# 922 U0610 電腦視覺
# Computer Vision

# Homework 1

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# I. INTRODUCTION

## 1.1. Descriptions of Problem

Part 1 of this homework is writing a program to generate the following images from lena.bmp:

A. Up-side-down lena.bmp.
B. Right-side-left lena.bmp.
C. Diagonally mirrored lena.bmp.

Part 2 of this homework is using any kind of software to do the following things:

A. Rotate lena.bmp 45 degrees clockwise.
B. Shrink lena.bmp in half.
C. Binarize lena.bmp at 128 to get a binary image.

## 1.2. Programming Tools

### 1.2.1. Programming Language: Python3

### 1.2.2. Programming IDE: Visual Studio Code

### 1.2.3. Tool used in part 2 of this homework: Microsoft Office Word 2016

# II. METHOD

## 2.1. Algorithms

### 2.1.1. Up-side-down lena.bmp

Step 1. Load image from file.

Step 2. Get width and height of image.

Step 3. New image with the same size and ‘grayscale’ format.

Step 4. Process image pixel by pixel. (r: row, c: column)

Step 4.1. Get pixel from lena.bmp at (c, height - 1 - r).

Step 4.2. Set pixel to target at (c, r)

Step 5. Save image.

### 2.1.2. Right-side-left lena.bmp

Step 1. Load image from file.

Step 2. Get width and height of image.

Step 3. New image with the same size and ‘grayscale’ format.

Step 4. Process image pixel by pixel. (r: row, c: column)

Step 4.1. Get pixel from lena.bmp at (width - 1 - c, r).

Step 4.2. Set pixel to target at (c, r)

Step 5. Save image.

### 2.1.3. Diagonally mirrored lena.bmp

Step 1. Load image from file.

Step 2. Get width and height of image.

Step 3. New image with the same size and ‘grayscale’ format.

Step 4. Process image pixel by pixel. (r: row, c: column)

Step 4.1. Get pixel from lena.bmp at (r, c).

Step 4.2. Set pixel to target at (c, r)

Step 5. Save image.

2.1.1. Rotate lena.bmp 45 degrees clockwise

Step 1. Open Microsoft Office Word 2016.

Step 2. 圖片工具>格式>其他旋轉選項>設定旋轉角度為 45，如 Figure 2.1.1.2.所示。

Step 3. Save image.

