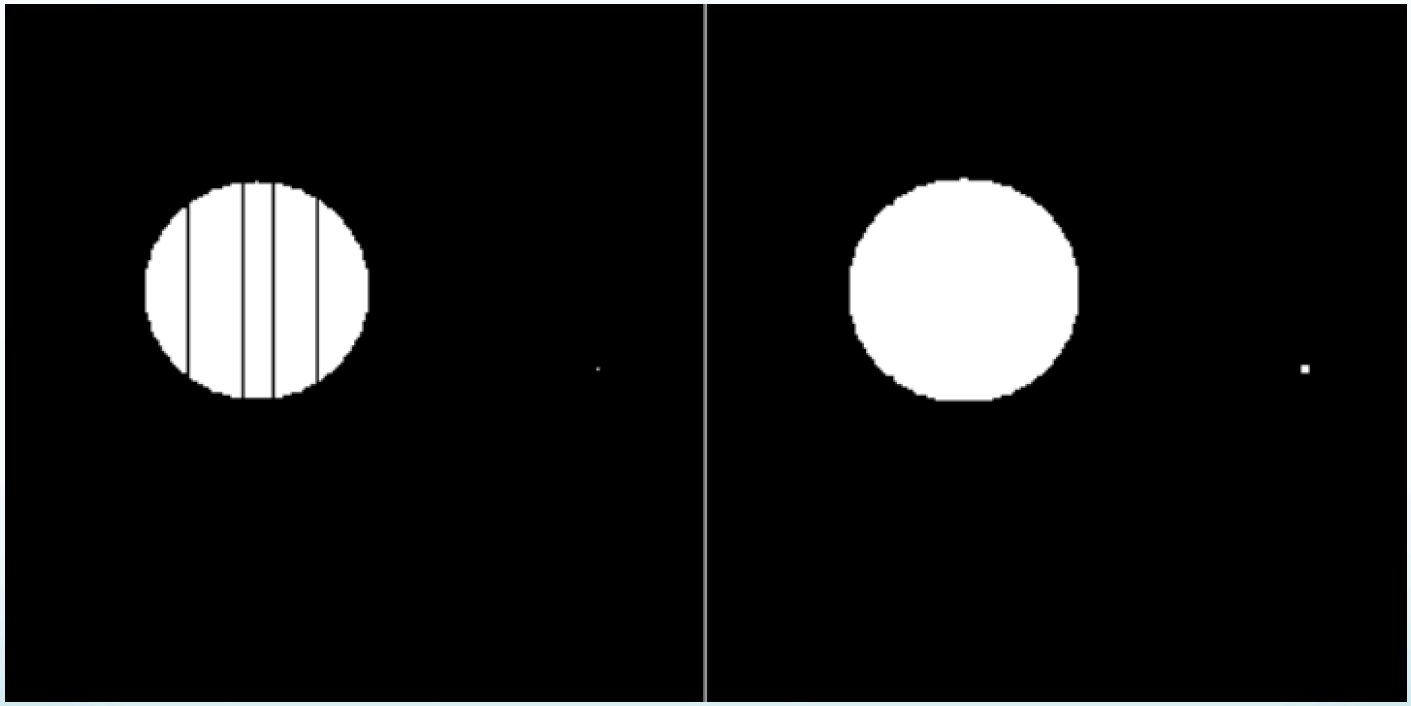
Dilation - Code

```
bool dif;

for (int i = 0; i < mat.rows; i++){
      for (int j = 0; j < mat.cols; j++){
            dif = false;
            for (int ki = i-radius; ki <= i+radius; ki++){
                  for (int kj = j-radius; kj <= j+radius; kj++){
                        if (!((ki < 0 || kj < 0) || (ki >= mat.rows || kj >= mat.cols))) {
