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Real-time Moving Object Detection using SURF

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Abstract: *Tracking and traffic monitoring are main application of moving Object detection in video. This paper presents SURF (Speed-Up Robust Features) algorithm and real-time detection of objects using frame difference. The main purpose of this proposed work is to solve the difficulty of modeling background and its update rate in background subtraction method. SURF is having fast processing technique to find features of an object image in real-time and then by using this algorithm we will compare object image features with our real-time object image features. After that match object image features and real-time features.*
Keywords: *Background subtraction, Feature Extraction, SURF algorithm*

I. Introduction

Generally, moving object detection system based on the video when it has been used in practical occasions is intricate and variable. Before detecting and tracking the moving objects, we should build the background model. So how to build the background model with high robustness in the practical occasions is an important problem in moving object detection research.

For detecting a moving object, background subtraction techniques are generally used. There are so many background techniques like GMM, KDE, codebook which have a good power to detect a moving object. The main idea behind the subtraction techniques is to find the pixel difference between two images. The real-time systems can construct a statistical model for tracking objects, including the Gauss pixel model [1]. After the background which is in the lack of moving object is initialized, the real-time system can obtain ideal detection results. But in real time outdoor environment there is a lot of background changes. At that time to modeled background each time is not an easier task.

Background subtraction is widely used because of its high accuracy and anti noise ability. Large amount of calculation, modeling are the difficulties when working with it [5]. In this paper, because the shortage of traditional background subtraction, here we taking a new measurement that combines surf algorithm with the frame difference method. The video image mosaic by the surf algorithm takes the whole background image, and then each sequence in the video and the whole background image mosaic. So the video under movement background are translated into under still background, and each frame in the video has a full background. The method can improve the detection rate and robustness of algorithm, and the video that is got by camera motion and irregular movement is processed. Experiment results compared with the mixed Gauss modeling method are obviously improved.

II. Principle of the surf algorithm

The SURF algorithm is a three step process [3]. The first step is interest point detection and in the second step descriptor is generated associated with interest points. In the last step descriptor matching is done. Similar to the SIFT method, the first two steps based on a scale-space representation, and on first and second order differential operators. SURF method operations are speeded-up by the use of an integral image and box filters techniques. While the scale space is gained by convolution of the initial images with Gaussians, the discrete box-space is obtained similarly by convolving the original image with box filters at several different discrete sizes. In the detection step, to find out interest point candidates local maxima of a Hessian-like operator, the box Hessian operator, applied to the box-space are computed. These candidates are then verified if the response is above a given threshold. Box size and location of these candidates are then refined using an iterative procedure. Generally, a number of hundreds interest points are detected in a digital image of one megapixel. In the second step we are generating a descriptor invariant to view point changes to the neighboring pixels. The location of this point in box-space gives invariance to scale and generate scale and translation invariance. To get rotation invariance, a dominant orientation is declared by considering the local gradient orientation distribution, estimated with Haar wavelets. Making use of a spatial localization grid, a 64-dimensional descriptor is then built, corresponding to a local histogram of the Haar wavelet responses. Traditionally, in the third step descriptors are matched for comparing images. Comparison is performed by computing the Euclidean distance between matching pairs.

III. Indentations and EQUATIONS

The first paragraph under each heading or subheading should be flush left, and subsequent paragraphs should have a five-space indentation. A colon is inserted before an equation is presented, but there is no punctuation following the equation. All equations are numbered and referred to in the text solely by a number enclosed in a round bracket (i.e., (3) reads as "equation 3"). Ensure that any miscellaneous numbering system you use in your paper cannot be confused with a reference [4] or an equation (3) designation.

IV. The Algorithm Description

In this paper, moving target detection algorithm proposed in the concrete can be divided into different stages: the first stage is using the SURF algorithm to find out image feature points and image matching feature points and to get the whole background image; In the second stage difference is find out between image frame and background and the whole background image are made a difference, morphology is processed and detection moving target is got.

