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OBJECT DETECTION AND TRACKING USING IMAGE PROCESSING

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Abstract: Detecting and tracking objects are among the most prevalent and challenging tasks that a surveillance system has to accomplish in order to determine meaningful events and suspicious activities, and automatically annotate and retrieve video content. Detection can be achieved by building a representation of the scene, frame difference is the method we use for background subtraction ,frame differencing is the intensity dissimilarity between two frames assuming that intensity change of a pixel apparently indicate something changing in the image, that is a moving object. It simply subtracts the current image from the previous or a reference image. After the detection, it is then the tracker's task to perform find its correspondence in the following frames while constructing object's trajectory. Here we use kalman filter to do the tracking of the objects. Thus in this way we can be able to detect and track the movable objects in a video.

Index Terms **-** Component Detection, tracking, frame difference, moving objects, background subtraction, kalman filter.

I. INTRODUCTION:A moving Object detection has wide range of applications Such as Automated video surveillance, mobile robot navigation, robot vision, monitoring of traffic, military reconnaissance, security systems, animation purpose and human-computer interaction etc. Now-a-days, moving object detection is a diverse topic in the computer vision research. Here in this paper, the two techniques are implemented in Matlab, and results were compared. Two-frame difference, the objective of the approach is to detect the moving objects from the difference between the existing frame and the reference frame. The frame difference method is the method of motion detection. This method adopts pixel-based difference to find the moving object. The first frame is captured through the continuous video and converted into grey scale image and then sequence of frames is captured at regular intervals, and converted into grey scale images. The absolute difference is calculated between the consecutive frames and the difference image is stored. The difference image is translated into binary images, by optimal threshold. The advantage of this technique, it can resist the interference of light to some extent when compared with the basic background subtraction technique. The input RGB video is converted into grey scale because the context of computing comprises only two intensity values of the colour image i.e. '0' & '1'. And also, basically background subtraction technique needs a stable background which is very complicated to extract in real time applications. Based on this, frame difference method is found to be better than background subtraction while considering implementation as a parameter.

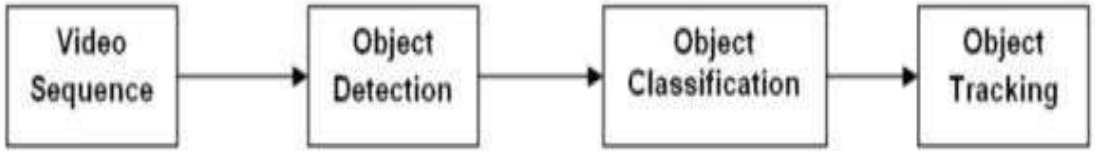

Fig.1.Object detection and tracking

The detection of a moving object and tracking of different objects in a video sequence is a very important task in the surveillance, analysis and monitoring, tracking and detection of humans and different gesture recognitions in human-machine interface. Object tracking plays a vital role in the field of computer vision. The basic steps for object detection and tracking are shown. In the object tracking, the video analysis involves, moving object detection, object classification, frame to frame object tracking. Object detection deals with the identification of objects from video frame and to cluster pixels of these objects .Real time object tracking is one of the most active research areas in computer vision. The goal of object tracking is to estimate the locations and motion parameters of the target in a video sequence given the initialized position in the first frame. Research in tracking plays a key role in understanding motion and structure of objects. It finds numerous applications including surveillance, human-computer interaction, traffic pattern analysis, recognition , and medical image processing, to name a few. Although object tracking has been studied for several decades and numerous tracking algorithms have been proposed for different tasks, it remains to be a very challenging problem. One of the most challenging factors in object tracking is to account for appearance variation of the target object caused by change of illumination, deformation.

1. PROPOSED ALGORITHM

A. OBJECT DETECTION

An important stream of research within a 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 surveillances. The goal of motion detection is to recognize motion of objects found in the two given images. Moreover, finding objects motion can contribute to objects recognition. Thus, the main objective of the research is to recognize pixels belonging to the same object. However, the present research is based on the following assumptions:

- A well fixed camera –stability is key if you want to isolate motion.
- Stable light, no flickering
- Contrasting background
- High camera frame rate and resolution

Human body motion analysis has been an interesting research for its various applications, such as physical performance, evaluation, medical diagnostics, virtual reality. At present methods used in moving object detection are mainly the frame subtraction method, the background subtraction method and the optical flow method. Optical flow method is to calculate the image optical flow field, and do cluster 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. 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. In the frame subtraction method the presence of moving objects is determined by calculating the difference between two consecutive images. Any motion detection system based on background subtraction needs to handle a number of critical situations such as:

- Image noise, due to a poor quality image source;
- Gradual variations of the lighting conditions in the scene
- Small movements of non-static objects such as tree branches and bushes blowing in the wind;
- Shadow regions are projected by foreground objects and are detected as moving objects.

➢ **Frame Difference Method**

Detection of moving object from a sequence of frames captured from a static camera is widely performed by frame difference method. The objective of the approach is to detect the moving objects from the difference between the existing frame and the reference frame. The frame difference method is the common method of motion detection. This method adopts pixel-based difference to find the moving object.

