Background Subtraction Algorithm Based Human Motion Detection

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Abstract- Recent research in computer vision has increasingly focused on building systems for observing humans and understanding their look, activities, and behavior providing advanced interfaces for interacting with humans, and creating sensible models of humans for various purposes. In order for any of these systems to function, they require methods for detecting people from a given input image or a video. Visual analysis of human motion is currently one of the most active research topics in computer vision. In which the moving human body detection is the most important part of the human body motion analysis, the purpose is to detect the moving human body from the background image in video sequences, and for the follow-up treatment such as the target classification, the human body tracking and behavior understanding, its effective detection plays a very important role. Human motion analysis concerns the detection, tracking and recognition of people behaviors, from image sequences involving humans.According to the result of moving object detection research on video sequences. This paper presents a new algorithm for detecting moving objects from a static background scene to detect moving object based on background subtraction. We set up a reliable background updating model based on statistical. After that, morphological filtering is initiated to remove the noise and solve the background interruption difficulty. At last, contour projection analysis is combined with the shape analysis to remove the effect of shadow; the moving human bodies are accurately and reliably detected. The experiment results show that the proposed method runs rapidly, exactly and fits for the concurrent detection.

Index Terms- Background model, Background subtraction, Background updating, moving object detection

I. INTRODUCTION

An important stream of research within computer vision which has gained a lot of importance in the last few years is the understanding of human activity from a video. The growing interest in human motion analysis is strongly motivated by recent improvements in computer vision, the availability of low-cost hardware such as video cameras and a variety of new promising applications such as personal identification and visual surveillance. It aims to automatically guess the motion of a person or a body part from monocular or multi-view video images. Human body motion analysis has been an interesting research for its various applications, such as physical performance, evaluation, medical diagnostics, virtual reality, and human–machine interface. In general, three aspects of research directions are considered in the analysis of human body motion: tracking and estimating motion parameters, analyzing of the human body structure, and recognizing of motion activities.

At present methods used in moving object detection are mainly the frame subtraction method, the background subtraction method and the optical flow method. The presence of moving objects determined by calculating the difference between two consecutive images, in the frame subtraction method. Its calculation is simple and easy to implement. For a variety of dynamic environments, it has a strong adaptability, but it is generally difficult to obtain complete outline of moving object, responsible to appear the empty phenomenon, as a result the detection of moving object is not accurate. Optical flow method is to calculate the image optical flow field, and do clustering processing according to the optical flow distribution characteristics of image. This method can get the complete movement information and detect the moving object from the background better, however, a large quantity of calculation, sensitivity to noise, poor anti-noise performance, make it not suitable for real-time demanding occasions. The background subtraction method is to use the difference method of the current image and background image to detect moving objects, with simple algorithm, but very sensitive to the changes in the external environment and has poor anti- interference ability. However, it can provide the most complete object information in the case of the background is known. In this paper, in a single static camera condition, we combine dynamic background modeling with threshold selection method based on the background subtraction, and update background on the basis of exact detection of object, this method is effective to improve the effect of moving object detection. Any motion detection system based on background subtraction needs to handle a number of critical situations such as:

1. Noise image, due to a poor quality image source;
2. Gradual variations of the lighting conditions in the scene;
3. Small movements of non-static objects such as tree branches and bushes blowing in the wind;
4. Undeviating variations of the objects in the scene, such as cars that park (or depart after a long period);
5. Sudden changes in the light conditions, (e.g. sudden raining), or the presence of a light switch (the change from daylight to non-natural lights in the evening);
6. Movements of objects in the background that leave parts of it different from the background model;

7. Shadow regions that are projected by foreground objects and are detected as moving objects.
8. Multiple objects moving in the scene both for long and short periods;

The main objective of this paper is to develop an algorithm that can detect human motion at certain distance for object tracking applications. We carry out various tasks such as motion detection, background modeling and subtraction, shadow detection and removal.

