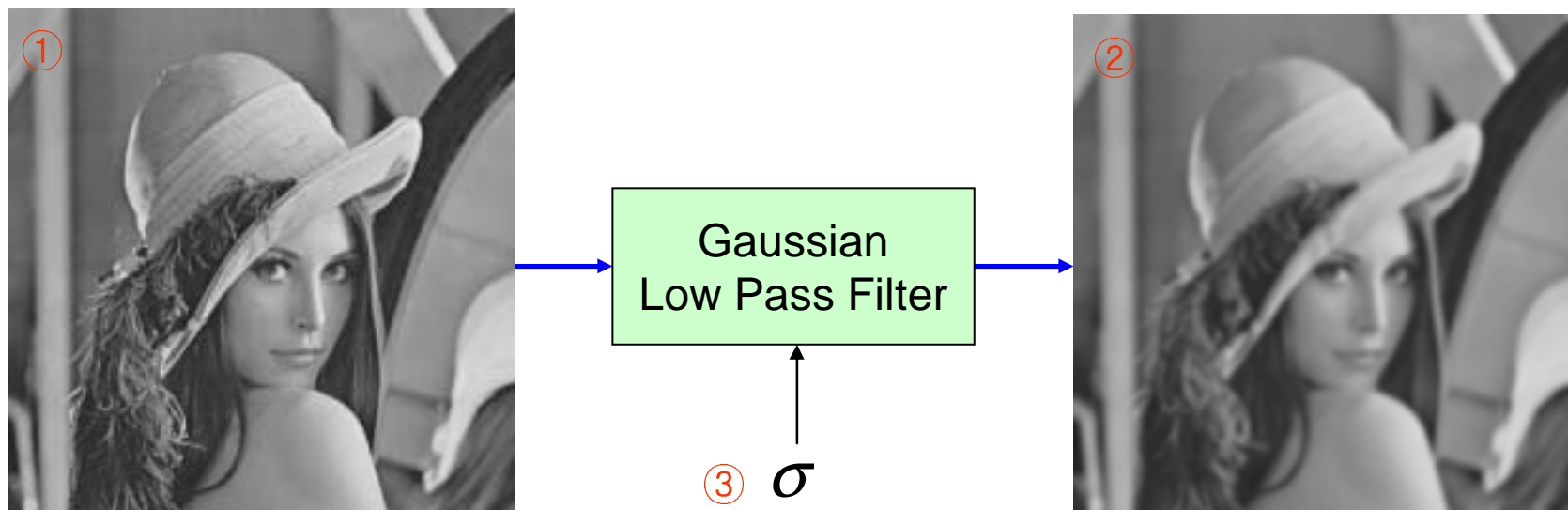


Detecting Edges (The Canny Edge Detector)