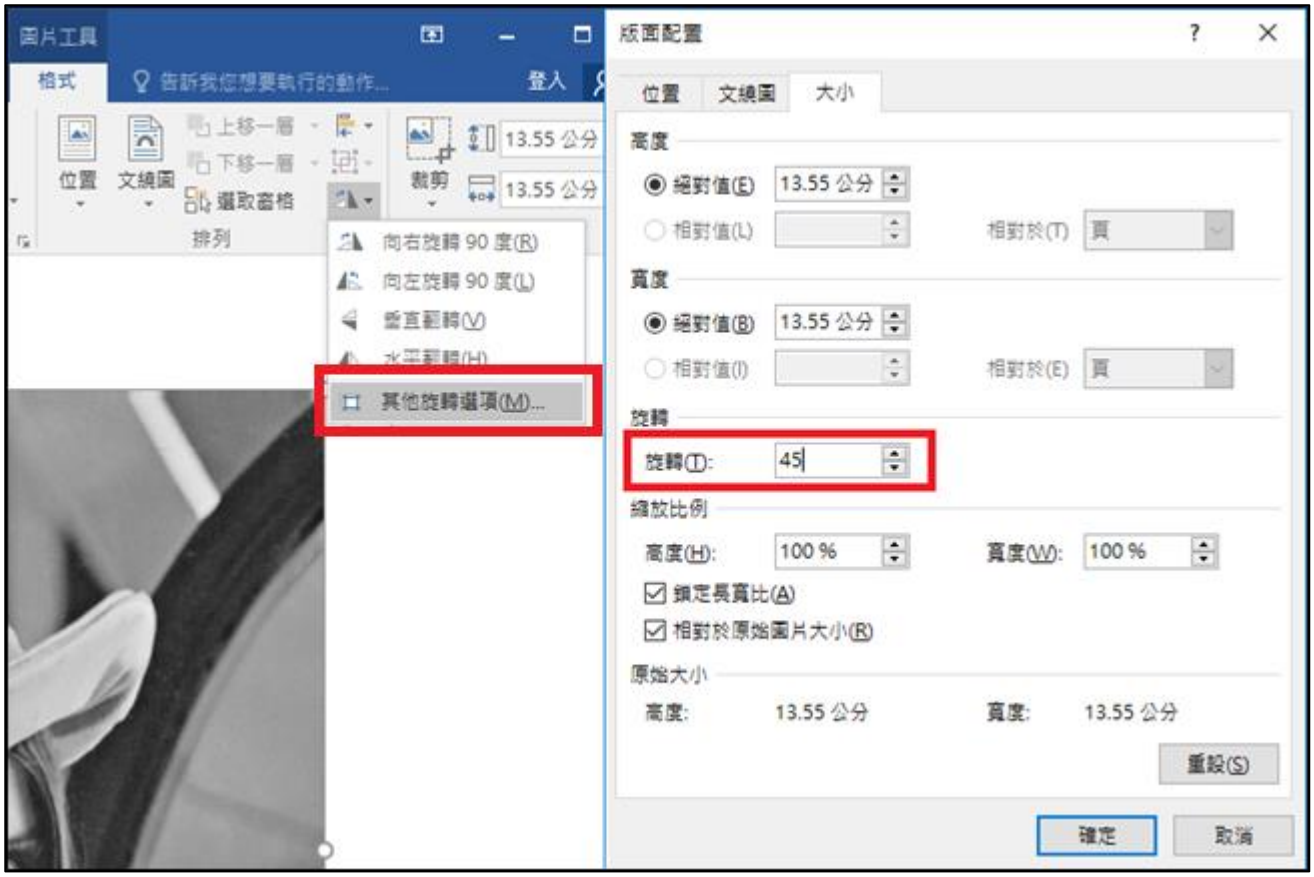


Figure 2.1.1.2. Set rotation of image with Microsoft Office Word 2016.

2.1.2. Shrink lena.bmp in half

Step 1. Open Microsoft Office Word 2016.

Step 2. 圖片工具>格式>大小進階選項>設定縮放比例之高度與寬度為 50%，如 Figure 2.1.2.2.所示。

Step 3. Save image.