II. LITERATURE SURVEY

The importance and popularity of human motion analysis has led to several previous surveys.

Neeti A. Ogale[1] discussed a agent sample of techniques for finding people using visual input. These techniques are classified with respect to the need for pre-processing ,features used to describe human appearance,use of explicit body models.

Prithviraj Banerjee and Somnath Sengupta[2] proposed Automated Video Surveillance System .The system employs a novel combination of an Adaptive Background Modeling Algorithm ,based on the Gaussian Mixture Model and a Human Detection for Surveillance (HDS) System. The HDS system incorporates a Histogram of Oriented Gradients based human detector which is well known for its performance in detecting humans in still images.

Xiaofei Ji, Honghai Liu[3] provides a total survey of human motion detection with the variation on view-invariant expression, and detection of special facial expressions and proceedings. In order to help readers understand the incorporated development of visual analysis of human motion detection, this paper presents recent growth in human detection, view-invariant pose demonstration and estimation, and human performance understanding.Public available standard datasets are recommended. The last replace assesses the development so far, and outlines some observed issues and future guidelines, and solution to what is necessary to get the goals of total human motion examination.

Murat Ekinci, Eyup Gedikli[4] presented a real-time background modeling and maintenance based human motion detection and analysis in an indoor and an outdoor environments for visual surveillance system is described. The system operates on monocular gray scale video imagery from a static CCD camera. In order to detect foreground objects, background scene model is statistically learned using the redundancy of the pixel intensities in a preparation stage, even the background is not completely stationary. This redundancy information of the each pixel is separately stored in an history map shows how the pixel intensity values changes till now.

Then the highest ratio of the redundancy on the pixel intensity values in the narration map in the training sequence is determined to have initial background model of the scene. A background maintenance model is also proposed for preventing some kind of falsies, such as, illumination changes, or physical changes. At the background modeling and maintenance, the consistency and computational costs of the algorithm presented are comparatively discussed with several algorithms. Based on the background modeling, candidate foreground regions are detected using thresholding, noise cleaning and their boundaries extracted using morphological filters.

Hanzi Wang and David Suter[5] presented an effective and adaptive background modeling method for detecting foreground objects in both static and dynamic scenes. The proposed method computes sample consensus (SACON) of the background samples and estimates a statistical model per pixel.

Sumer Jabri, Zoran Duric, Harry Wechsler, Azriel Rosenfeld [6] proposed a new method of finding people in video images is presented. Detection is based on a novel background modeling and subtraction approach which uses both color and edge information. We introduce confidence maps, gray-scale images whose intensity is a function of our confidence that a pixel has changed to fuse intermediate results and to represent the results of background subtraction. The latter is used to define a person's body by guiding contour collection to segment the person from the background. The method is understanding to scene clutter, slow illumination changes, and camera noise, and runs in near real time on a standard platform.

Jing Li and Zhaofa Zeng, Jiguang Sun, and Fengshan Liu [7] presented Ultra wideband (UWB) radar technology which has emerged as one of the chosen choices for through-wall detection due to its high range resolution and good dispersion. The motion is a result of high bandwidth of Ultra wideband radar and helpful for better separation of multiple targets in complex environment. One important attribute of human is the periodic motion, such as lungful of air and limb movement. In this paper, the human life is detected and identified by the methods based on fast Fourier transform and *S* transform; they apply the UWB radar system in through-wall human detection. In particular, they can extract the center frequencies of life signals and locate the position of human targets from experimental data with high accuracy. Compared with other examine studies in through-wall detection, this ultra wideband radar technology is well-built in the particular deliberation and identifying of the continued existence signal under strong insecurity.

