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Learning-based Multimedia Processing

2023/2024

Lab classes (5)

1 Image processing – Morphological filtering

Morphological filters require the definition of the structuring element, using the function `cv2.getStructuringElement()`, and then can be applied using function `cv2.morphologyEx()`.

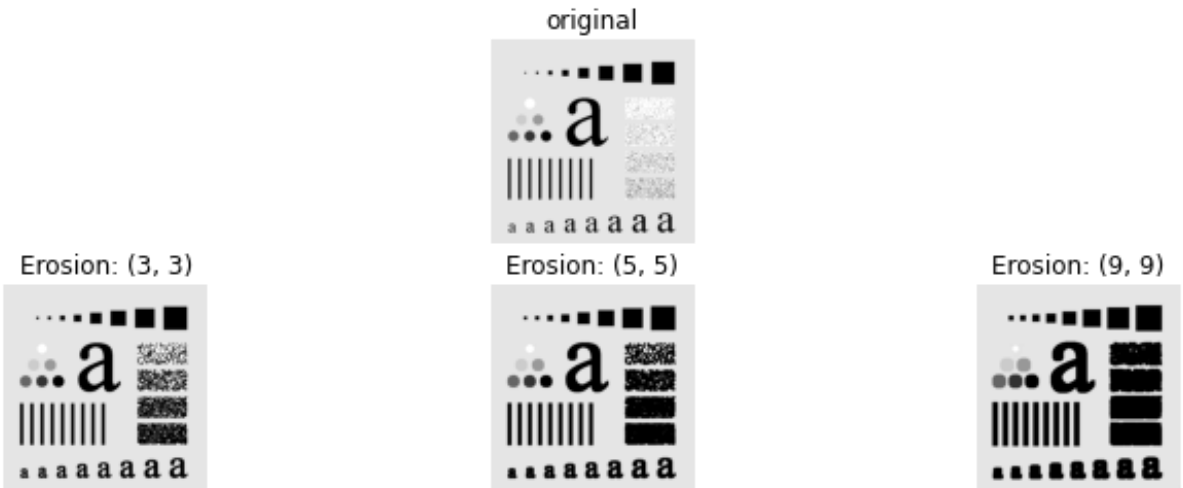
The `cv2.getStructuringElement()` function requires two arguments: type and the size of structuring element. Type `cv2.MORPH_RECT` indicates a rectangular structuring element; `cv2.MORPH_CROSS` means a cross shape structuring element, and `cv2.MORPH_ELLIPSE` is used to get a circular structuring element.

The `cv2.morphologyEx` function allows to select the morphological operation, followed by the structuring element.

Erosion

Example of applying morphological erosion:

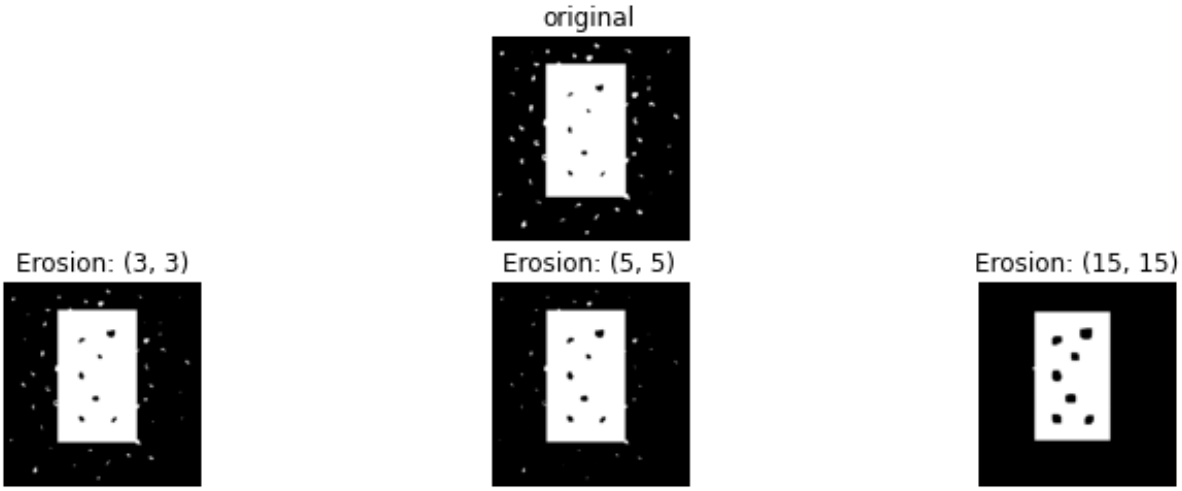
```
SE = cv2.getStructuringElement(cv2.MORPH_RECT, (3,3))
eroded = cv2.morphologyEx(img, cv2.MORPH_ERODE, SE)
```



The morphological erosion can also be applied using function `cv2.erode()`, which has as third argument: the number of iterations for erosion to be applied.