 **Hoon Yoo, Ph.D.**

The Canny edge detector

- Remove noise
 - Gaussian Low Pass Filtering

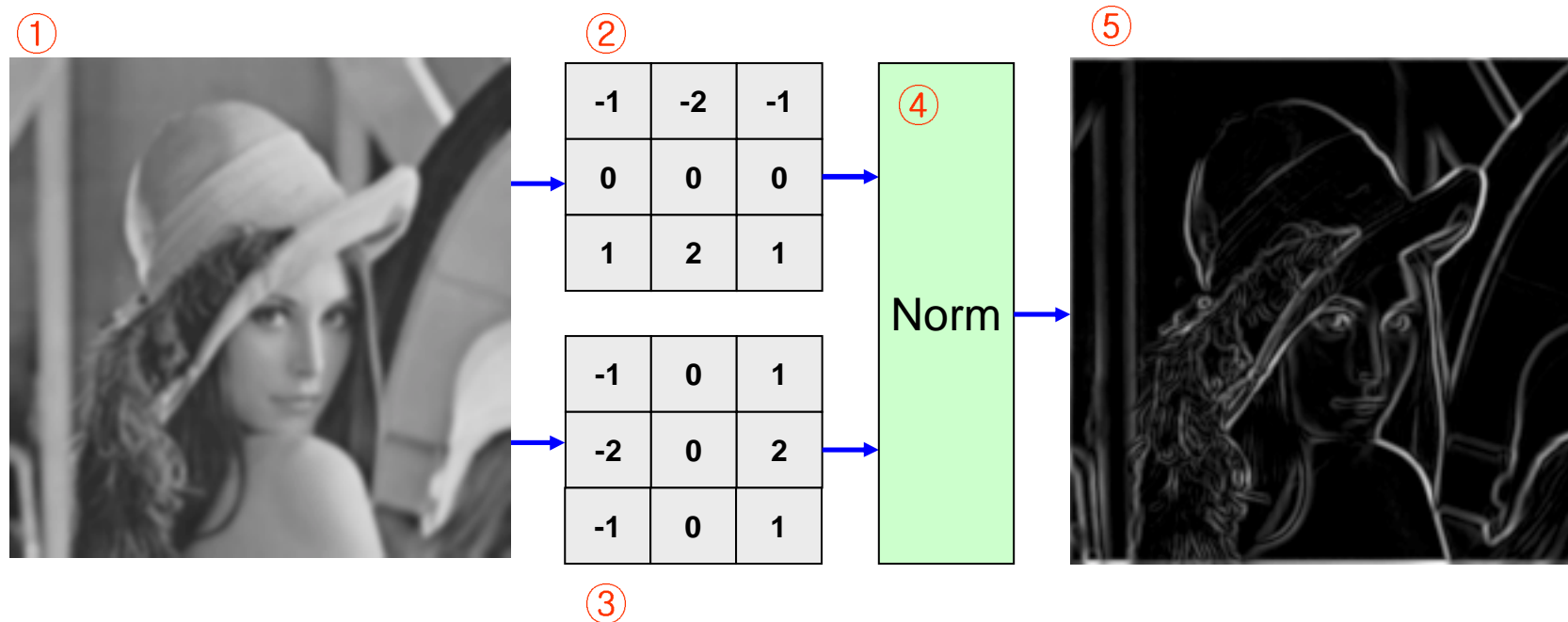


$$h[i] = \exp\left(-\frac{i^2}{2\sigma^2}\right), \quad i = 0, \pm 1, \pm 2, \pm 3, \dots$$

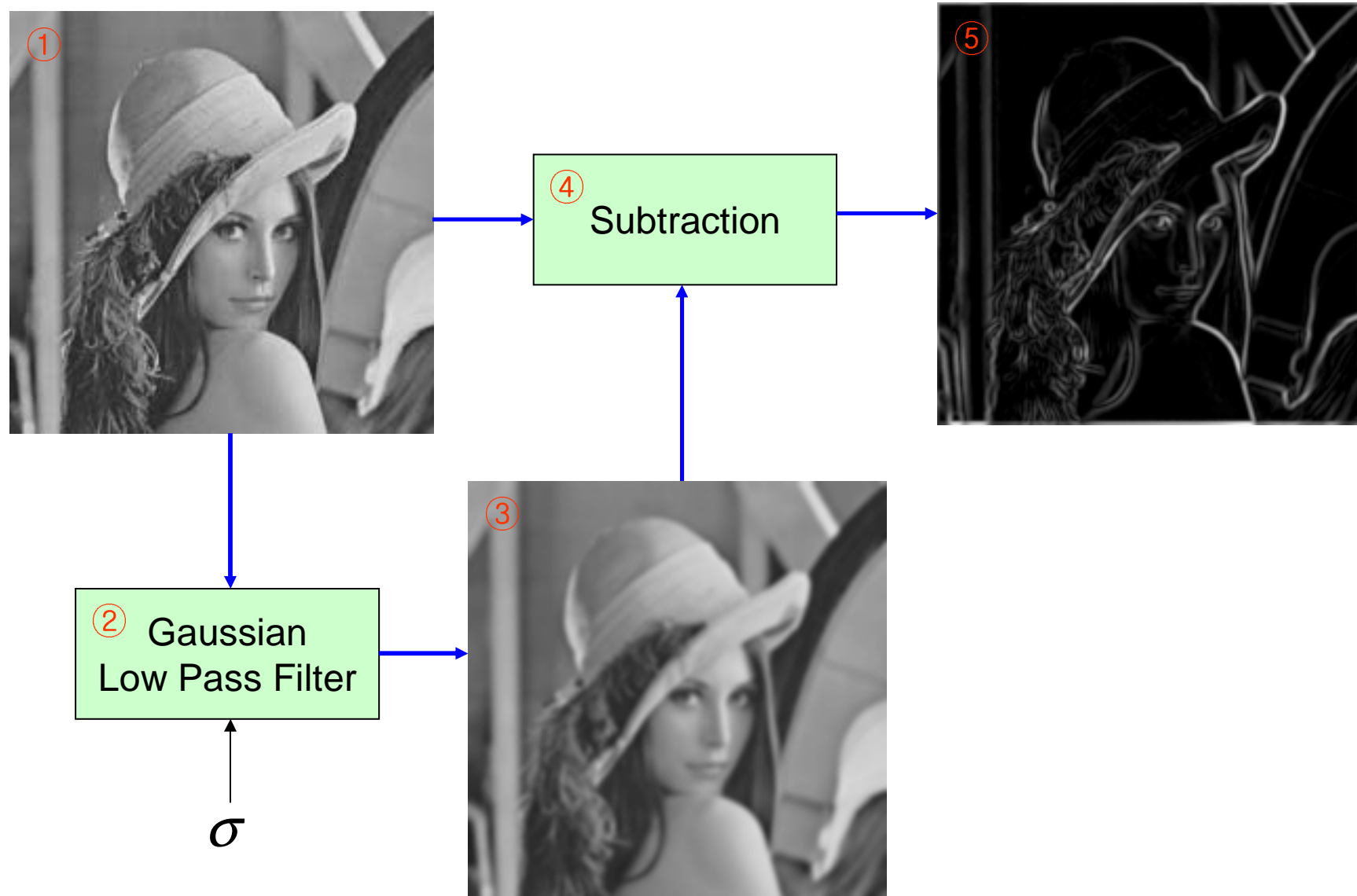
(4)

