HW 5: Gray Scale Morphology

Source Code

All questions are written in Python code, please refer to the file “main.py”.
All images will be stored in the folder “res” (automatically create a new folder).
In accordance with the **FAQ** of course website:

- All parts of the question are written from scratch, except for plotting images

Answer

1. Dilation
   Algorithm:
   1) Iterate grayscale image
   2) Find the local maxima in the area of image inside kernel

```
def grayDilation(img, kernel):
    temp = img.copy()
    ycenter = int(kernel.shape[0] / 2)
    xcenter = int(kernel.shape[1] / 2)
    for i in range(img.shape[0]):
        for j in range(img.shape[1]):
            pixel = 0
            for x in range(kernel.shape[0]):
                for y in range(kernel.shape[1]):
                    if kernel[x][y] == 1:
                        xdest = i + x - ycenter
                        ydest = j + y - xcenter
                        if (0 <= xdest < img.shape[0]) and (0 <=
ydest < img.shape[0]):
                            pixel = max(pixel, img[xdest][ydest])
            temp[i][j] = pixel
    return temp
```

2. Erosion

   Algorithm:

   1) Iterate grayscale image
   2) Find the local minima in the area of image inside kernel

```
def grayErosion(img, kernel):
    temp = img.copy()
    ycenter = int(kernel.shape[0] / 2)
    xcenter = int(kernel.shape[1] / 2)
    for i in range(img.shape[0]):
        for j in range(img.shape[1]):
            pixel = 255
            for x in range(kernel.shape[0]):
                for y in range(kernel.shape[1]):
                    if kernel[x][y] == 1:
                        xdest = i + x - ycenter
                        ydest = j + y - xcenter
                        if (0 <= xdest < img.shape[0]) and (0
<= ydest < img.shape[0]):
                            pixel = min(pixel,
img[xdest][ydest])
            temp[i][j] = pixel
    return temp
```

3. Opening
   Algorithm:
   1) Do dilation algorithm from erosion image

```
opening = grayDilation(erosion, kernel)
cv2.imwrite("res/opening.bmp", opening)
```

4. Closing
   Algorithm:
   1) Do erosion algorithm from dilation image

```
closing = grayErosion(dilation, kernel)
cv2.imwrite("res/closing.bmp", closing)
```