

Computer Vision

-Assignment 1 Report-

Question 1. Histograms

- a. *opencv* will cause crash when opening pictures on mac, using *Image.open* instead
- b. For grayscale 0 is taken to be black and 255 is taken to be white. Normal RGB to Lab transform the component of L has the range of (0, 100). So it would be better to convert it to (0,255) when using L to display a grey level image. In *opencv* L,a,b are converted using equation: $L \rightarrow L * 255/100$; $a \rightarrow a+128$; $b \rightarrow b+128$.
- c. Manual calculation of Gaussian filter is created. Considering the efficiency of convolution calculation, a Gaussian filter was imported from the library of *scipy.ndimage*. The different directions of derivative can be used to find vertical and horizontal edges separately.
- d. Both 1D histogram and 2D histogram heatmap are computed and displayed.
- e. In order to compute a back projection, part of the 'lawn' was cut out and used to detect the area of lawn on the original picture. Mainly use *cv2.calcBackProject* to compute back projection.
- f. Histogram Equalization is used to improve contrast in images. After using it, the main body of 'CRonald' in my picture is much more outstanding.

Question 2. PCA

- a. The mean image and the first 2 principal components are displayed as images. PCA is a very useful method to reduce the dimension of features by finding a more 'representative' axis and discard the orthonormal axis. In this case, we can extract most of the information using relatively fewer features.
- b. The comparison of original images and using different numbers of principal components ($p = 10$ and $p = 50$) were displayed. For each value of components, three randomly selected original pictures were used. I also displayed the 99% variation images ($p = 252$)
- c. SSD and DFFS are calculated and written in two function separately. For the performance SSD seems better than DFFS. The performances of these two algorithms are not as good as I expected. I think maybe $28*28$ pixels are insufficient to distinguish different digits. If these two algorithms are used to detect objects in a high resolution pictures, the result would be much better.