

Literature survey on the various methods of object detection in video surveillance systems

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Abstract - Video surveillance system is the most important dimension nowadays in order to maintain security and keep a track of events. It is used as a security system because it has the power to track and detect objects of interest. The importance of video surveillance system lies in the reality that it can be used in static and dynamic background as well. Static or stationary background examples are shopping mall, bank, school, colleges, ATMs etc and dynamic refers to vehicle tracking systems and traffic related areas. The most basic video surveillance systems undergoes many phases, after which it is able to detect the object of interest and makes necessary action like triggering of alarms. In this paper study of various phases of VSS is made and for each phase various alternative solutions with their advantages and disadvantages have been discussed.

Key Words: Video surveillance, shadow, occlusion, noise, false alarms, image acquisition, preprocessing, segmentation

1. INTRODUCTION

Moving object detection in stationary and mobile background has been widely used in diverse disciplines such as intelligent transportation system, airport security system, traffic surveillance and so on [24]. Basically movement detection of object in stationary background is relatively easy as compared to moving background. There are various methods deployed for these purposes. In section 2 basic system model of video surveillance is presented [3] and all its phases are discussed. In section 3 related work and techniques advised by various authors are presented. In section 4 Basic approaches of object detection is discussed. In section 5 Problems encountered during image retrieval and glimpse of various solutions has been discussed. In section 6 conclusions and lastly references.

2. Basic system model for video Surveillance Description of phases

Image Acquisition Phase

Image can easily be acquired with the help of a camera. At this stage image is in raw form with lot of disturbances and blurredness. Hence camera quality plays a vital role in posing a fruitful resulting image. If the quality of image is high, negative elements can be highlighted and identified, resulting in accurate and clear output. Raw image is influenced by factors called noise, shadow, light, image quality, contrast, blurring, image captured during day and night and many more. This raw image is converted into frames (collection of pixels) during preprocessing phase.

Pre-Processing Phase

It is process in which the image is converted into frames and also it helps in eliminating noise thereby enhancing the quality of frames. The video frames have lot of noise due to camera, illumination, reflection etc. This can be removed and quality of images can be enhanced with various pre-processing techniques. [14]

Segmentation Phase

A process of subdividing an image into its constituent parts, in order to analyze each part so that those images can be used for machine vision applications. Basically image when taken can be classified into two type's background and foreground image at this step foreground images are separated from background images. At this stage based on background status moving or stationary object can be identified, example where background is stationary are shopping mall, bank, ATM, colleges, schools and example where background is moving are intelligent transportation, vehicle detection and traffic analysis,

airlines etc. When the objects of interest is identified then for more clear identification, edge based extraction, feature based extraction, color and pattern based extraction, region based extraction mechanisms and many more techniques are applied and object of interest is achieved.[15PDF]

Description/ Feature selection

Objects can be of two types rigid and non rigid. Rigid objects are vehicles and non rigid objects are humans. [laptop prof ds patil]. Since these object vary there identification traits also varies for example in cases humans facial expressions, height, features , speed of walking which will be mostly be very low as compared to vehicles is of major concern. In case of non rigid objects shape, color, edges, region, velocity of vehicle will be main areas of concern. When object is vehicle then again it can be divided based on homogenous and heterogeneous traffic. Homogenous traffic where all vehicles are moving with almost same speed and heterogeneous was unsynchronized and unregulated flow of traffic is there.[Sipij oct 2015]. Therefore based on image features and image movement ,many authors have proposed various mechanisms with the help of which image recognition became an easy task.

Recognition & Interpretation

When the object is recognized then each and every moment, track of that object is maintained. On the basis of this track only further analysis is done and necessary action will be taken.

Activity Analysis and Action taken

In this phase threshold level is already fixed and in case of suspicious object going beyond it will raise an alarm and alert others. In case of object being below threshold no action will be taken.

3. Related Work and Techniques Available For Each Phase

Image Acquisition Phase

Authors[1] presents a new approach for adapting the camera response with respect to the environment's lighting conditions. For this we model a digital camera's response as a function of its parameters. The obtained mathematical model is vital for adapting the cameras to the environment's lighting conditions. The most widely used

camera parameters are the exposure time and amplification gain. By adjusting these parameters the image acquisition system can be less dependent on the environment's lighting conditions and can provide better quality images for further processing.