III. BACKGROUND SUBTRACTION METHOD

Detection of moving human in videos from static camera is widely performed by background subtraction method. The origin in the approach is that of detecting the moving objects from the difference between the existing frame and a reference frame, frequently called the “background copy”, or “background replica”[1]. **As** a baric, the background image must be a representation of the scene with no moving objects and must be kept regularly updated so as to adapt to the varying luminance conditions and geometry settings. More difficult models have extended the concept of “background subtraction” beyond its literal meaning. The background subtraction method is the common method of motion detection. It is a technology that uses the difference of the current image and the background image to detect the motion region, and it is generally able to provide data included object information. The key of this method lies in the initialization and update of the background image[2]. The effectiveness of both will affect the accuracy of test results. Therefore, this paper uses an effective method to initialize the background, and update the background in real time.

The process algorithm is described as follow:

1. Sequences of Video Frames
2. Frame Separation
3. Image Sequence
4. Separation of Image Sequence in Current Frame Image and Background Frame Image
5. Perform Background subtraction
6. Detection Of Moving Object
7. Perform Background updating
8. Noise Removal
9. Shape Analysis

A. Background Image Initialization

There are many civilizations to obtain the initial background image. For instance, with the first frame as the background directly or, the average pixel brightness of the first few frames as the background or using a background image sequences without the hope of moving objects to approximate the background model parameters and so on. From these methods average method is commonly used for background Image initialization [3], but there are many shadow problems will occur which can be removed by median method, So the median method is selected in this paper to initialize the background.

Expression is as follows:

$$Binit\ (L,M) = \text{median}\ Fk(l,m)\ k = 1,2\ \ldots.n$$

Where Binit is the initial background, *n* is the total number of frames selected.

B. Moving Object Mining

Background subtraction is a popular technique to fragment out the interested objects in a frame. This technique involves subtracting an image that contains the object, with the previous background image that has no foreground objects of interest. The area of the image plane where there is a significant difference within these images indicates the pixel location of the moving objects[5]. These objects, which are represented by groups of pixel, are then separated from the background image by using threshold technique.

After the background image B(l,m) is obtained, subtract the background image B(l,m) from the current frame Fk(l,m*)*.If the pixel difference is greater than the set threshold *T* , then determines that the pixels appear in the moving object, otherwise, as the background pixels. The moving object can be detected after threshold operation.

Expression is as follows:

$$Dk(l,m) = \begin{cases} 1 & \text{if } |Fk(l,m) - Bk(l,m)| \geq T \\ 0 & \text{Otherwise} \end{cases}$$

The flow chart of moving human body mining is shown in (Fig.1)**:** Human body detection is to identify the corresponding part of human from the moving region. But the extracted moving region may correspond to different moving objects, such as vehicles and other such birds, floating clouds, swaying tree and other moving objects [8]. Hence we use the shape features of motion regions to further determine whether the moving object is a human being or not. Judging criteria are as follows:

1. The object area is larger than the set threshold
2. The aspect ratio of the object region should conform to the set ratio.

If these two conditions are met, the moving object is the moving human body or not a human body is conform.

