Mini project report

1155166747 CHEN Jinhua

Template tracking algorithm description:

1. Determine whether the image is the first one.
2. If it is the first image, we can use Normalized cross-correlation method to figure out the window.
3. If it is not the first image, we can use Modified Lucas-Kanade to compute the motion of the template and get the new_window base on the previous window and the motion.(LKT is assumes very small motion between every two adjacent image frames. Actually, the motion is always more than one pixel. As a result, we normally use iteration to get the motion from each small motion.)

Parameter selection

Because we use iteration to get the actual motion, we need to consider if we have already gotten the actual motion, or we lose the template. If we lose the template, we have to break in case the code iterate infinity.

1. We can use a threshold to determine whether the motion close enough to the actual motion. If the motion of current step is less than threshold, we can assume the total motion is the actual motion of the template.
2. We can set up a maximum iteration times. If the step is more than maximum iteration times, we know it lose the template.
3. Sigma will also make influence on the error and total iteration times.

If we set the threshold of each motion to 0.01, we can discover the influence of sigma on iteration times as figure 1 and figure 2.
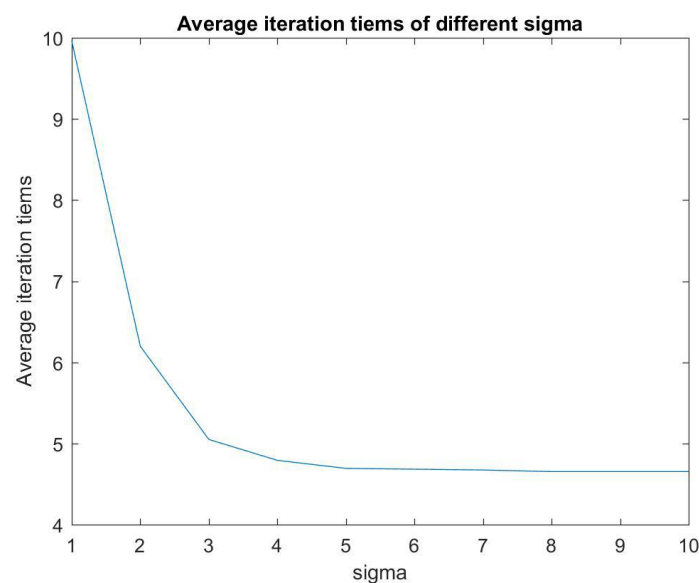

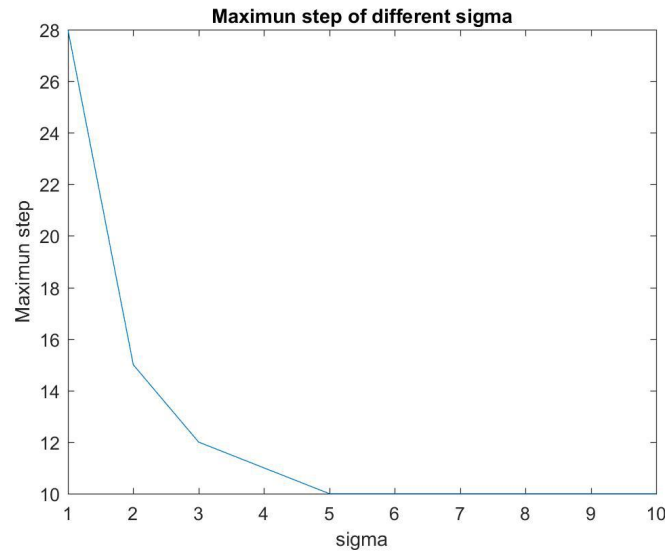Figure 1 Average iteration times of different sigma

Figure 2 Maximum iteration times of different sigma

We can discover that both average iteration times and maximum average iteration times decrease with the increasing of sigma and it remain the same when sigma above five. In order to improve the efficiency, it is better to choose sigma large to 5.

We can also discover that the maximum iteration is 28 times. So we can set the maximum iteration to 30. The parameter selection as table 1.

Parameter	selection
Maximum iteration	30
sigma	5
threshold	0.01

Table 1 The selection of parameter

Discussion

Different smoothing sigma values can influenced the iteration times and initial error. The effect on iteration times had showed below. The effect on error as figure 3.
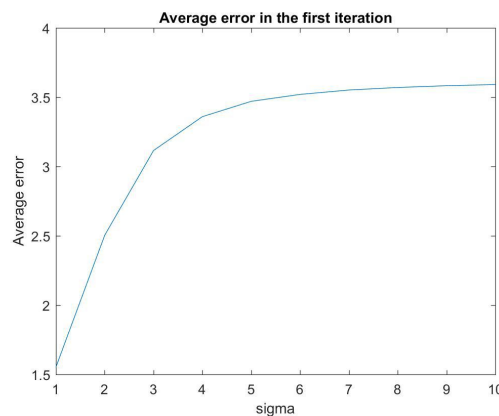

Figure 3 Average error in the first iteration

We can discover the error of first iteration increase with the increasing of sigma. Summary, a lager sigma will cause:

1. Less iteration times.
2. Increasing errors in the first iteration.

Possible cause:

Gaussian put more weight on the middle. As a result, the error of edge pixel will increase. When the window haven't moved to the actual position of the template, It will possibly calculate the edge of the template which may cause more errors. However, more errors means the motion will larger in the next iteration since

$p = p + \Delta p$. Consequently, the window move quicker and the iteration times will be

decreased.