The Canny edge detector

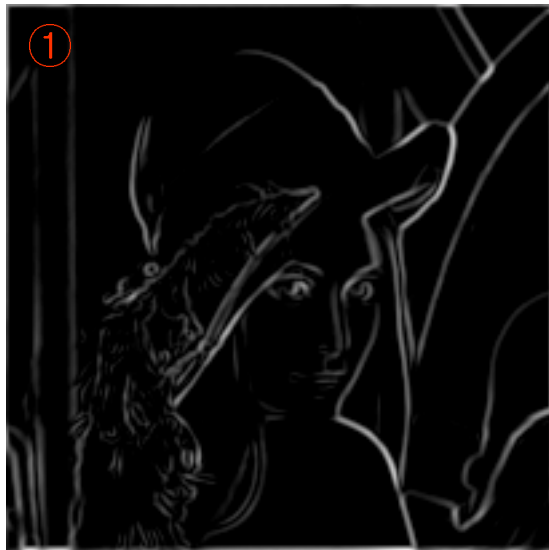
- Norm of the gradient



Edge detection by subtraction



The Canny edge detector



Thresholding



Thresholding
+
④ Thinning



Effect of σ (Gaussian kernel size)



① original



Canny with $\sigma = 1$



Canny with $\sigma = 2$

Chain Code

- Meta data for the edge map image
- Edge images have many pixels
 - Edge lines has fewer pixels



