Computer vision
Homework3
Histogram Equalization

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Description

Write a program to generate images and histograms:

(a) original image and its histogram

Use the method in homework 2 to generate the histogram of the original image.

Source code

```
8   Mat histogram(Mat img) {
9       //data collection
10      int value[256] = { 0 };
11      int max = 0;
12
13      for (int i = 0; i < img.rows; i++) {
14          for (int j = 0; j < img.cols; j++) {
15              value[img.at<uchar>(i, j)] ++;
16          }
17      }
18
19      //highest data
20      for (int i = 0; i < 256; i++) {
21          if (value[i] >= max) {
22              max = value[i];
23          }
24      }
25
26      //graph
27      Mat graph(768, 768, CV_8UC1, Scalar(0));
28
29      //float ratio = max / 256.0;
30      float ratio = max / 768.0;
31
32      //plot
33      for (int x = 0; x < 256; x++) {//0~255
34          for (int y = 0; y < value[x]; y++) {//number
35              graph.at<uchar>(767 - floor(y / ratio), x * 3) = 255;
36              graph.at<uchar>(767 - floor(y / ratio), x * 3 + 1) = 255;
37              graph.at<uchar>(767 - floor(y / ratio), x * 3 + 2) = 255;
38          }
39      }
40      return graph;
41  }
```

(b) image with intensity divided by 3 and its histogram

Please refer to the source code.

Source code

```
54      //(b) image with intensity divided by 3 and its histogram
55      Mat b;
56      Mat b_hist;
57
58      b = img_in.clone();
59      for (int i = 0; i < b.rows; i++) {
60          for (int j = 0; j < b.cols; j++) {
61              b.at<uchar>(i, j) /= 3;
62          }
63      }
64      b_hist = histogram(b);
65      imwrite("b_img.jpg", b);
66      imwrite("b_hist.jpg", b_hist);
```

(c) image after applying histogram equalization to (b) and its histogram

1. Count and record the numbers of pixels of different intensity(0~255).
2. Use the equation below to calculate the new intensity.

$$s_k = 255 \sum_{j=0}^{k} \frac{n_j}{n}$$

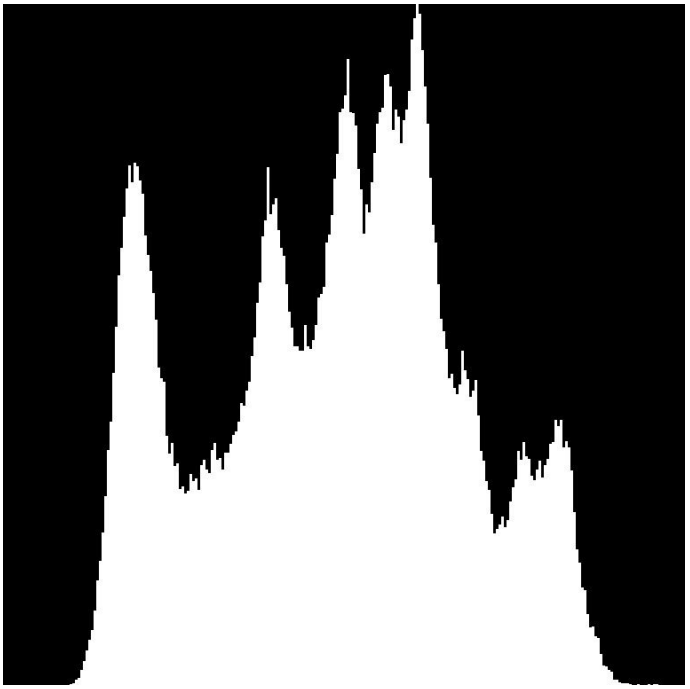
3. Apply the new intensity to every pixel.

Source code

Please refer to main.cpp (line 68~109).

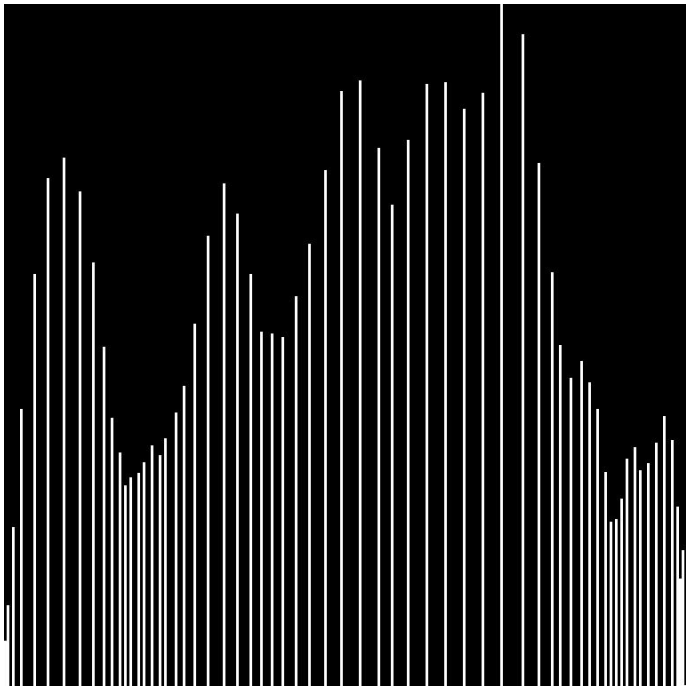
Result

(a) original image and its histogram



(b) image with intensity divided by 3 and its histogram


(c) image after applying histogram equalization to (b) and its histogram

Reference:

1. *https://docs.opencv.org/2.4/*
2. *lecture slide (CV1_CH3_2020 p.79~83)*