                              if (mat.at<uchar>(ki,kj) != 0) dif = true;
                        }
                  }
            }

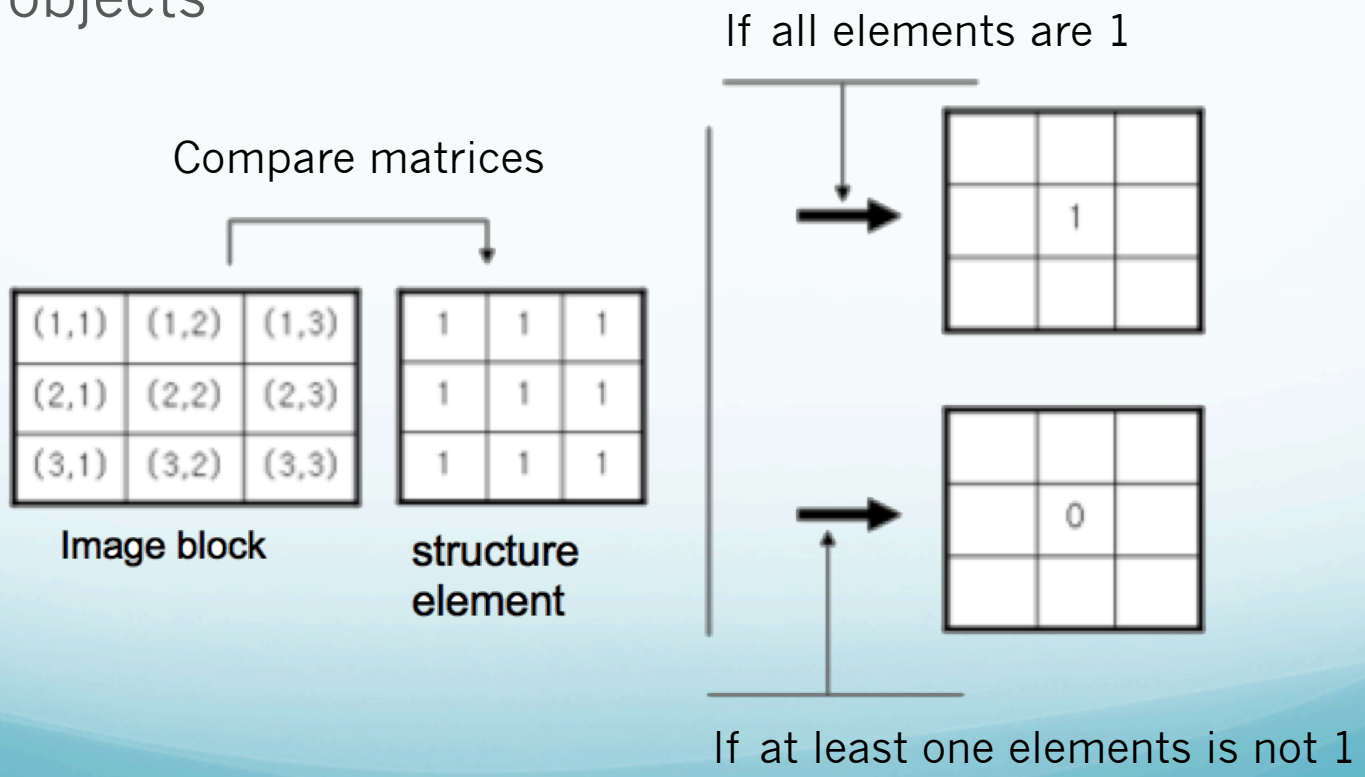
            if (dif) img.at<uchar>(i,j) = 255;
            else img.at<uchar>(i,j) = 0;
      }
}
```

Dilation - Result



Erosion

- Shrinks foreground and expands background
