Motion Detection for Intelligent Video Surveillance System: A Survey

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Abstract:
Motion detection is a main task for video Surveillance system. In video surveillance, motion detection refers to the capability of the surveillance system to detect motion. Video surveillance is the procedure of finding a moving object or various objects over a period utilizing camera. Video Surveillance is a term given to monitor the behavior of any kind through videos. It requires person to monitor the CCTV and huge volume of memory to record it. One of the major challenges involved is the huge volume of video storage and retrieval of the same on demand. In order to avoid the depletion of human resources and to detect the suspicious behaviors that threaten safety and security, Intelligent Video Surveillance system (IVS) is required Because of key feature of video surveillance, it has a various uses like human-computer associations, security and surveillance, video communication, traffic control, open territories, for example, airports, underground stations, mass events, and so on. This paper present classification of different method which are used for motion detection and survey on different previously proposed system for motion detection.

Keywords- *Video Surveillance, Moving Object Detection, Motion detection, Kalman filters and Gaussian mixture models.*

I. INTRODUCTION

Motion detection in real time application is an important challenging task in video surveillance systems. A video is a collection of static images or frames and associated audio data. A frame is a single picture or still shot, that is shown as part of a larger video. Motion detection in video acts as a first step for next processing such as tracking, classification of the detected moving object [2].

A field of computer vision is integration and automation of various representations and processes used in vision perception, which includes different techniques that are themselves important, such as statistical decision theory(statistical pattern classification applied to video, general patterns, or otherwise) and image processing (encoding, transmitting and transforming images)[6]. Surveillance is one of the primary applications in Computer vision or evolving information, for the most part of people groups with the end goal of securing. Surveillance applied in electronic equipment such as CCTV cameras, are installed in many places such as airports, parking lots, railway stations and banks [5]. In the past, the video imagery has been mostly utilized as a scientific instrument after an occasion. To take advantage of the video in real-time, a human must monitor the system continuously in order to alert security officers if there is an emergency. Besides, one individual can just watch more or less four cameras at once with great exactness. Hence, this requires classy human resources for real-time video surveillance using recent technology.

Motion detection has become a central topic of discussion in field of computer vision because of its extensive variety of uses like video surveillance, monitoring of security at airport, law enforcement, video compression, automatic target identification, marine surveillance and human activity recognition. Several methods have been proposed so forth for object detection, out of which Background Subtraction, Frame differencing, Temporal Differencing and Optical Flow are extensively used traditional methods.

Intelligent video surveillance is a well-established commercial technology. Intelligent video surveillance detecting only the moving footage of the human objects [5]. The surveillance system utilizes Network Video Recorder (NVR) and IP cameras. It utilizes scientific calculations to detect moving things in an image. Intelligent video surveillance Solutions permits the user to monitor and secure zones with the security cameras. Processing in an intelligent video surveillance system are: motion detection and recognition, tracking, behavioral analysis and retrieval. These stages include the points of machine vision, pattern analysis, artificial intelligence and data management.

The conventional video surveillance frameworks have disadvantage in that a man ought to monitor the closed circuit televisions (CCTV). Henceforth, the requirements for the intelligent video surveillance systems which can monitor and respond to situations in real time have improved due to the high-cost and low-efficiency of the existing ones. In addition, the video surveillance systems using IP cameras have been common and NVR enables a person to keep watching anywhere [5].

II. CLASSIFICATION OF DIFFERENT METHODS FOR MOTION DETECTION

Motion detection is a computer vision technology that deals with identifying instances of objects such as human, vehicle, animal or bird and other moving objects. Motion detection is one of the initial steps for video surveillance system. Traditional Approaches for motion detection can be broadly categorized into four forms as Background subtraction, Frame Differencing, Temporal Differencing and Optical Flow.

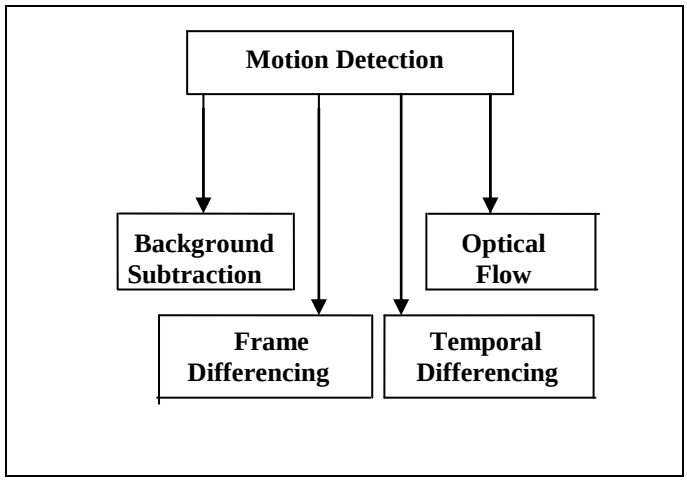

Fig.1 Different Method for Motion Detection

A. Background Subtraction:

Background subtraction is very much important in security and surveillance applications, because this is the first and foremost step in identifying and detecting people or objects in the videos [6]. It attempts to detect moving regions by subtracting the current image pixel-by-pixel from a reference background image. The pixels where the difference is above a threshold are classified as foreground. The creation of the background image is known as background modeling. Performance of traditional background subtraction method mostly gets affected when background is dynamic, illumination changes, in presence of shadow, Bootstrapping or Presence of noise in video [7]. Many techniques have been created so forth to upgrade background subtraction method and overcome its drawbacks. Unfortunately, the derivation of backgroundSubtraction model is complex and computationally expensive [2].