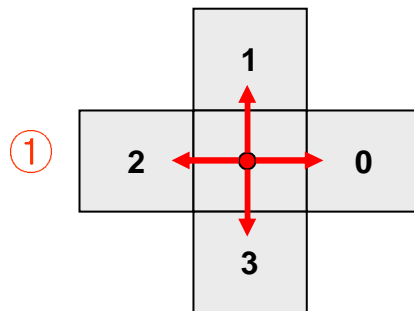
edge map image

②
Chain
Coding

③
{3,3,2,3,0,3,0,3,0,0,3}

Chain Code

- Connection between edge pixels
 - 4 neighbors, 8 neighbors

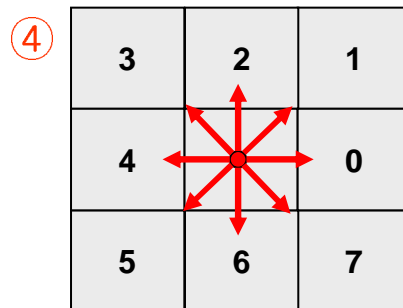


② Current -> right :0

Current -> up :1

Current -> Left :2

③ Current -> down :3



Current -> right :0

⑤ Current -> right +up:1

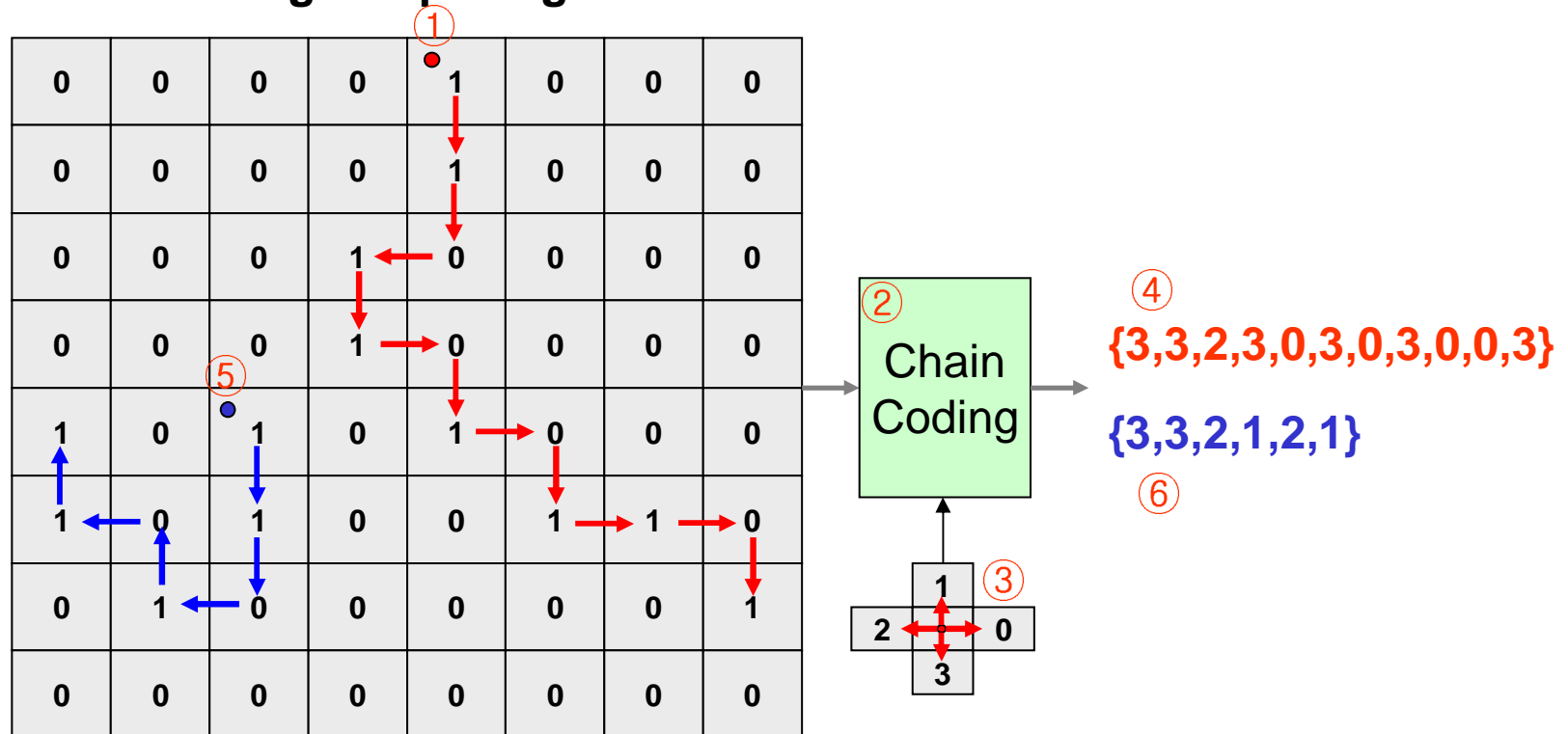
Current -> up :2

...