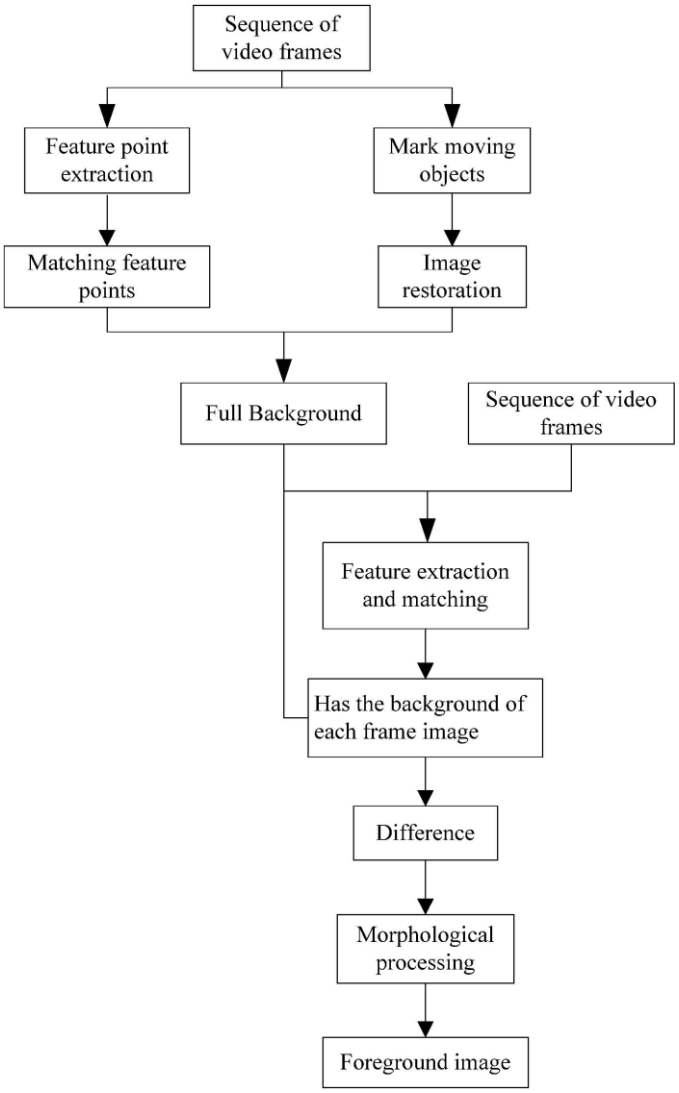

Fig 1: Flow of work

In this paper, the surf algorithm is used to do the image registration in the video. Even when the camera moving in parallel can also be handled by the SURF algorithm, and complete the video registration. The rapidity of SURF algorithm is the main point of consideration in video segmentation. The steps as shown:

• SURF algorithm is used to analysis feature point extraction of the input of each frame image to get the location of the feature point and get the description vector.

• Registration and stitching is done using 10 frame of the input video and fist frame image also signing the moving object and fill in the effective area so that can obtain the whole background image.

• Feature point will get match with registered video frame. These characteristics then made available for further classification.

• And then by RANSAC algorithm, we are removing extreme point feature.
• Using transformation matrix video frames are mapped frame by frame with the background. Background does not move according to foreground.

The background image is obtained by the video matching and splitting with each frame image with background difference has been moving foreground, using the following formula to describe:

$$D_{k(x,y)} = I_{i,k} + 1_{(x,y)} - BK_{(x,y)}1 \qquad (1)$$

In the formula $D_{k(x,y)}$, $I_k + 1_{(x,y)}$ and $Bk_{(x,y)}$ is respectively difference image , current frame video and background image. Still there exists a noise in foreground image that is we got after detection. Morphology will process a foreground image with open operation, close operation and filling. Closed operation is used when we have to fill tiny hole body. Here opening operation is used because of to remove small and miscellaneous points to obtain detection moving targets.

V. Experimental Result And Analysis

We have first implement the GMM model of background subtraction techniques in which we came to know that if the object is not moving for some time then it will take it as a background. Then we apply proposed algorithm for stable and moving camera. As per result we can see that we can get effective results.

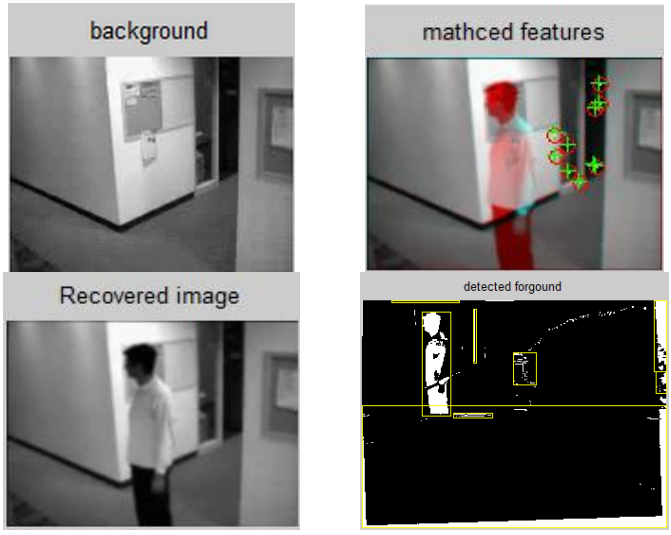

Fig 2: Output taken by stable camera

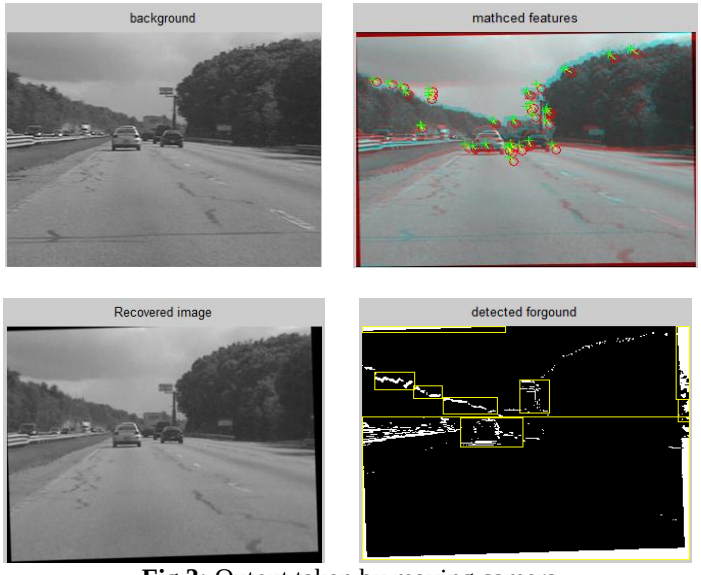

Fig 3: Output taken by moving camera

VI. Conclusion

This paper adopts the method based on surf algorithm to extract the background, combining the background subtraction and surf algorithm. It can solve the problem, which building the background modeling is difficult in the process of classical background subtraction and update is not in real time. This paper also introduces the concept of whole background moreover ensures that the detected moving target information is integrated and accurate, so that can effectively avoid the occurrence of capitation moving targets.

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