Example:

```
eroded = cv2.erode(img, None, 2) # None means a 3x3 SE
```

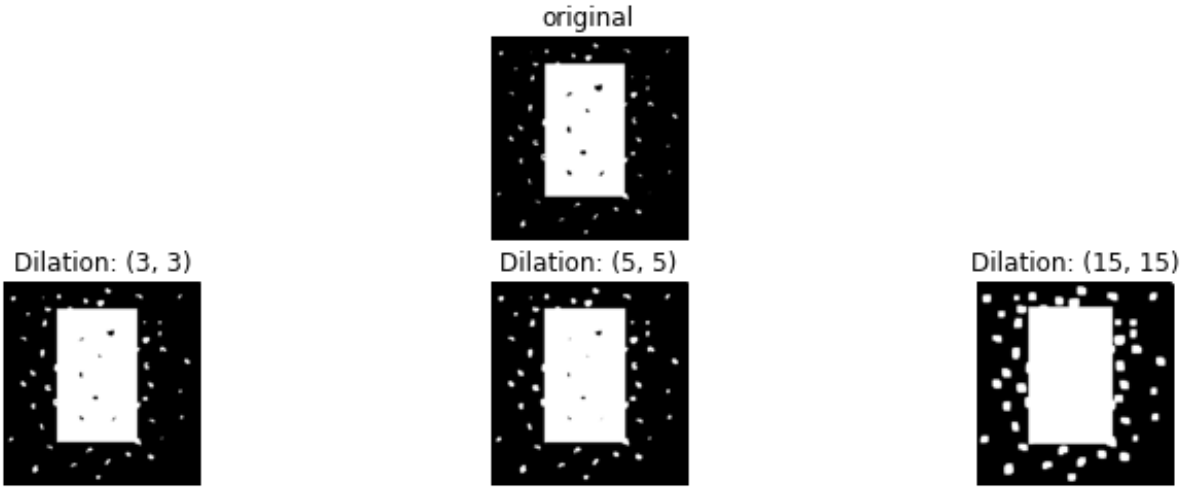


Dilation

Example of applying morphological dilation:

```
SE = cv2.getStructuringElement(cv2.MORPH_RECT, (3,3))
dilated = cv2.morphologyEx(img, cv2.MORPH_DILATE, SE)
```

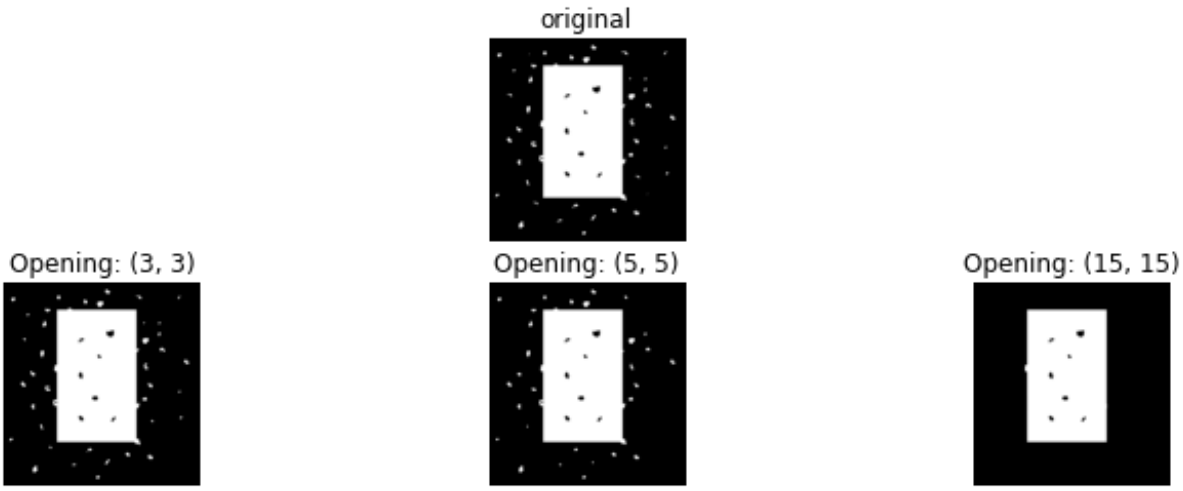
The morphological dilation can also be applied using function **`cv2.dilate()`**, which has as third argument: the number of iterations for dilation to be applied.



