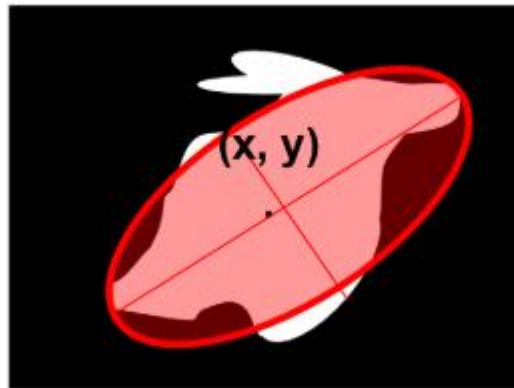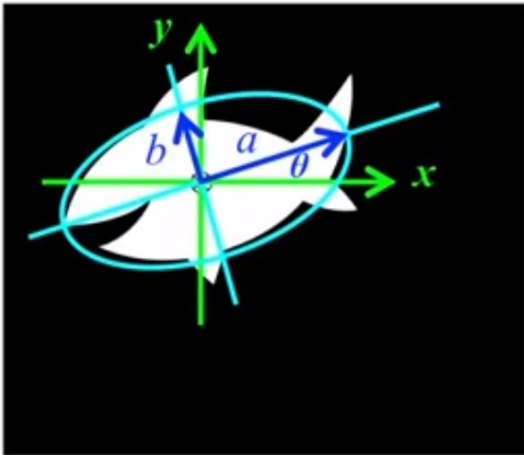# 電腦視覺原理及應用簡介

Lab7

PCA Ellipse Fitting

Ellipse Fitting

- Fit an ellipse on an object
- In order to draw an ellipse, you need to decide:
    - Center of the ellipse (x, y)
    - Rotational angle of the major axis
    - Length of the major axis and minor axis

Principal component analysis

- Get eigenvalues(λ_1, λ_2) and eigenvectors(v_1, v_2)