To solve the problems like excessive storage space required to store the video ,time consumption to record and view the video , Ching-Kai Huang and Tsuhan chen[1] proposed a method by recording only video that has motion in the scene. This can be achieved with a digital video camera and a DSP algorithm hat detects motion[14]. Similarly many other techniques are employed which are helpful in retrieving efficient and clear image.

Pre-Processing Phase

In the paper[4] author Urvashi and team described a method of preprocessing in which video is converted into frames first and then preprocessing of each frame having RGB component is done using NTSC equation.

$$\text{Intensity} = 0.2989(R) + 0.5870(G) + 0.1140(B)$$

Preprocessing consists of converting video into frames and background subtraction .Background subtraction is based on frame differencing method.

In paper[5] authors have mentioned that there are techniques through which noise or inconsistency can be removed. These are smoothing , binning, mean, median preprocessing techniques.

Segmentation Phase

This is major phase of focus because the effective object detection and classification is truly based on this phase.

In paper [6], author has focused on shadow elimination, therefore before segmentation, horizontal and vertical projection is done and then segmentation is applied on each connected region labeled.

In paper[7], author has proposed a robust segmentation algorithm that detects foreground pixels corresponding to moving vehicles. With the help of candidate selection and blob splitting, author is able to control occlusion.

In paper[4], author has proposed a method in which Otsu method is used which sets the threshold by itself for performing segmentation. Further canny detector is used for smoothening of image ,finds gradients and provides non maximal suppression and edges are tracked by hysteresis.

In paper [8], author during survey mentioned a new approach based on RGB color space along with edge ratio that allows determining moving object and shadow separately which was proposed Dong et al.[9]

Description/ Feature selection

In paper [10], author has mentioned various methods for feature selection and extraction like edge information, texture, time-domain characteristics ,proposed a method based on edge and connected component analysis.

In paper[11],author has proposed co training based approach for vehicle detection named haar for feature selection.

Recognition & Interpretation

In paper[11],author has used date time, direction of travel, color and speed features in for attribute extraction of a vehicle.

In paper[12] author used trajectory method to trace object movement and interpret results

Activity analysis and Action taken

Activity analysis deals with whether the activity of object of interest comes under suspicious or non suspicious category. If it comes under suspicious, action taken is raising alarms compression or locking sensitive area is proposed and if it is unsuspecting then it is treated as normal activity without any action performed.

4. Basic approaches for object detection and classification

1. Background subtraction algorithm: In this method current image is subtracted from reference background image, [13] has been classified into two categories

a)Simple background subtraction :In this method problem is that if reference background is dynamically inserted then it fails.

b)Running average method: It overcomes simple background subtraction method , as it takes average of all the frames n then set the reference frames.

2.Temporal Differencing[5]:In this method , differencing of pixels are used for two or more consecutive frames in the video sequence to detect moving regions, but problem with this method is that it

doesn't work when object is of uniform texture or is moving slowly.

3. Statistical methods [5]:They remove the problems encountered in background subtraction method, as it uses properties of pixels to build up a new background model.

5. Problems in object detection and few Solutions

1. Noise in image: With the use of filters like median , low pass filters, Gaussian low pass filters and many more reduces the noise in images

2.Shadow in image: Several shadow detection methods exists like hypotheses based that shadowed zone is darker than illuminated zone.[15], region growing method[16],comparison based on different shadow models[17].

3.Occlusion in dense scenes: Combination –of-parts(COP) and further a mechanism of global occlusion reasoning approach is used to solve this problem[14]

4. False alarms: Threshold based method is advised to figure out this problem but still lot of scope is left in this area.

6. Conclusion

In this paper, we have presented various studies , methods through which a better and clean picture of video surveillance can be projected. It is clearly stated that if all the steps of video analytics is taken and problem solving methods with its pros and cons are applied, an effective mechanism can be build up which will result in fruitful and clear image capturing.

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