Opening

Example of applying morphological open (erosion followed by dilation):

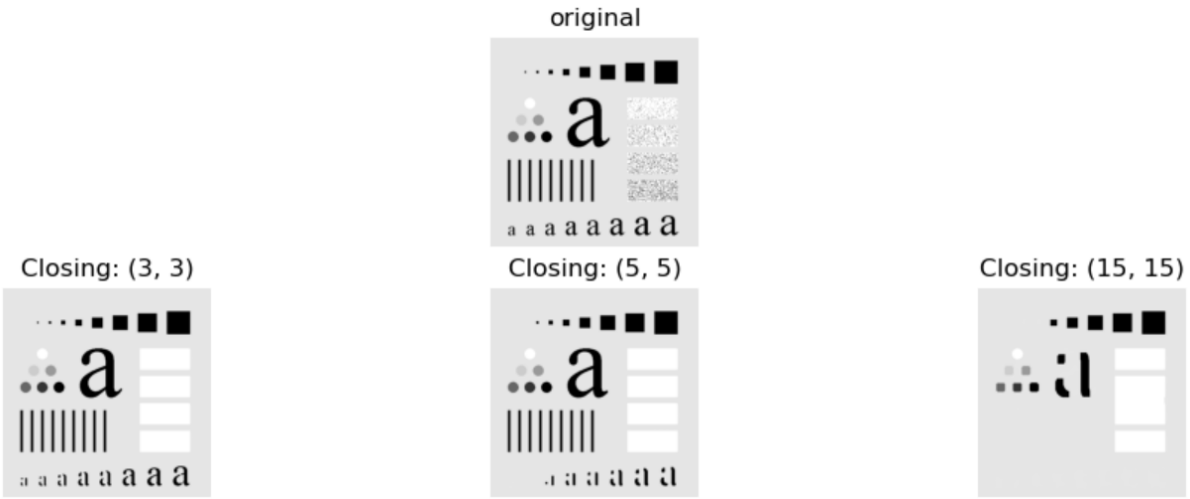
```
SE = cv2.getStructuringElement(cv2.MORPH_RECT, (3,3))
output = cv2.morphologyEx(img, cv2.MORPH_OPEN, SE)
```

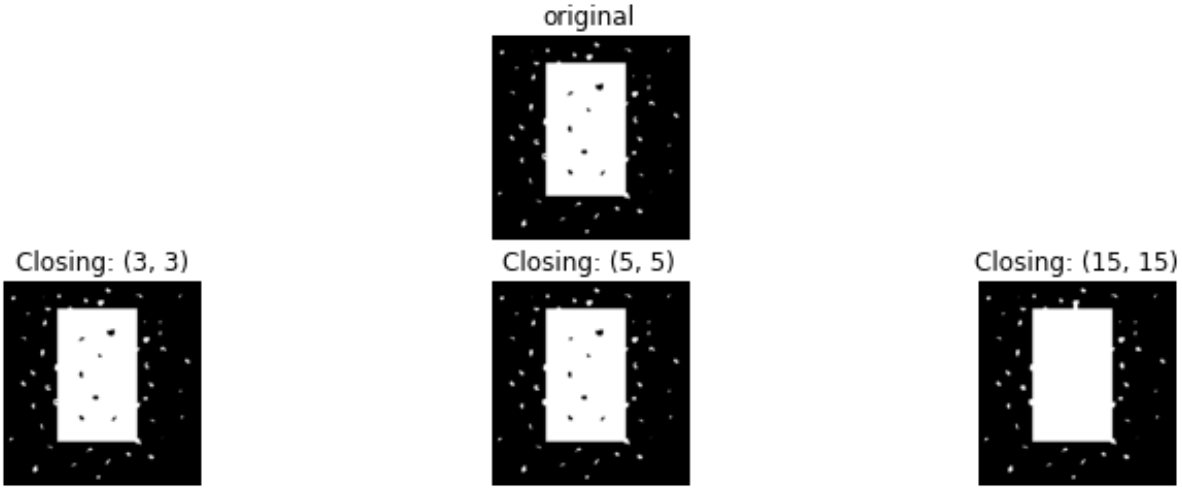


Closing

Example of applying morphological close (dilation followed by erosion):

```
SE = cv2.getStructuringElement(cv2.MORPH_RECT, (3,3))
output = cv2.morphologyEx(img, cv2.MORPH_CLOSE, SE)
```

