COMPGV15 Homework #1

Computational Photography and Capture

Name: Min Li ID: 17101062

1. Detection of scene cuts (10%)

The way to detect scene is to calculate the histogram for every frame and compare them. If the difference between the adjacent two frames is large, it indicates that the scene begin to change. The parameter to determine whether the difference is large enough is set after the testing. The Figure 1.1 shows the text will be overlaid on the image to inform that the scene begin to change.

Figure 1.1

2. Correction of global flicker (10%)

The histogram is also used to correct the global flicker. First, get the adjacent four frames of the current frame (previous 2 frames and next 2 frames). Next, get the sum of the current frame and adjacent frames. Subsequently, get the average of the sum and get the histogram of the average. Finally, using histeq function to make the current frame matching the intensity of average histogram. The Figure 2.1 shows the image which index is 258 before the correction. The Figure 2.2 shows the image after correcting.

Figure 2.1

Figure 2.2

3. Correction of blotches (25% + 10%)

According to [1], the simplified ranked ordered difference (S-ROD) method can be used to detect the blotches. First, a set of reference pixels is set. The reference pixels has 3 pixels from the previous frame and 3 pixels from the next frame. Then, the S-ROD can be defined as

$$(6) \qquad d_n(z) = \begin{cases} min(p_{n,i}(z)) - I_n(z) & \text{if} \quad min(p_{n,i}(z)) - I_n(z) > 0 \\ I_n(z) - max(p_{n,i}(z)) & \text{if} \quad I_n(z) - max(p_{n,i}(z)) > 0, \\ 0 & \text{otherwise} \end{cases}$$

Then, the T value should be defined to test whether this pixel is a blotch:

$$(7) \qquad d_n(z) > T_1 \quad \text{with} \quad T_1 \geq 0.$$

The T value in the coursework is 6.
After testing, the S-ROD method can detect the blotches. However, it also can detect many false blotches and the motion also increase the probability of the noise. The improvement of the S-ROD is to add probability of false alarm to each pixel. Subsequently, define a limitation R to check whether the pixel is a blotch.
The following two figures shows the detection of blotches. The Figure 1 shows the result of S-ROD:

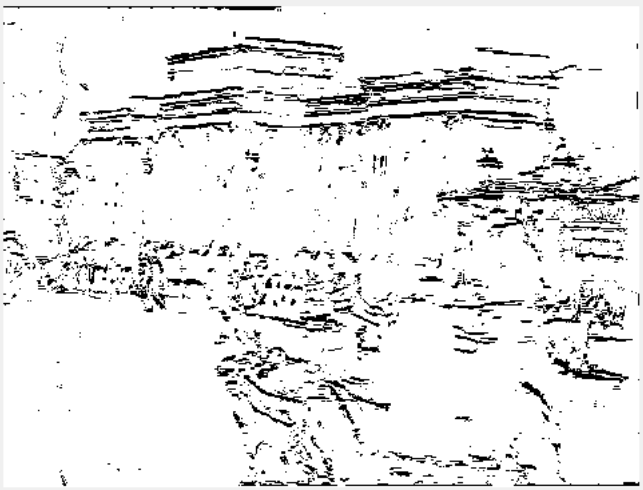

Figure 3.1

The Figure 2 shows the S-ROD with improvement:

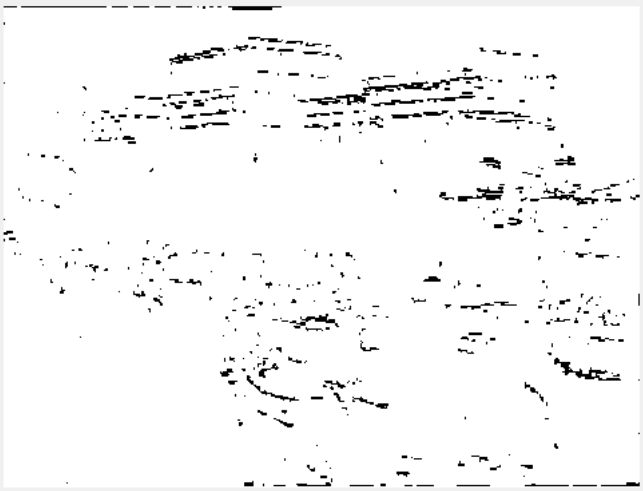

Figure 3.2

The way to remove the blotches is to get the corresponding median value of the previous frame. The Figure 3 shows the origin frame and Figure 4 illustrates the frame after removing blotches.

Figure 3.3

Figure 3.4

4. Correction of vertical artefacts (15%)

To correcting the vertical artefacts, the median filter with one dimension is used to smooth the frame. However, the median filter will cause blurring. The difference matrix between origin frame and filtered frame can be used to reduce the blurring. In my coursework, if the difference between 0.7 and 1.6, this pixel will be determined as the noise. The following three figures shows the origin frame, filtered frame and the result.

Figure 4.1

Figure 4.2

Figure 4.3

5. Correction of camera shake (30% + 10%)

In this part, the code generated four frames which are the current frame moves up, down, left and right. Then, calculate the difference between the current frame and the moved frames. If the difference of the moved up frame is the smaller than the moved down and also smaller than the difference between the current and previous frames, the current frame will move up. The same rule to other directions. Finally, it will

generate the directions to move to make the least difference between the current and previous frames.