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A Comparative Approach of Human Motion Detection Methods in video Surveillance Application –A Review

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Abstract: Identifying the moving objects from a video sequence is the fundamental and critical task in robotics, surveillance and many computer vision applications. According to the result of moving object detection research on video sequences, this work gives a review on existing methods and proposes a comparative analysis using statistical methods and self organizing method to detect moving object . We are using Background Subtraction and Self Organizing Background Subtraction (SOBS) algorithm for moving object detection. In Background Subtraction establishing a reliable background updating model based on statistical and use a dynamic optimization threshold method to obtain a more complete moving object. While in SOBS approach to moving object detection based on neural background model automatically generated by a self organizing approach. The proposed method runs quickly, accurately and fits for the real-time detection

Keywords: Background subtraction; background model; moving object detection, Self organizing, visual surveillance

I. INTRODUCTION

The word surveillance is commonly used to describe observation from a distance by means of electronic equipment or other technological means. Surveillance is the monitoring of behavior. Systems surveillance is the process of monitoring the behavior of people, objects or processes within systems for conformity to expected or desired norms in trusted systems for security or social control. Surveillance in many modern cities and buildings often uses closed-circuit television cameras. Although surveillance can be a useful tool for law enforcement and security companies, many people have concerns about the loss of privacy.

Surveillance includes simple, relatively no- or low-technology methods such as direct observation, observation with binoculars, postal interception, or similar methods.

Fig.1:cctv based surveillance cameras

Over the recent years, detecting human beings in a video scene of a surveillance system is attracting more attention due to its wide range of applications in abnormal event detection, person counting in a dense crowd, person identification, gender classification, fall detection for elderly people, etc. The scenes obtained from a surveillance video are usually with low resolution. Most existing digital video surveillance systems rely on human observers for detecting specific activities in a real-time video scene. However, there are limitations in the human capability to monitor simultaneous events in surveillance displays [1]. Hence, human motion analysis in automated video surveillance has become one of the most active and attractive research topics in the area of computer vision . An intelligent system detects and captures motion information of moving targets for accurate object classification. The classified object is being tracked for high-level analysis. In this study, we focus on detecting humans and do not consider recognition of their complex activities. Human detection is a difficult task from a machine vision perspective as it is influenced by a wide range of possible appearance due to changing articulated pose, clothing, lighting and background, but prior knowledge on these limitations can improve the detection performance. Object detection could be performed by background subtraction, optical flow and spatio-temporal filtering. Background subtraction is a popular method for object detection where it attempts to detect moving objects from the difference between the current frame and a background frame in a pixel-by-pixel or block-by-block fashion. There are few available approaches to perform background subtraction. The most common ones are adaptive Gaussian mixture, non-parametric background , temporal differencing ,warping background and hierarchical background models. The key purpose of this paper is to provide a comprehensive review on studies conducted in the area of human detection process of a visual surveillance system. Various available techniques are reviewed in following Sections. We present a review and analyses of recent developments and highlight future directions of research in the area of human detection in visual surveillance[2].

II. EXISTING METHODS REVIEW

The main contributions of this paper are as follows:

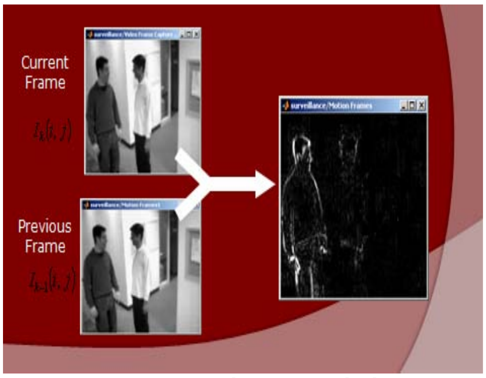

Fig.2:Frame subtraction method

- Frame subtraction method is through the difference between two consecutive images to determine the presence of moving objects.

