An Effective Surveillance Video Retrieval Method based upon Motion Detection

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Abstract — **Intelligent surveillance systems have become an important research issue recently. They can provide an early warning or help us to retrieve interested video frames. The motion detection techniques play an important role in these two applications. In this paper, we propose an effective surveillance video retrieval method based upon the motion detection technology. We can use this method to search frames with moving objects. We also use the feature, motion vectors, to retrieve the frames with objects in pre-defined moving directions. We use video samples to show the feasibility of our method.**

Index Terms—**intelligent surveillance system, video retrieval, motion detection.**

I. INTRODUCTION

In the last decade, automatic surveillance systems have been increasingly applied in many public places for incident detection and crime prevention. Video interpretation tasks related to surveillance are usually completely performed by human. And the way to searching interested video shots is by sequentially scanning the entire video, frame by frame. This kind of tasks is very tedious and time-consuming. So, an efficient video retrieval method for us to search interested events in video data will be helpful.

Many low-level feature based approaches for content-based retrieval were presented [1, 2, 3]. The retrieval of such techniques is performed on feature vectors that are extracted from the data (i.e., the key frame of the sequences) and then used as indexes.

II. PROPOSED METHODS

A. Motion detection

The flowchart of the process is illustrated in Fig. 1[4]. Background subtraction is performed between interested frame f^n and background frame B. The result is frame d^B. Temporal differencing is performed between frames f^n and f^{n-1}, and frames f^n and f^{n+1}. The outputs are referred as d^{n-1} and d^{n+1}.

The subsequently process is followed by applying the *AND* logical operator between d^B and d^{n-1}, then d^B and d^{n+1}. The outputs of the *AND* logical operation are $motion_{n-1}$ and $motion_{n+1}$. Then, the motion mask of frame f^n is obtained by applying the *OR* logical operator between $motion_{n-1}$ and $motion_{n+1}$, and the output is $motion_n$.

Morphological operators are applied on the motion mask $motion_n$ to remove noises and get the final motion mask $motion_n'$.

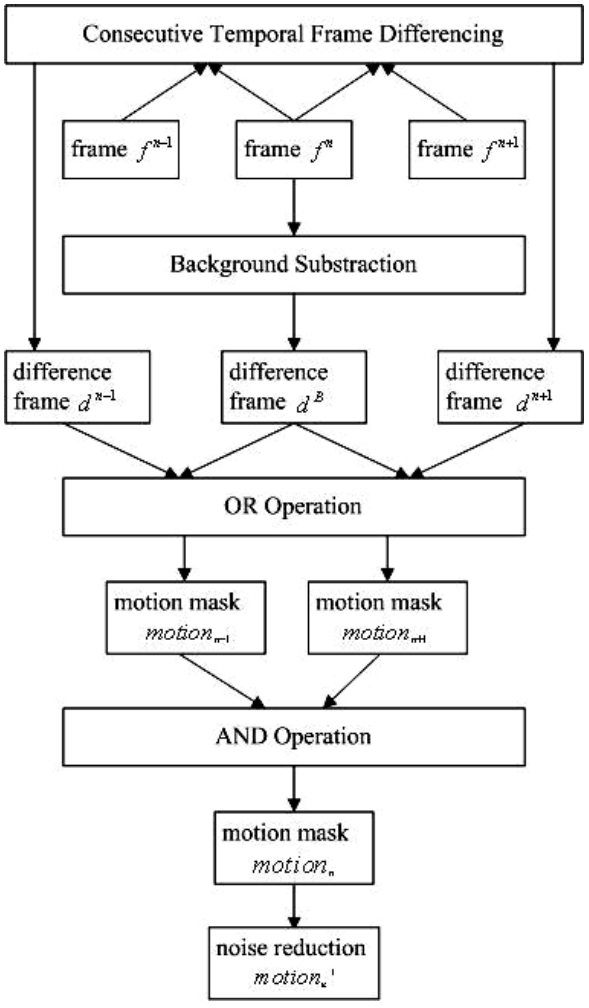

Fig. 1. The flowchart of motion detection.

B. Feature extraction

We utilize motion information of a moving object and estimate the gravity points of the object in the frame. With some gravity points obtained from adjacent frames, we can get the motion vectors of the moving object. Fig. 2 shows an example.

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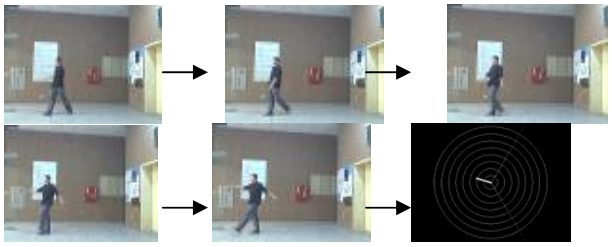

Fig. 2. The diagram of motion vectors of a moving object.

III. EXPERIMENTAL RESULTS

We test our method with two digital surveillance videos. In our experiments, we use two searching rules: (1) the range of the angle of motion vectors is from 300 to 60 degrees, (2) the range of the angle of motion vectors is from 30 to 150 degrees. Fig. 3 and Fig. 4 show some example frames.

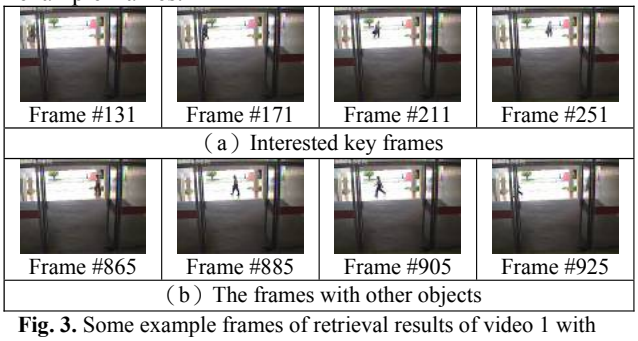

Fig. 3. Some example frames of retrieval results of video 1 with the rule 1.

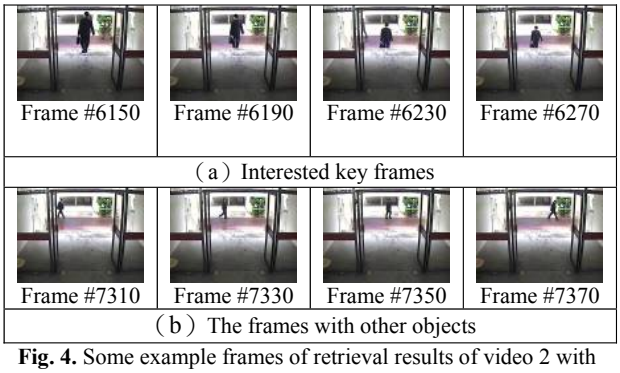

Fig. 4. Some example frames of retrieval results of video 2 with the rule 2.

IV. CONCLUSION

In this paper, we propose an effective surveillance video retrieval method based upon the motion detection technology. We extract motion vectors from analyzing moving objects. We utilize the motion vectors to extract key frames from surveillance video data. We can retrieve frames with objects moving in indicated direction. Our method can help us reduce the searching time when we try to find some interested frames in video data. In the future work, we will try to incorporation other tracking model and consider possible complex trajectories by the moving object.

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