B. Frame Differencing:

Frame difference method identifies the existence of moving object by considering the variation between two consecutive frames. It carries out a subtraction among the consecutive frame [6]. Threshold is used for the segmentation. Many previous approaches use image subtraction method to obtain output images by subtracting current frame from the previous frame. Frame differencing method lacks in obtaining the entire form of the object as a result of which morphology operations are common used to obtain improved results.

C. Temporal Differencing:

Over the past years, various motion detection techniques have been proposed. The most commonly used technique is temporal differencing [7].In this method current frame is compared with previous frame. The compared image is then threshold to segment out foreground objects. This technique fails if objects have uniformly distributed intensity values and if object stays still for more than a frame period (I/fps).Frame differencing method lacks in obtaining the complete contour of the object as a result of which morphology operations are common used to gain well results. This method is greatly adaptive to dynamic changes in the scene as most recent frames are involved in the computation of the moving regions. However, it generally fails to detect whole relevant pixels of some types of moving objects. It also wrongly detects a trailing regions as moving object (known as ghost region) when there is an object that is moving fast in the frames. Detection will also not be correct for objects that preserve uniform regions.

D. Optical Flow:

Optic flow is the pattern of motion of objects in a visual scene caused by the relative motion between the scene and an eye (a camera).Optical flow method is a method used for particular fields such as allowing better video compression, image segmentation for tracking a moving object and motion estimation to predict the motion vector of a moving object [4]. Optical flow approach of motion detection is based on calculation of optical flow field of image (or video frame). Optical flow methods make use of the flow vectors of moving objects over time to detect motion in an image. It is an effective but time consuming method. Background motion model, which serves to steady the image of the background plane, can be calculated using optic flow. This method can detect motion in video sequences even from a moving camera and moving background, however, most of the optical flow methods are computationally complex and cannot be used in real-time without specialized hardware.

III. RELATED WORK

Over the past years, different motion detection techniques have been proposed. Xing, Kejunet. al [1] used kalman filter for multiple object Tracking. Main features of Kalman filter are prediction in object's future scene, noise reduction, able to track single as well as multiple objects. In it showed that the Kalman filter achieves the efficient tracking of multiple moving objects under the confusing situations.

Raj Bharath et. al [2] proposed a technique for object detection, classification and parametric evaluation. They used the techniques like image subtraction, threshold and foreground detection for object detection and for the classification patterns are used. Parameters like speed and velocity of motioned object are calculated. They used morphological filtering for noise removal. It achieves good

results and able to separate foreground and background in accurate way with low time consumption.

Cheng-Chang et. al [3] proposed a method for night video surveillance. Night video surveillance faces some problems: no color information, low brightness, low contrast, and low signal to noise ratio (SNR) to overcome these problems they apply second-order image features and identify the moving objects via the support vector machines and achieve 93% accuracy with the efficiency 25 fps.

Milin and Shankar [4] used optical flow for moving object detection with moving Background. They used lucas – kanade optical flow algorithm for moving object detection with complex background. Bilateral filter is used for pre-processing by which accurate and fast detection of the object is achieved.

Prakash and Thamaraiselvi [5] proposed a method for multiple moving objects. RGB Background Modeling is used with some new parameter to extract the moving regions. Morphology schemes are used to remove the noise. To track the multiple object particle filter tracker is used which works on offline. Homogeneity between two frames is identifying using Euclidean distance.

Swapnil and Shilpa [6] introduce a robust spatio-temporal background subtraction using frame differencing method. Which handles both slowly as well as rapidly moving objects and also able to identify automobiles waiting for traffic signal. It gives superior performance, compared to other existing method and computational efficiency is enough to use it for real-time applications.

Birmohan et.al [7] proposeda new color model to resolve the issues of shadowing and illumination changing. They proposed non-parametric pixel based algorithm for motion detection in video surveillance. It also specifies the moving and non-moving object which is achieve by observing only foreground pixels for particular duration of time.

Hossein et. al [8] proposed the Adaptive Noise Cancelation algorithm for motion detection. Gaussian Mixture Model method is used to model the background in ANC that increases the accuracy of detecting motion. Proposed algorithm can segment the objects successfully even if their motion is very slow and it can remove the background even in the existence of repetitive motion and lighting changes.

IV. CONCLUSION

In this paper, we have presented the survey on different methods for motion detection. Background subtraction, frame difference and temporal difference are mainly used approaches for the motion detection. During survey it was identified that shadow, illumination variation, noise and dynamic background are the major issues which decrease the accuracy of the result. Many works can be done to solve these issues and provides better result related to conventional approaches, but need more computational time and need additional algorithm to deal with complex environment.

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