**影像處理hw1**

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**Q1.**

**Output**: “Q1\_answer.png”, the horizon combination picture of “laptop\_right.png” and “laptop\_left.png”

Explain:

(1) Import “cv2” package.

(2) Use the function ‘imread’ in cv2 to read the picture ‘laptop\_left.png’ and ‘laptop\_right.png’

(3) Combine two picture above by function ‘hconcat’ to obtain new picture and save it as "Q1\_answer.png".

**Q2.**

**Input**: (Image, degree)

**Output**: “Q2\_answer.png”, the picture rotates 15 degrees

Explain:

1. Set a function “image\_rotate (image,degree)”

2. Take the high and width of the image by “shape” function

3. Create an zeros pixel value image with () as. high and width

4.Rotate the image from the center of the picture, by compute ,however, since the rotated picture will get out of the image so we set the rotating center as parameter (middle x // , middle y // ).

5.Output the rotating image.

**Q3.**

**Input:** (image, new\_high, new\_width)

**Output**: “Q3\_answer.png”, new image with new\_high and new\_width

Explain:

(1) Define a function “resize (image, new\_high, new\_width)” which input the target image and the size you wonder it become.

(2) In “resize” function, set a new image which pixel values are zeros, new\_high and new\_width as high and width.

(3) Set the x\_scale, y\_scale be the ratio between new\_width and old\_width, new\_high and old\_scale.

(4) If the pixel is on the four corner, then new\_image[I,j,k] = image[i,j,k]

Else we use the Bilinear interpolation method to get the pixel value.

(Set the pixel value of the corner as the values using in Bilinear interpolation)

(5) Then we input “lena.bmp” as image to function resize(image,1024 1024) to get the 1024\*1024 size lena image.

**Q4.**

**Input:** (under\_image, top\_image)

**Output:** “Q4\_image.png”, an image which top\_image is overlay on ther under\_image

Explain:

1. First, set a function “remove\_bg (image)”, to remove the background of the image, by the “remove” function and save it.

2. Second, set a function ”overlay (under\_image, top\_image)” function to the the top\_image to overlay on the under\_image.

3. In function ”overlay (under\_image, top\_image)”, I create a pixel values zeros image with same size as the under\_image.

4. Let the t\_h be the high of top\_image, t\_w be the width of top\_image

5. Let the new\_image[I,j,:] == top\_image[I,j,:] if i<t\_h && j<t\_w && k<t\_c && !(all(top\_image[I,j,:]==0))

Else new\_image[I,j,:] == under\_image[I,j,:]

6. Then we got the new\_image which top\_image is on the under\_image.

**Q5.(1)**

**Watermark part:**

**Input**: (original image, watermark )

**Output**: “Q5\_1\_water.png” image with watermark

Explain:

1. Create an zeros pixel values image with same size as original image denote the image as **new\_img**

2. Copy the watermark, divide the pixel values by 32(We only take 3 bits of watermark) denote the image as **wm**

3. Copy the original image, divide the pixel values by 8 and multiple the pixel value by 8 (Set the last 3 bits of original values as 000) denote the image as **ori\_img**

4. Let **new\_img**[I,j,k] = **wm**[I,j,k] + **ori\_img**[I,j,k] if I,j,k is in the size of **wm (**embed the watermark), else **new\_img**[I,j,k] = **ori\_img**[I,j,k]

5. Obtain the watermark image.

**Extract part:**

**Input**: watermark image

**Output:** watermark

1. Take the watermark image denote as **wm\_img**

2. For I,j,k in the size of **wm\_img** , **wm\_img**[I,j,k]%8\*32 (Get the last 3 bits of watermark image and recover it)

3.Obtain the similar image as watermark.

**Q5.(2)**

**Input:** watermark image(denote as wim)

**Output**:

PSNR between original image and decode of wim with compressed ratio 10,

PSNR between original image and decode of wim with compressed ratio 50,

PSNR between original image and decode of wim with compressed ratio 100,

Extract image of decode of wim with compressed ratio 10,

Extract image of decode of wim with compressed ratio 50,

Extract image of decode of wim with compressed ratio 100,

Explain:

1. Define the function “PSNR”, if inputs two image, then can obtain the psnr value of two image.

2. Get the array of watermark image save it as compression ratio of 10,50,100 by function “imencode” in “cv2” package

3. Decode the encoding image with compression ratio 10,50,100 by function “imdecode” in “cv2” package

4. Use “PSNR” function to obtain the psnr values between decoding images and original image.

5. Use the “extract” function in Q5(1) to retrieve watermark, however, we can’t retrieve watermark both after encode and decode.