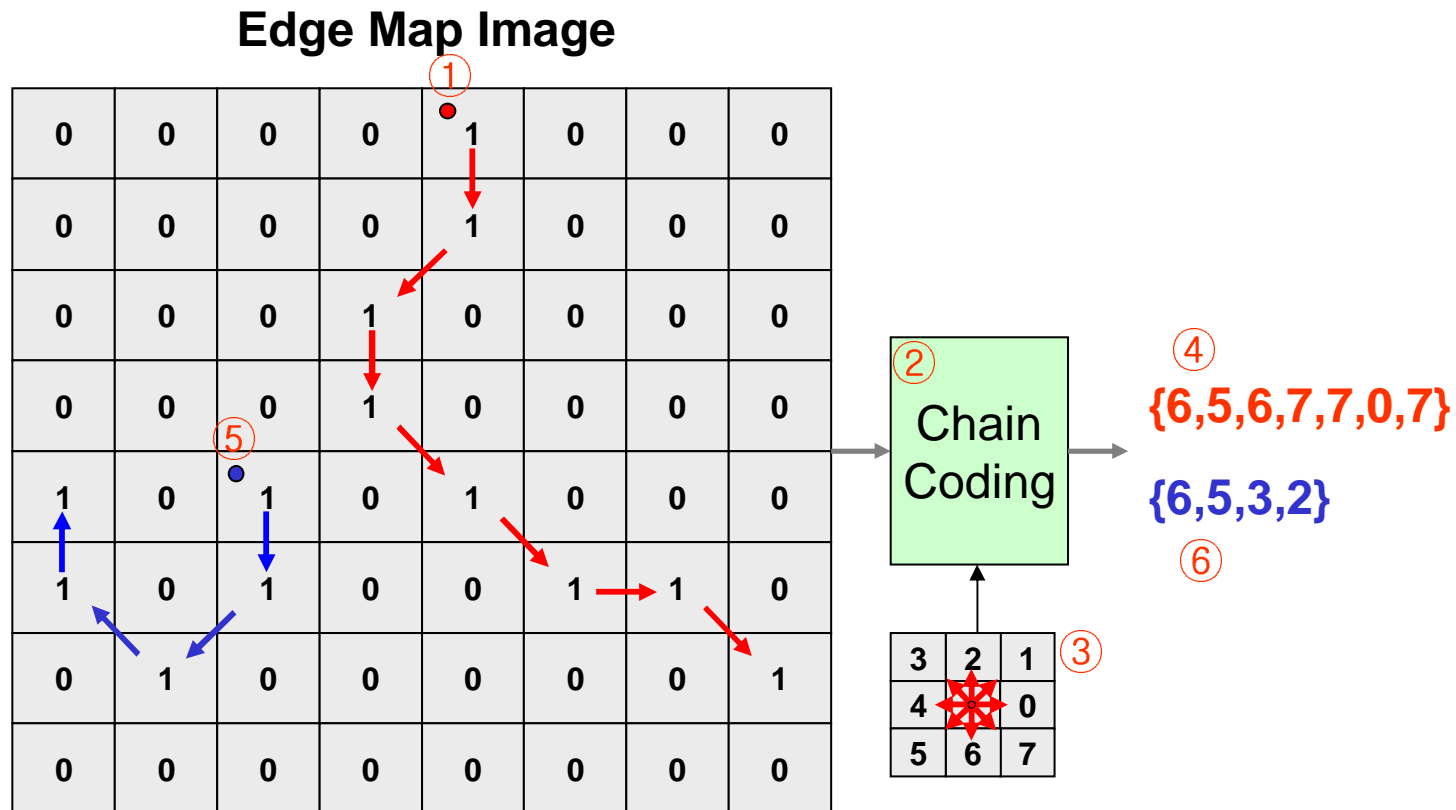
Current -> right+down :7

Example of Chain Code

Edge Map Image



Example of Chain Code



Summary

- Canny detector
 - Gaussian low pass filter
 - Canny edge masking (high pass filter)
 - Thresholding with non-maximum suppression
- Chain Code
 - Convert edge map images to meta data