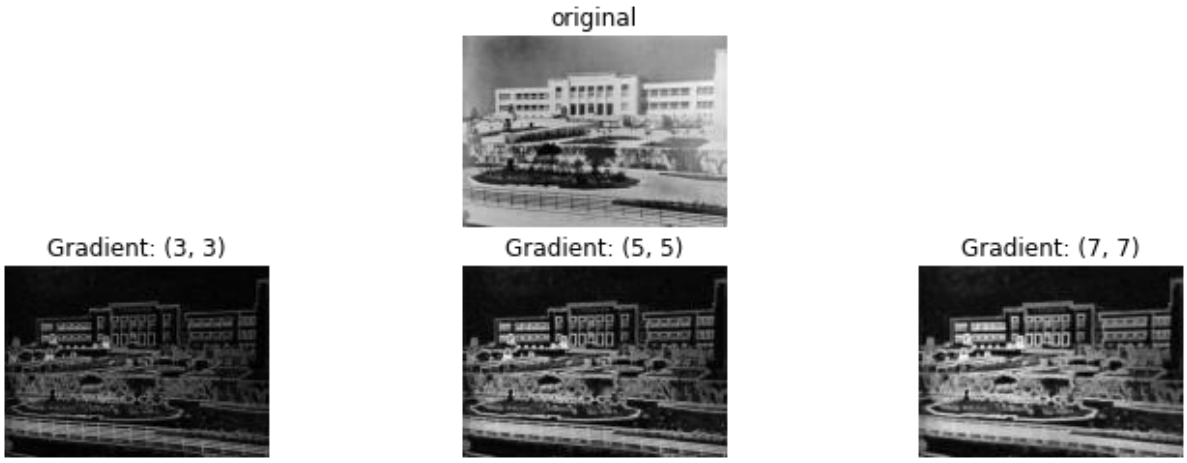




Morphological gradient

The morphological gradient is the difference between dilation and erosion.

```
SE = cv2.getStructuringElement(cv2.MORPH_RECT, (3,3))
output = cv2.morphologyEx(img, cv2.MORPH_GRADIENT, SE)
```

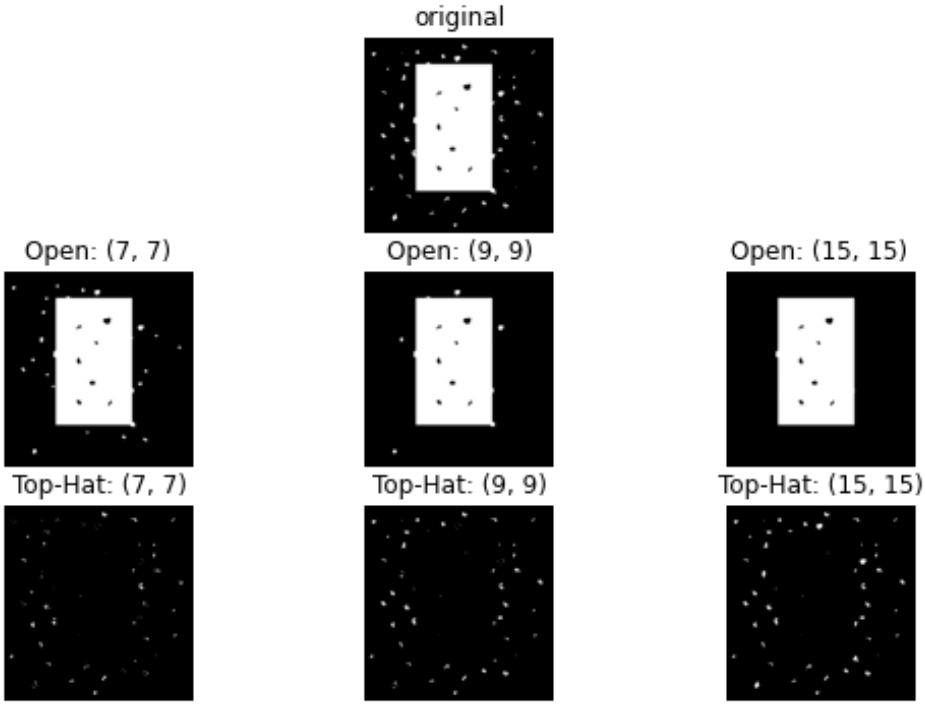


Morphological top-hat

A top hat (also known as a white hat) morphological operation is the difference between the original (grayscale/single channel) input image and the opening.

A top hat operation is used to reveal bright regions of an image on dark backgrounds.

```
SE = cv2.getStructuringElement(cv2.MORPH_RECT, (3,3))
output = cv2.morphologyEx(img, cv2.MORPH_TOPHAT, SE)
```



Morphological black-hat

A black hat morphological operation is the difference between the original (grayscale/single channel) input image and the closing.

A black hat operation is used to reveal dark regions of an image on light backgrounds.

```
SE = cv2.getStructuringElement(cv2.MORPH_RECT, (7,7))
output = cv2.morphologyEx(img, cv2.MORPH_BLACKHAT, SE)
```