- Remove small noises and separates connected objects



Erosion - Code

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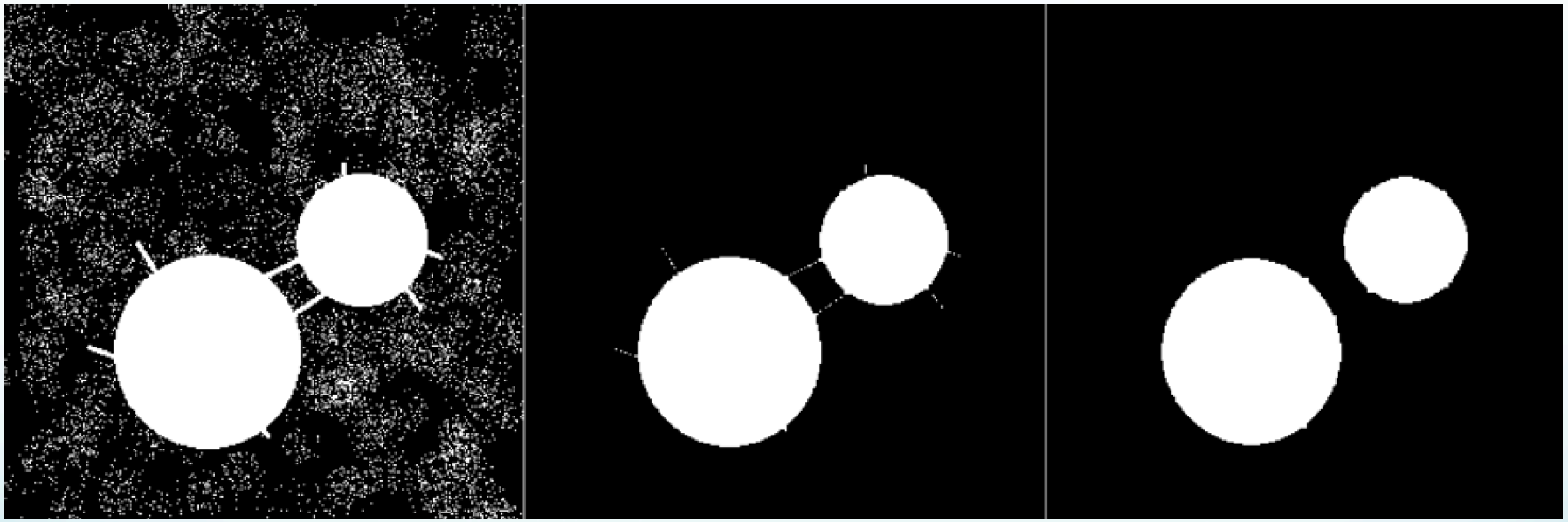
                  }
            }

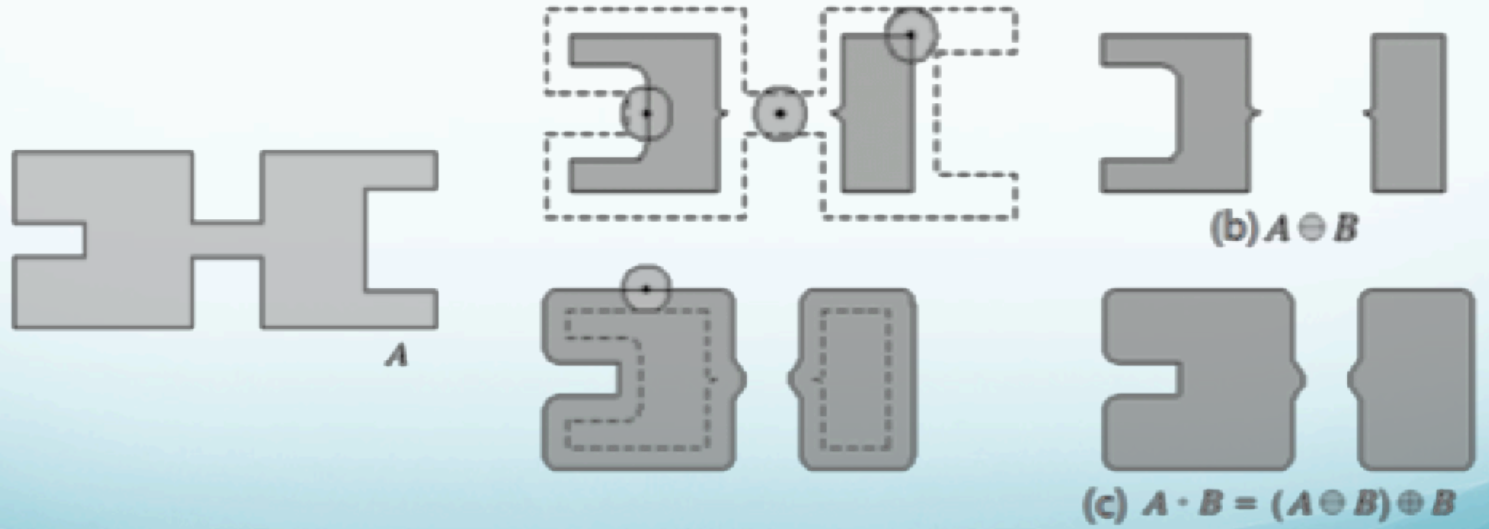
            if (dif) img.at<uchar>(i,j) = 255;
            else img.at<uchar>(i,j) = 0;
      }
}
```