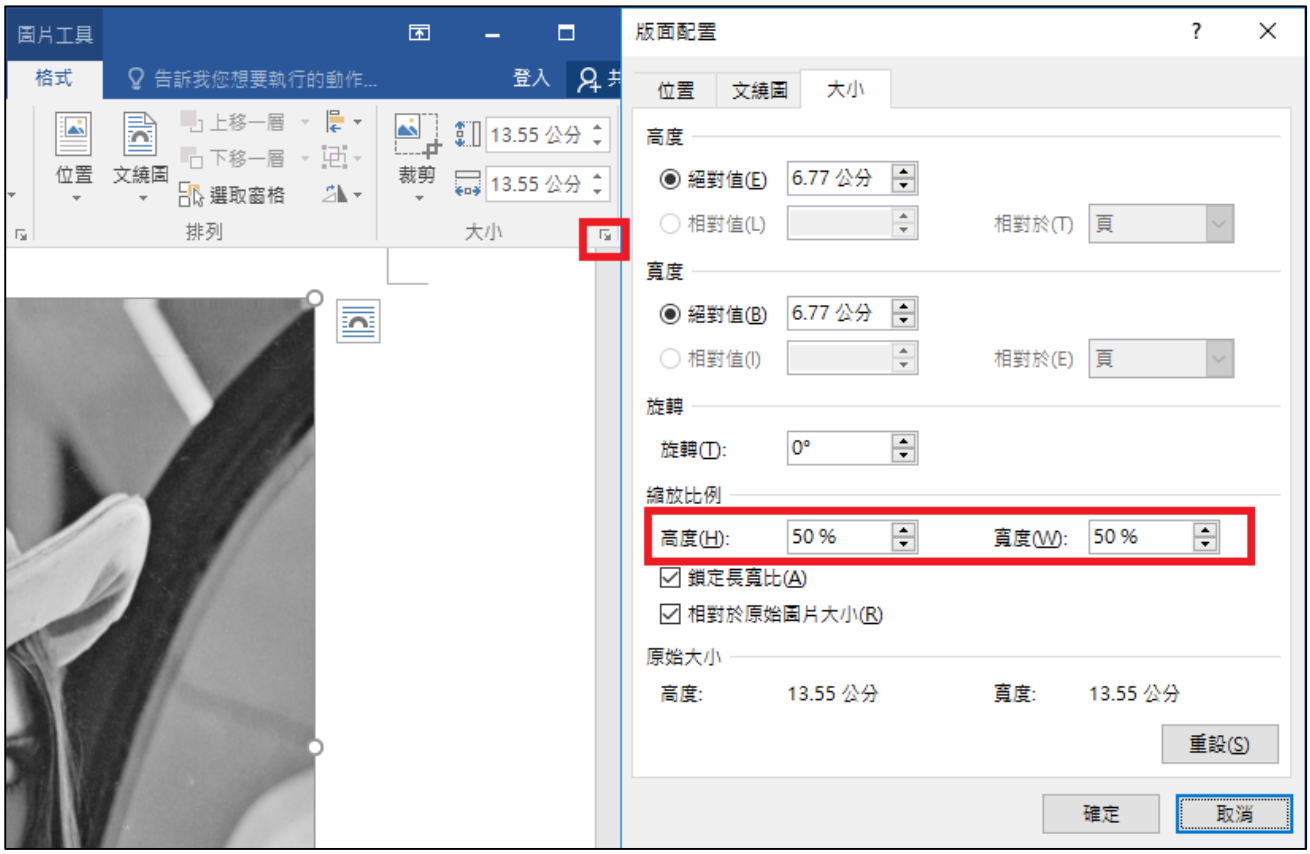


Figure 2.1.2.2. Set height and width of image with Microsoft Office Word 2016.

2.1.3. Binarize lena.bmp at 128 to get a binary image

Step 1. Open Microsoft Office Word 2016.

Step 2. 圖片工具>格式>色彩>重新著色>選擇黑白:50%(T = 128)，如 Figure 2.1.3.2.所示。其左邊與右邊則可 25%或 75%(T = 64 / T = 192)。

Step 3. Save image.