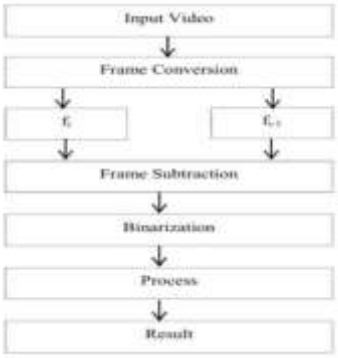

Fig.2..Flow Chart for Frame difference

Steps involved in Frame Difference: 1)Convert the incoming frame to gray scale image. 2)Subtract the current from the previous frame. Difference image= | (Current image) - (Previous image)

3)The difference image is translated into binary images by optimal threshold.

4)For each pixel ,if the difference between the current frame is greater than a threshold then the pixel is considered as

{ 1(if | Difference image | >= Threshold) or 0(else)

} The main moto of this approach is to detect the moving objects from the difference between the existing frame and reference frame.

Frame difference method, is also known as the adjacent frame difference method, the image sequence difference method etc.it refers to a very small time intervals Δt of the two images before and after the pixel based on the time difference, and then thresholding to extract the image region of the movement, according to which changes in the difference of the specific flow chart. The specific method of calculation of difference image Dk between the kth frame images fk with the k-1 the frame image fk-1 is differential, the negative differential and fully differential, the corresponding formula is as follows.

Fig.3.Example for Object detection.

B. OBJECT TRACKING

➢ Point tracking algorithm

Points are often used to represent the smallest objects that do not change their scale dramatically. In point tracking, objects are represented as points and the motion and position of these points are tracked in consecutive image frames. Point trackers estimate only translation of the object. The estimation can be performed using frame-to-frame tracking,key-point matching and key-point classification. A well-known method for statistical point tracking is multiple hypothesis tracking. A set of hypotheses are defined for an object and predictions are made for each hypothesis for the object's position. The hypothesis with the highest prediction is the most likely and is chosen for tracking. Other statistical methods that can be used to track single objects are the Kalman filter and Particle filters. The Kalman filter is limited to a linear system and uses prediction and correction to estimate an object's motion.

The tracking process can be online, where only past and present video information is available for processing, or offline, where all of the video information is available. Real-time tracking falls in the category of online tracking methods which process information as it arrives and provide a tracking result before the next video frame becomes available. Real-time tracking is necessary for many applications. It is necessary to differentiate between these methods of object tracking depending upon the way they process information. We know that offline methods cannot process information in real time, so they are not often useful for interactive applications. But they are useful for after-the-fact analysis, such as video indexing or traffic analysis. They have an advantage over online methods in that they have access to all of the video information, including future information, which can improve tracking robustness. Offline methods also have the freedom to be less computationally efficient than real-time methods. Online methods only have access to past and present information. However, by introducing a short time delay, online systems can behave like offline methods with access to a small amount of future information. In general, online methods should be more computationally efficient than offline methods, as they are intended to run in real-time. Of course, the frequency of the updates of the tracking parameters may vary, but there is little advantage to ignoring future information if real-time processing is not an ultimate goal.

❖ Kalman Filter

The Kalman Filter was first developed in 1960 by R. E. Kalman. The original Kalmanfilter, was used in continuous-time, but soon also a discrete version was derived. It is a predictor-corrector type estimator that minimizes the error covariance of the system having two major characteristics: it maintains both the mean vector for the state and also the covariance matrix of the uncertainty state. The process is estimated using a form of feedback control: the filter estimates the process state at a certain time and then gathers feedback in the form of measurements. Kalman Filter equations are divided into two groups: time update and measure update equations. The first group of equations is responsible for projecting forward both the current state and error covariance while the second is responsible for the feedback.

One of the drawbacks of the Kalman filter is that it performs the probability density propagation for problems in which the system can be described through a linear model and in which both system and measurement noises are white and Gaussian. In order

to solve this problem, an extension of the Kalman filter called Extended Kalman Filter (EKF) can be adopted The nonlinear functions are linearized using Taylor series expansion. As with the original kalman filter, the extended version also assumes that the state is distributed by a Gaussian.

Fig.4.Example for Object Tracking

III Block Diagram

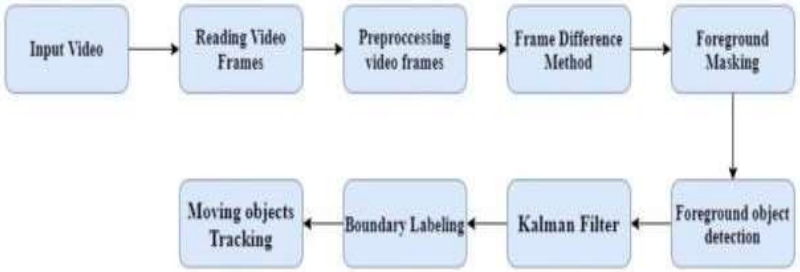

Fig.5.Block Diagram

Application

- Self driving cars
- Activity Recognition
- People counting
- Ball Tracking in sports
- Traffic Monitoring

Results

The proposed algorithm is performed in MATLAB. The output is presented in the following figures.

Fig.6.Input Video Frame

Fig.7.Output Video Frame

Conclusion

In the present research, moving object is detected by the method of motion detection, which composes of frame difference method and morphological operations. The obvious keystone of the work is studying the principle of frame difference method and to resolve the various problems. The experiment shows that the method has good performance and efficiency. Future enhancement may include alerting the user by sending multimedia SMS, by email or by capturing video and streaming it online

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