Erosion - Result

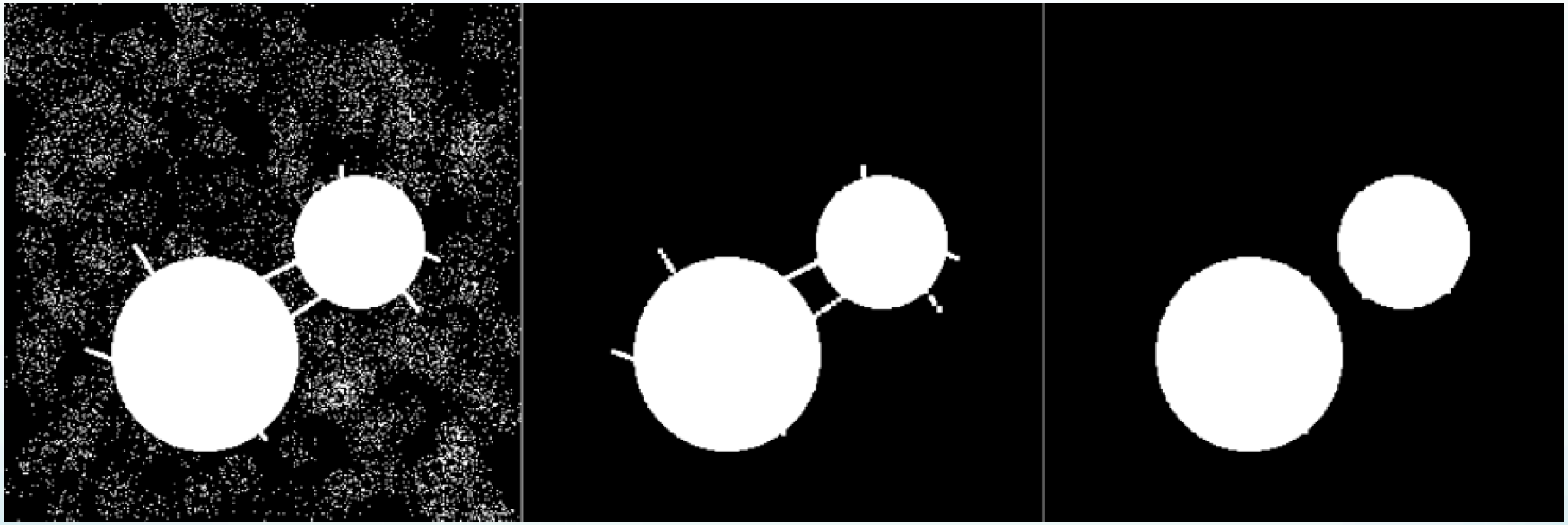


Opening

- Erosion followed by a dilation
- Smoothes contour of object
- Eliminates thin protrusions and connections

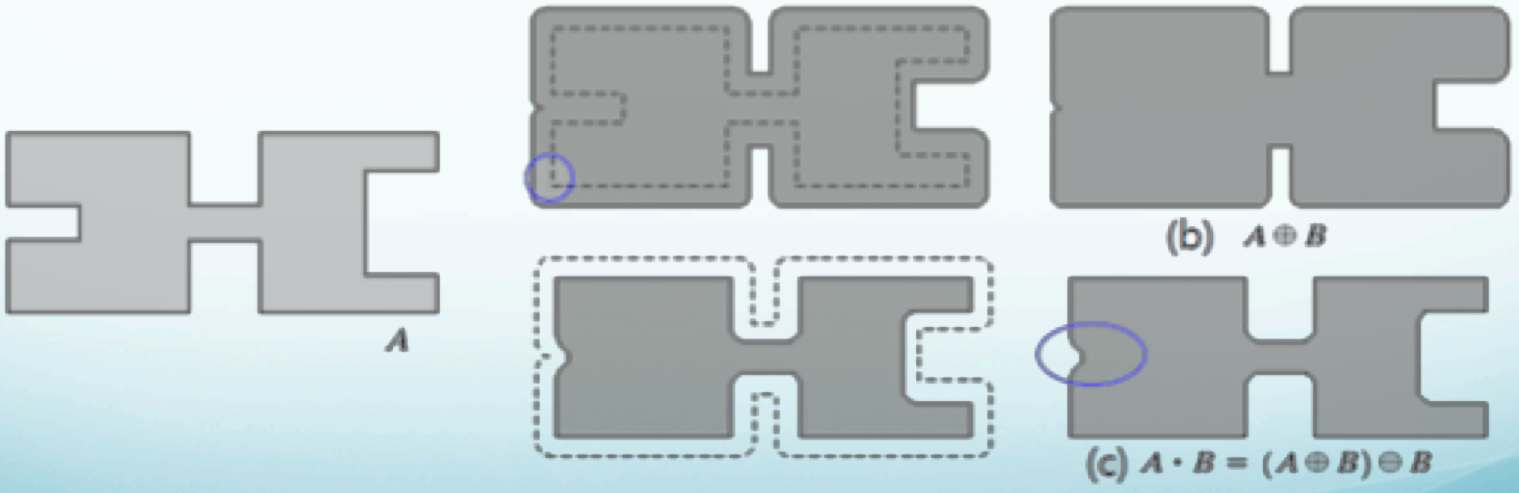


Opening - Result



Closing

- Dilation followed by an erosion
- Also smooths the contour
- Eliminates small holes and fills gaps



Closing - Result