Laboratory Report IV
Change detection and Tracking

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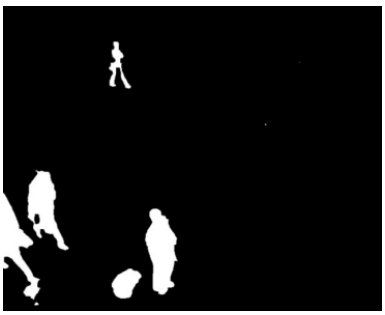
Abstract

This work is devoted to the investigation of video surveillance system. The presence of a structure is suggested to the visual system only by motion information: the differences that perceived from one frame to the next using image sequence at time t1 and t2. The result has shown the motion segmentation using binary colors: white color for the movements and black for stable objects.

1 Introduction

An automated, or "smart", video surveillance system must be sensitive to slight object motion wherever it may occur within a large field of view. The system must also be capable of distinguishing changes of interest from other image activity or noise. The video surveillance cameras often use the change detection and tracking algorithms for the security purposes of the buildings, borders, for the research purposes and so on. It can be observed from Figures 1 and 2 illustrated below:

(a) label 1



(b) label 2

Figure 1: Motion segmentation of the background model

2 Task 1

In this task, the work has been done on the video surveillance sequence using the simple background model as an average between two empty frames. At the beginning two empty images

were loaded to MATLAB and a simple background model was calculated. Thereafter each images in the sequence was loaded in order to perform the change detection. The frame, as well as the background and the binary map were illustrated on the final figures.

After loading the sequence of frames with threshold $\tau = 20$, it was possible to observe the black and white motion detection, which can be observed in Figure 2.

Figure 2: Threshold 20 for motion detection

After obtaining results, the threshold value was changed several times in order to observe how the output will change. Finally, by changing $\tau = 100$, it could be seen, that some colours switched to black ones as in Figure 3.

Figure 3: Threshold 100 for motion detection

3 Task 2

In this task, working again on the video surveillance sequence background model were implemented. In other words, the change detection has been made by updating the background with the running average. In order to run that, the initial points for the $tau = 25$ and $alpha = 0.9$ have been set. The final results are illustrated on Figure 4, from which it can be seen that on the black background, there are white pixels which represent objects and humans motion.

Figure 4: Motion detection (Task 2)

4 Task 3

For task 3, the same experiment was repeated again, but with changing values for *tau* and *alpha*. The change detection has been made by updating the background with the running average. In order to complete that task, the initial points were changed from the $alpha = 0.9$ to $alpha = 0.1$. Since we know that $tau = 25$ is affecting the white and black colours threshold, the effect of *alpha* values were observed for this experiment. The obtained outputs can be observed in Figure 5. As it can be seen, there are fewer white colours appear in the background compared to the previous task.

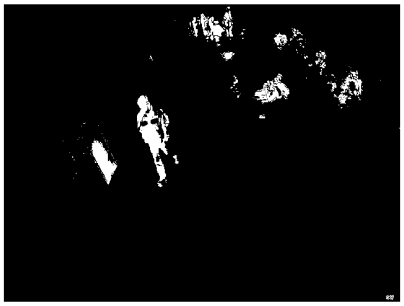


Figure 5: Motion detection with different tau value (Task 3)

5 Task 4

In the final experiment, a simple tracking system was implemented. For the beginning, the background model was initialized and the tracking history was initialized to empty. In addition to that *for* loop was implemented, where the change detection was applied in order to obtain the binary map and the background model was updated. Furthermore, the connected components were identified in the binary map and each of them was associated with the previously observed target. Finally, after completing above mentioned steps the following output was obtained, which can be seen in Figure 6. It can be observed that bounding box appears on each object which performs motion on the sequence.

Figure 6: Simple tracking system (Task 4)