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A Review on Video Surveillance Techniques

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Abstract: ***This paper presents a survey of various video surveillance techniques. The aimof this paper is to review of various techniques used for motion detection of an object related to human being as well as face detection. This paper provides a review on moving object detection and then it will identify the human entity in the video sequence which needs to be in Liveness nature. The basic task of video surveillance system is detecting and tracking moving object in the given video sequence or in the real time scenario. Video surveillance is an important security asset to control theft, home, banks, department stores, trespassing or traffic monitoring, highways and crowded public places.***

Keywords: Machine vision, Motion Detection, Theft, Video Surveillance.

1. Introduction

In today era, Video surveillance plays an important role in the field of security. The task of surveillance is to detect and track moving objects in the given video sequence or in the Liveness nature. Now-a-days, video surveillance system is an important security asset to control theft, to protect home, hospitals, trespassing or traffic monitoring, banks, department stores, highways, crowded public places, etc. Video surveillance is a process of analyzing video sequences. It is an active area in computer vision. It gives huge amount of data storage and display. In video surveillance, detection of moving objects from a video is necessary for object classification, target tracking, activity recognition as well as behaviour understanding. Video surveillance is used in two key modes, watching for known threats in real-time and searching for events of interest after the fact.

In last one-two decades there are lots of research work being carried out in the area of video surveillance system with various applications. The authors [1] present the video surveillance for detection of objects related to human motion and tracking of movements to identify it as a human or non-humanity. It is a novel combination of an Adaptive background modelling algorithm (which is based on the Gaussian Mixture Model) and a Human Detection for Surveillance i.e. HDS system. The HDS system deals with a Histogram of Oriented Gradients based human detector which is famous for its performance in detecting humans in still images. The foreground is extracted from video sequence by learning a statistical model of the background and subtracting it from the original frame [1]. This system deals with Gaussian mixture model for modelling the background adaptively. So motion regions are identified in the video frame, which consist the region of interest (ROI) for HDS system. The Histogram of Oriented Gradients algorithm is applied on the ROI to detect which category of object is present in the ROI. There are many categories present as ROI like human figure, a vehicle or an animal. To check out whether the ROI contains human figure or not SVM (Support Vector Machine) is useful. Linear SVM's are useful for baseline classifier because their performance is good relative to other linear classifiers and running fast. The HDS system makes a decision at each frame for a particular object being tracked [1]. After certain number of frames, object being tracked. The HDS systems compute majority decision taken by analysing 100 frames and then declare it as a human or non-human entity.

2. Discussions of Various Techniques

In a survey on Moving object Detection and Tracking in video surveillance system, Authors [2] presented in his paper that how moving object are detected and tracked through various techniques such as Foreground Detection, Pixel Level Post Processing, Region Level Post Processing etc., Authors [3] presented background subtraction with Alpha method. In that, when system starts at that time after passing first few frames from video sequence reference background initialized and then it is updated to adapt dynamic change. The threshold and reference background are updated through foreground pixel information. It attempts to detect moving regions by subtracting the current image pixel by pixel from a reference background image that is created by averaging images over time in an initialized period [3]. The differences of pixels higher than threshold are known as foreground. After that with the use of some morphological operations like erosion, dilation is performed for reducing noise effect as well as extracting the detected regions.

Another technique is used, to overcome the shortcoming of the basic background methods is called Statistical method [2]. This method is inspired by background subtraction method. The statistical methods' example is an adaptive background mixture modelled by a mixture of Gaussians which was described by Authors [4]. To extract moving regions, take the pixel wise differences between two or more consecutive frames, this method is known as Temporal differencing. It is highly adaptive approach to dynamic scene changes however, it fails to extract all relevant pixels of a foreground object especially when the object has uniform texture or moves slowly [5]. The limitations of temporal differencing method is when foreground object does not move at that time the change between consecutive frames is fail.

Eigen background subtraction [6] method is proposed by Author. In that, Eigen space model presented for segmentation of moving object with the help of Principle Component Analysis (PCA), the dimensionality of the space

which is generated by sample images is reduced. It is proposed by that the reduced space after PCA should present only the static part of the scene, remaining moving objects, if an image is projected on the space [2].

Authors [7] described the adaptive background mixture model in their paper. Goal is to develop a robust, adaptive tracking system which is flexible when there is moving scene clutter, variations in lighting, multiple moving objects etc. changes during the scene observed. In mixture model, assume the values of a particular pixel over time as a "pixel process".
Consider a particular pixel, at time t, {x0, y0}, is its history

$$\{X1,.....,Xt\} = \{I(x0,y0,i) ; 1 \leq i \leq t \}$$

Where I is the image sequence [7]. If pixel process could be considered a stationary process, a standard method for maximizing the likelihood of the observed data is expectation maximization [8]. But unfortunately, each pixel process varies with time so approximate method is needful which is consider sample size 1 for each new observation and to integrate new data uses standard learning rules. The great advantages of this method are when anything becomes a part of background then it does not destroy existing model of background. The method uses an approximation to Gaussian mixture modelling to describe the recent history of color and depth scene observation at each pixel, is described by author in paper [9].

