

VIETNAM NATIONAL UNIVERSITY HO CHI MINH CITY  
UNIVERSITY OF SCIENCE  
COMPUTER VISION



APPLIED DIGITAL IMAGE & VIDEO PROCESSING

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PRACTICE#1 REPORT

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Ho Chi Minh city - 2023

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# 1 Binary image

## 1.1 Dilation

### 1.1.1 Idea

$$X \oplus B = \{p \in \varepsilon^2 : p = x + b, x \in X, b \in B\}$$

Where:

- X: binary image
- B: structure matrix

### 1.1.2 Result

??<sup>1</sup>



## 1.2 Erosion

### 1.2.1 Idea

$$X \ominus B = \{p \in \varepsilon^2 : p + b \in X, \forall b \in B\}$$

Where:

- X: binary image
- B: structure matrix

<sup>1</sup>Convention: in result section, image from left to right: Original image, Morphology by OpenCV, Morphology by self-code

### 1.2.2 Result



## 1.3 Opening

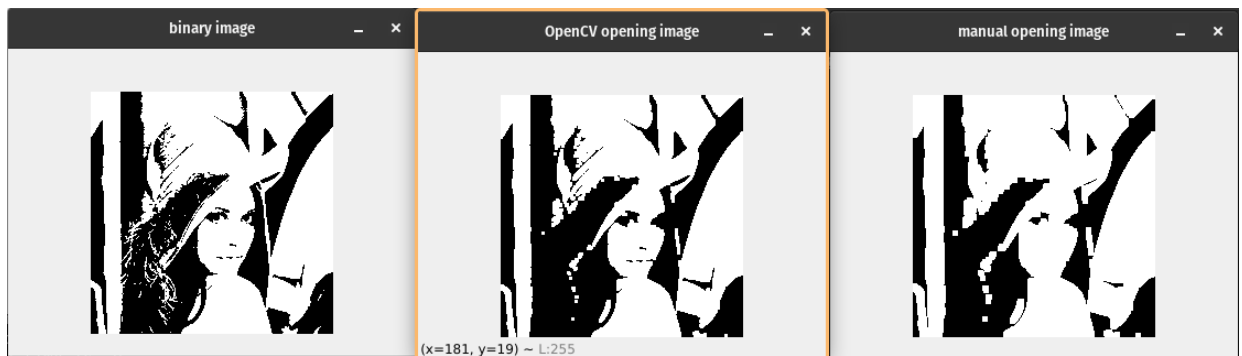
### 1.3.1 Idea

$$X \circ B = (X \ominus B) \oplus B$$

Where:

- X: binary image
- B: structure matrix

### 1.3.2 Result



## 1.4 Closing

### 1.4.1 Idea

$$X \bullet B = (X \oplus B) \ominus B$$

Where:

- X: binary image
- B: structure matrix

### 1.4.2 Result



## 1.5 Hit or miss

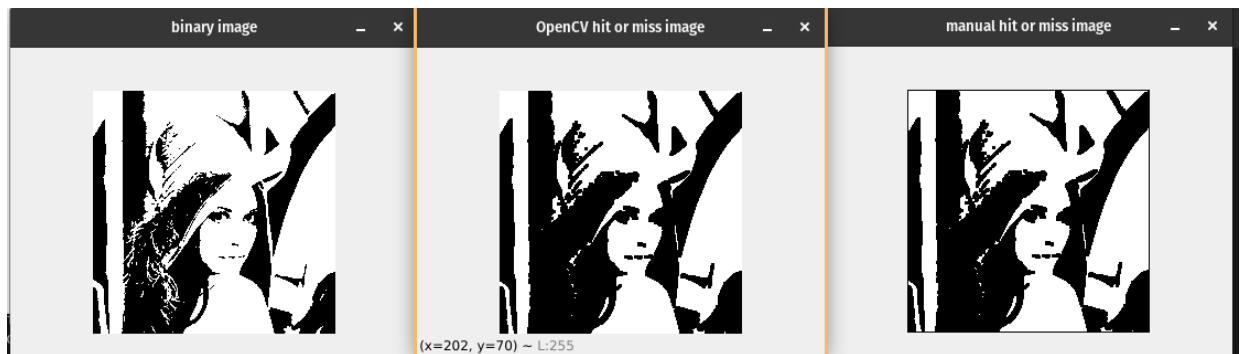
### 1.5.1 Idea

$$X \otimes B = (X \ominus B_1) \cap (X^c \ominus B_2)$$

Where:

- X: binary image
- $B_1, B_2$ : structure matrix
- $B_2 = B_1^c$

### 1.5.2 Result



## 1.6 Boundary extraction

### 1.6.1 Idea

$$\beta(X) = X - (X \ominus B)$$

Where:

- X: binary image
- B: structure matrix

### 1.6.2 Result



## 1.7 Thinning

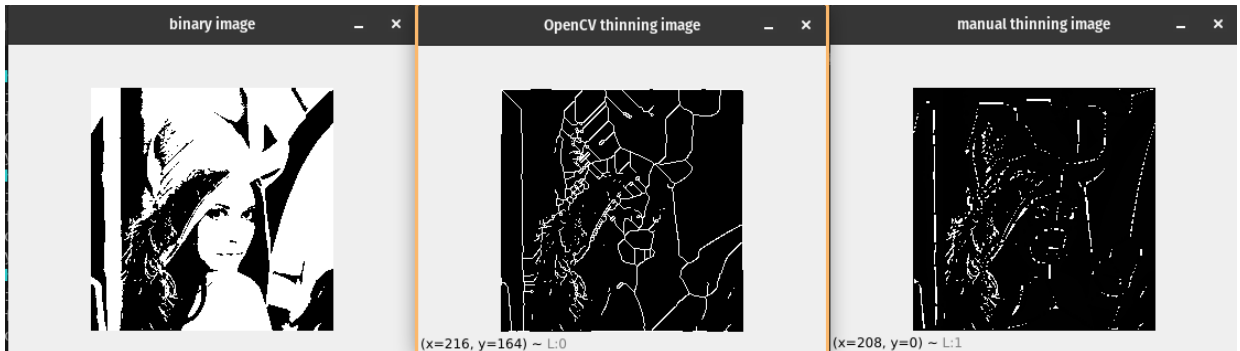
### 1.7.1 Idea

$$X \oslash B = X - (X \otimes B)$$

Where:

- X: binary image
- B: structure matrix

### 1.7.2 Result



## 1.8 Grayscale image

## 1.9 Dilation

### 1.9.1 Idea

$$(f \oplus b)(s, t) = \max\{f(s - x, t - y) + b(x, y) | (s - x), (t - y) \in D_f; (x, y) \in D_b\}$$

Where:

- $f(x, y)$ : gray-scale image
- $b(x, y)$ : structuring element

### 1.9.2 Result



## 1.10 Erosion

### 1.10.1 Idea

$$(f \ominus b)(s, t) = \max\{f(s + x, t + y) - b(x, y) | (s + x), (t + y) \in D_f; (x, y) \in D_b\}$$

Where:

- $f(x, y)$ : gray-scale image
- $b(x, y)$ : structuring element

### 1.10.2 Result



## 1.11 Opening

### 1.11.1 Idea

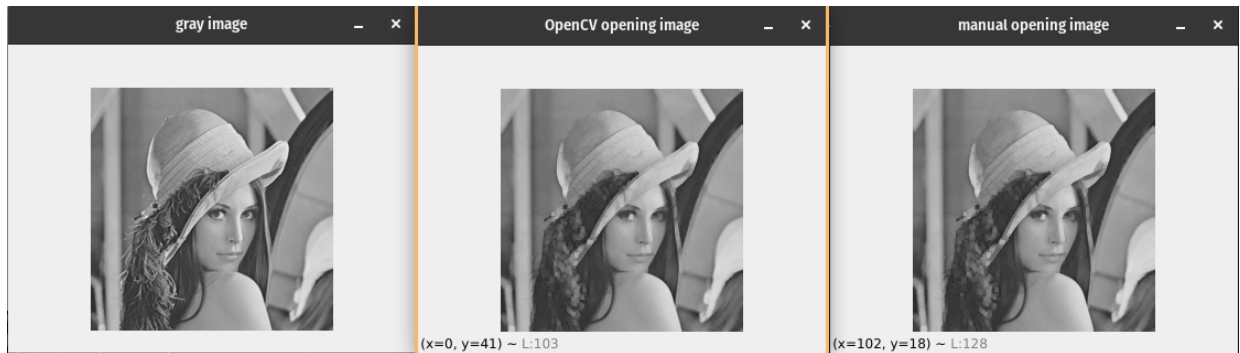
$$f \circ b = (f \ominus b) \oplus b$$

Where:

- $f(x, y)$ : gray-scale image
- $b(x, y)$ : structuring element



### 1.11.2 Result



## 1.12 Closing

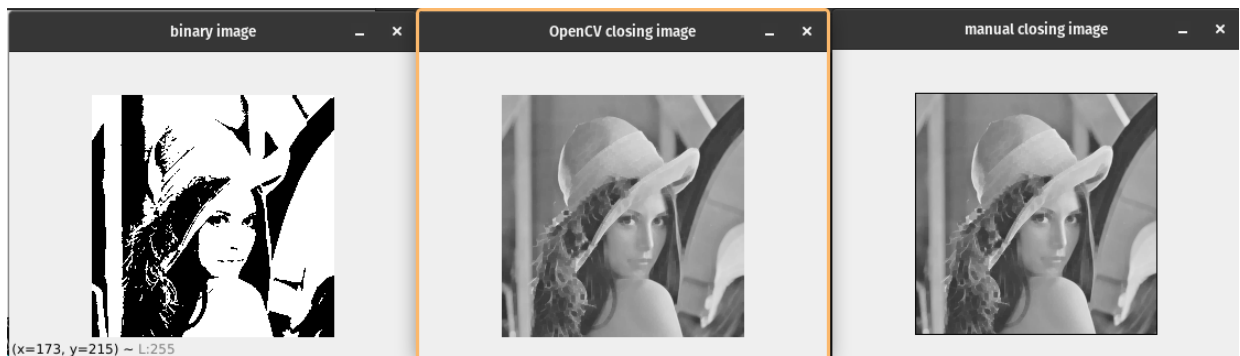
### 1.12.1 Idea

$$f \bullet b = (f \oplus b) \ominus b$$

Where:

- $f(x, y)$ : gray-scale image
- $b(x, y)$ : structuring element

### 1.12.2 Result



## 1.13 Gradient

### 1.13.1 Idea

$$h = (f \oplus b) - (f \ominus b)$$

Where:

- $f(x, y)$ : gray-scale image
- $b(x, y)$ : structuring element

### 1.13.2 Result



## 1.14 Top Hat

### 1.14.1 Idea

$$h = f - (f \circ b)$$

Where:

- $f(x, y)$ : gray-scale image
- $b(x, y)$ : structuring element

### 1.14.2 Result



## 1.15 Black Hat

### 1.15.1 Idea

$$h = (f \bullet b) - f$$

Where:

- $f(x, y)$ : gray-scale image
- $b(x, y)$ : structuring element

### 1.15.2 Result



## 2 Self-scoring table

No.	Type	Morphology	Percent	Note
1	Binary image	Dilation	100%	
2		Erosion	100%	
3		Opening	100%	
4		Closing	100%	
5		Hit or miss	100%	
6		Boundary extraction	100%	
7		Thinning	100%	
8	Grayscale image	Dilation	100%	
9		Erosion	100%	
10		Opening	100%	
11		Closing	100%	
12		Boundary extraction	100%	
13		Top-hat	100%	
14		Black-hat	100%	