

HW2

Method

Histogram equalization

The first function is to compute the histogram of the image and return a numpy array indicating what a value should be transferred into.

```
def get_histogram_function(image):
    count = np.zeros(256)
    for i in range(image.shape[0]):
        for j in range(image.shape[1]):
            count[image[i][j]] += 1
    sum = np.zeros(256).astype(np.float32)
    for i in range(256):
        sum[i] = sum[i-1] + count[i]
    # new_value = (L-1)/MN * sum
    sum = 255*sum/image.shape[0]/image.shape[1]
    sum = np.round(sum).astype(np.uint8)
    return sum

def histogram_equalization(image):
    func = get_histogram_function(image)
    for i in range(image.shape[0]):
        for j in range(image.shape[1]):
            image[i][j] = func[image[i][j]]
    return image
```

Histogram specification

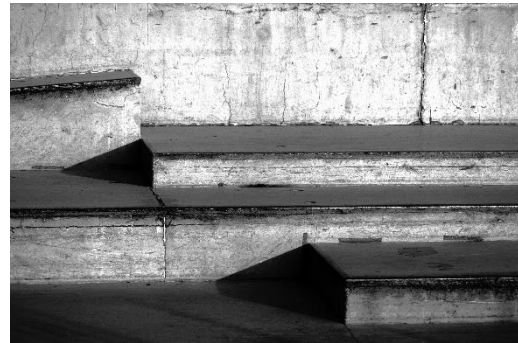
Get the histogram equalization function for both source and reference image, compute the inverse function of func2. Some of the values in function 2 has the same value, here I use the smaller index for the inverse function. Some of the values in the function is not covered by the inverse function, so here I use the higher values to fill in the 0s.

```
def get_inverse_mapping(func):
    inverse = np.zeros(256).astype(np.uint8)
    for i in range(255, -1, -1):
        inverse[func[i]] = i
    for i in range(255, 0, -1):
        if inverse[i] == 0:
            inverse[i] = inverse[i+1]
    return inverse

def histogram_specification(image, reference):
    func1 = get_histogram_function(image)
    func2 = get_histogram_function(reference)
    func2 = get_inverse_mapping(func2)
    for i in range(image.shape[0]):
        for j in range(image.shape[1]):
            image[i][j] = func2[func1[image[i][j]]]
    return image
```

Result

Q1



Q2

source / reference



result



Feedback

In this homework, I practiced how to do histogram equalization and specification. Although the algorithm is not too hard, it shows great result in Q1, making the image have higher contrast. The result in Q2 is also surprising. The new image shows more details than the original image (the top left corner) and have similar lighting condition to the reference image.