The input to the algorithm is a time series of spatially registered, time-synchronized pairs of color and depth images obtained by static cameras [9]. Each pair of corresponding pixels in the two images for a given time step provides one scene observation in the combined input space of color and depth [9]. Authors present a novel real-time abnormal motion detection scheme [10]. This algorithm uses the macro block motion vectors that are generated anyway as part of standard video compression method [11]. Improbable motions indicate abnormal motion at the time of real time operation. A method for motion detection in the given video sequence is Foreground extraction using background subtraction. As we know, image is a combination of stationary part and motion (moving) part. The part which is stable during the video sequence is called stationary part. For instance: background, while the moving part is not stationary. With the use of Static background subtraction algorithm, we get original image (which contain motion as well as stationary part) and estimated background image (which is having only stationary part) and after that subtracted original image from estimated background image operation gives motion part only.

M.Sivarathinabala, S.Abirami proposed an Intelligent Video Surveillance system framework as shown in fig. In that, the image is acquired from camera which is consisting stationary and motion part. The overview of the model is discussed below:

1) Capturing the live video feed is the first step in video surveillance. We cannot process the video as it is. Video sequence is composed of series of video images. Images are pre-processed which contains features of containing geometry information of the target.
2) Analyzing images, we can classify the target and extract relevant information to analyze the motion of targets.
3) Activity/ Behaviour of the human is analyzed in the intelligent analysis module. If the abnormal behaviour is found in the scene, the system automatically stores the images and executes the alarm according to the user settings.
4) Video encoder can improve the efficiency of compression algorithms and reduce the transmission rate. The video is compressed by H.264 coding by adjusting the QP value.
5) The compressed video is sent to the mobile phone of the user. The mobile phone can decode them and play the surveillance video.

Neural network is also useful in the field of Video surveillance system. Author [13] focused his paper in this area and with this the proposed system is detected mobile objects as well as identifies their movements. With the use of Alarm detection whenever unacceptable movements are detected, alarm will raise. The process consisting the steps that first of all cameras sends a frame then signature extracted from frame. The neural network store the knowledge about it as "known" or "unknown" entity and according to that it classify and if "unknown" entity classify then system raised an alarm. The current frame is compared with the centroids, which is having background knowledge. If the current frame signature is having minimum distance from centroid then the frame is considered as a similar. But the distance is more than experimentally-defined threshold, and then frame is not similar compared to centroid so alarm is raised and withthat we can know that something suspicious may occurred.

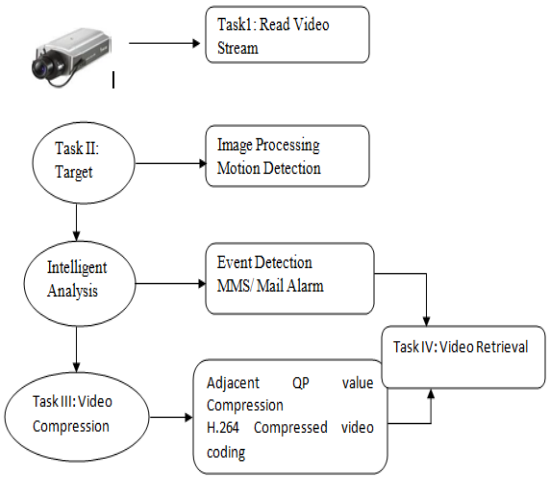

Figure: Intelligent Video Surveillance system

Author [14] discuss various algorithm related to frame based motion detection in surveillance system. The action of sensing a physical movement in the video sequence/area is called motion detection. With the use of it we can also identifies the movement of an object within two or more successive frames. Motion detection can be achieved by Mechanical form or Electronics form. In mechanical form of motion detection, a tripwire, this is a simple form of motion detection. If a moving object steps into the tripwire's field of view (i.e. trips the wire), then a simple sound device (e.g. bells) may alert the user [14]. While in electronic form of

motion detection, motion detection have sensors which detect the movement of an object and according to that it send signals to sound device which produce an alarm or switch on to the image recording device. In that method, they approach three stages for video frame which are: Tracking Step, Detection Step and Validation Step. In tracking step, the objects which have been previously identified are tracked to find their position and shape within the current video frame [14]. Same time motion of these objects is estimated. In detection Step, the new moving objects are detected and their shape as well as motion is estimated. This step also consisting creation of new hypotheses regarding new moving objects. In final step i.e. validation step, if any of the hypotheses are deemed valid, then we have identified a new moving object at this frame and this will now be tracked through subsequent frames [14]. Face recognition in video surveillance is described by Author [15] in their paper. A generic system for video-based face recognition works like first it takes images from camera and then after segmentation Region of Interest (ROI) identifies. The features vectors for extraction and tracking is completed and the biometric data base is decided the face recognition. This is an example of a system which is a combination of spatial and temporal computations. They also proposed a modular multi-classifier system (MCS) for accurate recognition of individuals in video-to-video surveillance applications. It is composed of a long-term memory (LTM), an ensemble of binary 2-class classifiers or detectors (EoDs) per individual and a dynamic multi-objective optimization module.

3. Conclusion

This paper gives the basic idea about various techniques used for motion detection in the field of video surveillance system. Video surveillance system is very useful in the field of security. With the use of motion detection we are tracking moving object and identify its activity. Extraction of information due to surveillance provides us object classification, define the difference between vehicles and humans, or between animals and humans, human identification. Some useful applications like to define human activities in video sequence which also includes animals or vehicles. Another application like track the vehicles as well as human simultaneously. The main feature of all of above is to ability to track the particular objects.

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