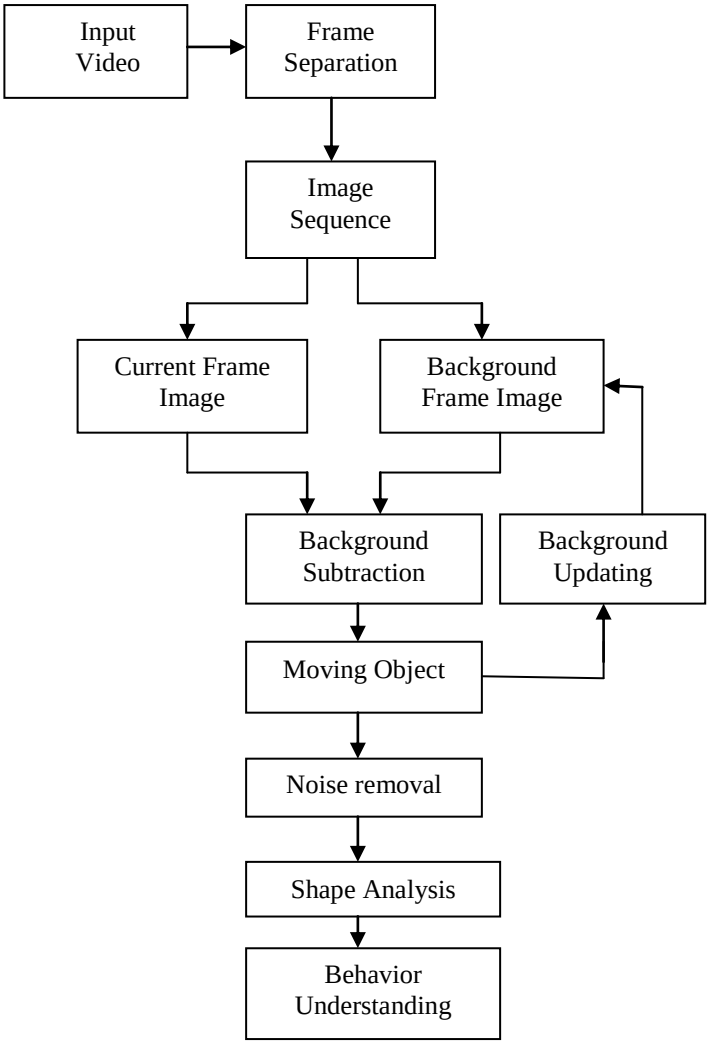

Figure 1.Flow chart of moving human body mining

C. Noise Removal

Since the difficulty of the background, the discrepancy image obtained contains the motion region as well as large number of noise. These noises might be included in the image due to environmental factors, illumination changes, during transmission of video from the camera to the further processing. Therefore, noise needs to be removed. In this paper we adopts median filter with the 3 X 3 window for filtering noise.

As we know, motion region just not includes human being, but also it may include moving cars, flying birds, flowing clouds and swaying trees and other non body parts. Morphological

methods are used for further processing. Corrosion operation is taken to effectively filter out non-human activity areas and by using the development operation they can filter out most of the non-body motion regions while preserving the shape of human motion without injury. After expansion and corrosion operations, some inaccessible spots of the image and some intrusion of small pieces are eliminated, and we get more accurate human motion region.

D. Extraction of Moving Human Body

Some accurate edge regions will be got after median filtering, corrosion and expansion operations, but the region belongs to the moving human body could not be determined. Through inspection, we can find out that when moving object appears, shadow will appear in some regions of the scène.Accurate mining of the moving object affected by the presence of shadow. By analyzing the characteristics of motion detection, we combine the projection operator with the previous methods.

Based on the results of the methods above, height of the motion region will get detected by adopting the method of combining horizontal with vertical projection. This can eliminate the impact of the shadow to a certain level. Then we analyze the vertical projection value and set the threshold value to remove the pseudo-local maximum value and the pseudo-local minimum value of the vertical projection to determine the number and width of the body in the motion region, we will get the moving human body with precise edge. This paper assumes that people in the scene are all in upright-walking state.

E. Behavior Understanding

After successfully detecting the moving humans from one frame to another in an image sequence, the problem of understanding human behaviors from image sequences follows naturally. Behavior understanding involves action identification and description. Human behavior understanding can guide the development of many human motion analysis systems.

Behavior understanding is to analyze and recognize human motion patterns, and to produce high-level description of actions and interactions .The behavior understanding will be the most important area of future research in human motion analysis.

IV. CONCLUSION

Our proposed method of moving object detection will help to find the moving object perfectly in the approved manner. To minimize or avoid the problems approaching in moving object detection, we use threshold method to detect moving object, background initialization and update the background in real time. At last, shadow effect removed by combining projection analysis with shape analysis. This method has also a very good effect on the elimination of noise and shadow, and be able to extract the complete and accurate picture of moving human body.

V. FUTURE IMPROVEMENT

In this paper, we have considered static background; in future it can be improved for changing/non-static background.

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