- radii

$$a = \sqrt{\lambda_1} \,,\, b = \sqrt{\lambda_2}$$

where $\lambda_1 > \lambda_2$

- orientation

$$\theta = \tan^{-1} \frac{v_y}{v_x}$$

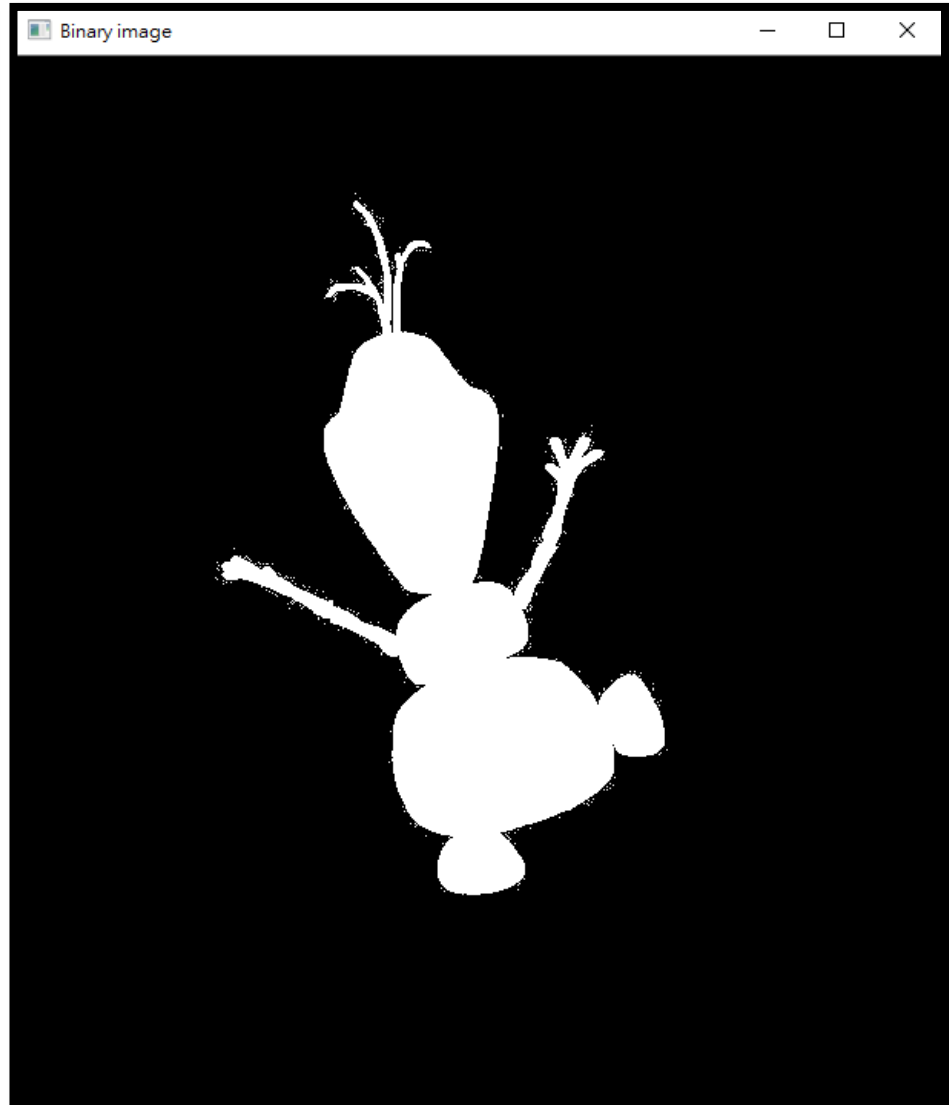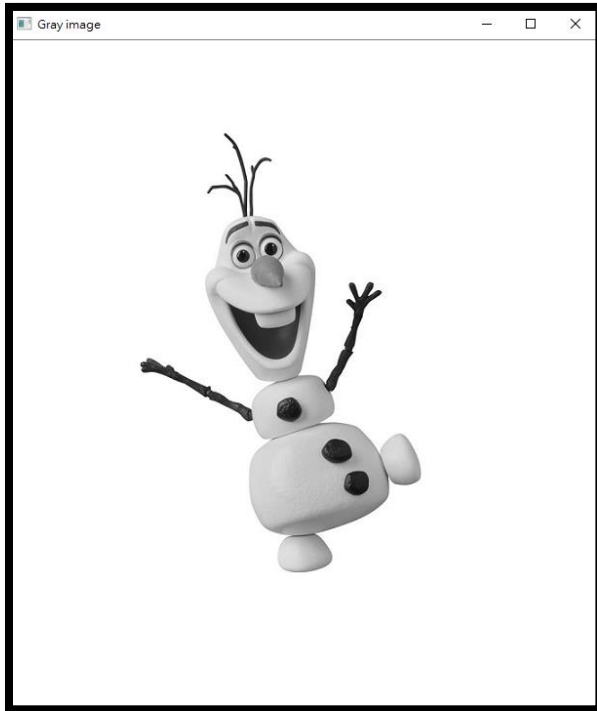where *v* is the eigenvector corresponding to the largest eigenvalue

Assignment

- 將物件輪廓點做PCA後畫出橢圓、原點、物件輪廓

- 完成請繳交程式碼與圖片

Assignment (cont.)

```python
1   import cv2
2   import numpy as np
3   from math import atan2, sqrt, pi
4
5   ## read image
6   grayImage = cv2.imread('olaf.jpg', cv2.IMREAD_GRAYSCALE)
7
8   ## convert to binary image
9
10  ## morphological
11  kernel = np.ones((3, 3), np.uint8)
12
13
14  ## find and draw contours
15
16  ## PCA analysis
17
18  ## center of the object, rotational angle, length of the major axis and minor axis
19
20  ## draw center circle and ellipse
21
22
23  ## show images and write image
24  cv2.imshow('Gray image', grayImage)
25  cv2.imshow('Binary image', binaryImage)
26  cv2.imshow('Morphological', opening)
27  cv2.imshow('PCA ellipse', pca_ellipse)
28
29  cv2.imwrite("PCA_ellipse.jpg", pca_ellipse)
30
31  cv2.waitKey(0)
32  cv2.destroyAllWindows()
```

- cv2.threshold()

- cv2.morphologyEx()

- cv2.PCACompute2()

- atan2()

- cv2.circle()

- cv2.ellipse()

Demo

Demo