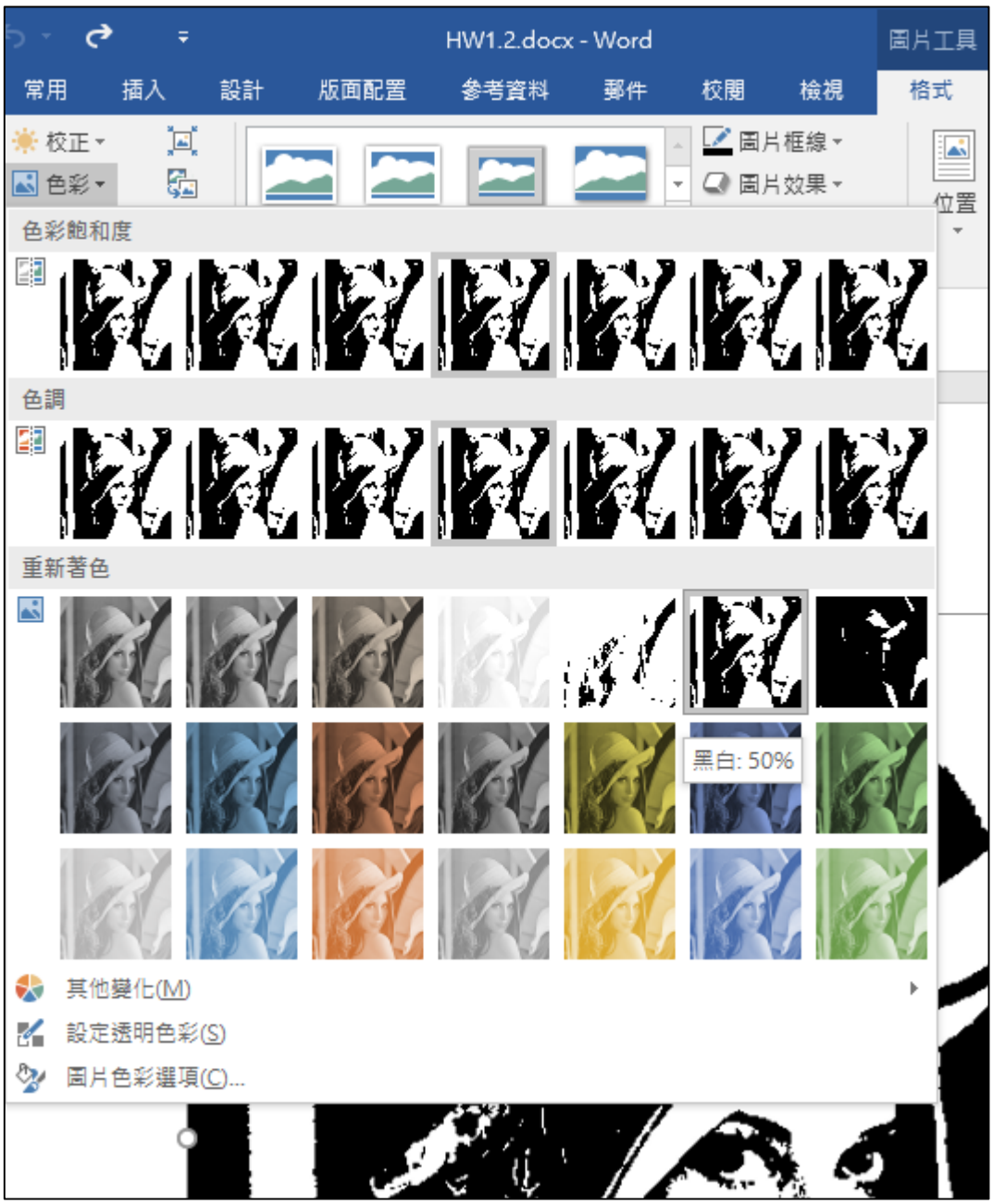


Figure 2.1.3.2. Binarize image with Microsoft Office Word 2016.

## 2.2. Code Fragments

### 2.2.1. Part 1 of this homework

HW1.1.py

```python
from PIL import Image

# Load image from file.
originalImage = Image.open('lena.bmp')

# Get width and height of image.
width, height = originalImage.size
# print ('width = %d, height = %d' %(width, height))

# New image with the same size and 'grayscale' format.
upSideDownImage = Image.new('L', originalImage.size)
rightSideLeftImage = Image.new('L', originalImage.size)
diagonallyMirroredImage = Image.new('L', originalImage.size)

# Process image pixel by pixel.
for c in range(width):
    for r in range(height):
        # Get pixel for up-side-down image.
        value = originalImage.getpixel((c, height - 1 - r))
        # Put pixel to up-side-down image.
        upSideDownImage.putpixel((c, r), value)
        # Get pixel for right-side-left image.
        value = originalImage.getpixel((width - 1 - c, r))
        # Put pixel to right-side-left image.
        rightSideLeftImage.putpixel((c, r), value)
        # Get pixel for diagonally mirrored image.
        value = originalImage.getpixel((r, c))
        # Put pixel to right-side-left image.
        diagonallyMirroredImage.putpixel((c, r), value)

# Save image.
upSideDownImage.save('up-side-down.bmp')
rightSideLeftImage.save('right-side-left.bmp')
diagonallyMirroredImage.save('diagonally-mirrored.bmp')
```

Figure 2.2.1. Code of part 1 of this homework.

### 2.2.2. Part 2 of this homework

This part doesn't need any code.

# III. RESULTS

## 3.1. Original Image

Figure 3.1. Original lena.bmp.

## 3.2. Results of part 1 of this homework

Figure 3.2.1. Original lena.bmp.

Figure 3.2.2. up-side-down.bmp.

Figure 3.2.3. right-side-left.bmp.

Figure 3.2.4. diagonally-mirrored.bmp.

## 3.3. Results of part 2 of this homework

Figure 3.3.1. Original lena.bmp.

Figure 3.3.2. Rotate-45degree-clockwise.bmp.

Figure 3.3.3. Shrink-in-half.bmp.

Figure 3.3.4. Binarize-at-128.bmp.