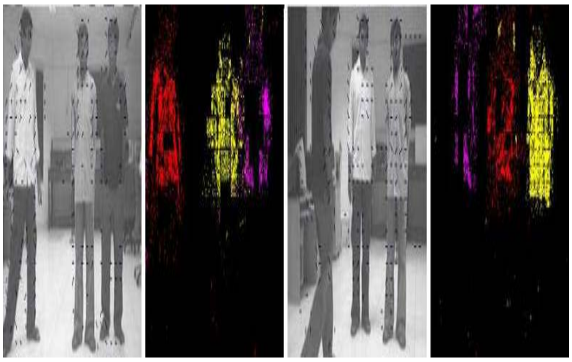

Fig.3:Optical flow method

Optical flow is a vector-based approach that estimates motion in video by matching points on objects over image frame(s). Under the assumption of brightness constancy and spatial smoothness, optical flow is used to describe coherent motion of points or features between image frames. Optical flow-based motion segmentation uses characteristics of flow vectors of moving objects over time to detect moving regions in an image sequence. One key benefit of using optical flow is that it is robust to multiple and simultaneous cameras and object motions, making it ideal for crowd analysis and conditions that contain dense motion. Optical flow-based methods can be used to detect independently moving objects even in the presence of camera motion. Apart from their vulnerability to image noise, colour and non-uniform lighting, most of flow computation methods have large computational requirements and are sensitive to motion discontinuities. A real-time implementation of optical flow will often require a specialized hardware due to the complexity of the algorithm and moderately high frame rate for accurate measurements.

- 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.

Fig.4: Background subtraction method

Background subtraction is a popular method to detect an object as a foreground by segmenting it from a scene of a surveillance camera. The camera could be fixed, pure translational or mobile in nature. Background subtraction attempts to detect moving objects from the difference between the current frame and the reference frame in a pixel-by pixel or block-by-block fashion. The reference frame is commonly known as 'background image', 'background model' or 'environment model'. A good background model needs to be adaptive to the changes in dynamic scenes. Updating the background information in regular intervals could do this, but this could also be done without updating background information[3].

• ***Mixture of Gaussian model***.

Gaussian mixture model, which is sensitive to the changes in dynamic scenes derived from illumination changes, extraneous events, etc. Rather than modeling the values of all the pixels of an image as one particular type of distribution, this modeled the values of each pixel as a mixture of Gaussians. Over time, new pixel values update the mixture of Gaussian (MoG) using an online K-means approximation[4].

• **Non-parametric background model**.

Sometimes, optimization of parameters for a specific environment is a difficult task. Thus, a number of researchers introduced non-parametric background modelling techniques . Non-parametric background models consider the statistical behaviour of image features to segment the foreground from the background. The computational requirement is high for this method.

• **Temporal differencing.**

The temporal differencing approach involves three important modules: block alarm module, background modelling module and object extraction module .The block alarm module efficiently checked each block for the presence of either a moving object or background information. This was accomplished using temporal differencing pixels of the Laplacian distribution model and allowed the subsequent background modelling module to process only those blocks that were found to contain background pixels. Next, the background modelling module is employed in order to generate a high-quality adaptive background model using a unique two-stage training procedure and a mechanism for recognizing changes in illumination. As the final step of their process, the proposed object extraction module computes the binary object detection mask by applying suitable threshold values.

• ***Hierarchical background model.***

It is based on region segmentation and pixel descriptors to detect and track foreground. It first segments the background images into several regions by the *mean-shift* algorithm. Then, a hierarchical model, which consists of the region models and pixel models, is created. The region model is one kind of approximate Gaussian mixture model extracted from the histogram of a specific region. The pixel model is based on the co occurrence of image variations described by HOG of pixels in each region. Benefiting from the background segmentation, the region models and pixel models corresponding to different regions can be set to different parameters. The pixel descriptors are calculated only from neighboring pixels belonging to the same object. The hierarchical models first detect the regions containing foreground and then locate the foreground only in these regions, thus avoid detection failure in other regions and reduce the time and cost.

Spatio-temporal filter

For motion recognition based on spatio-temporal analysis, the action or motion is characterized via the entire 3D spatio-temporal data volume spanned by the moving person in the image sequence. These methods generally consider motion as a whole to characterize its spatio temporal distributions processed a video sequence using a spatial Gaussian and a derivative of Gaussian on the temporal axis. Due to the derivative operation on the temporal axis, the filter shows high responses at regions of motion. These responses were then used to generate thresholds to yield a binary motion mask, followed by aggregation into spatial histogram bins. Such a feature encodes motion and its corresponding spatial information compactly and is useful for far-field and medium-field surveillance videos. As these approaches are based on simple convolution operations, they are fast and easy to implement.

III. PROPOSED METHOD

- In this paper, in a single static camera condition, we combine dynamic background modeling with dynamic threshold
- Selection method based on the background subtraction, and update background on the basis of accurate detection of object, this method is effective to enhance the effect of moving object detection.
- Implementation of new self-organizing method for modeling background by learning motion patterns and so allowing foreground/background separation for scenes from stationary cameras. Learns background motion trajectories in a self organizing manner using neural network structure. By applying the detection mask, we can observe that the object is almost perfectly detected, despite the camouflage and moving background.

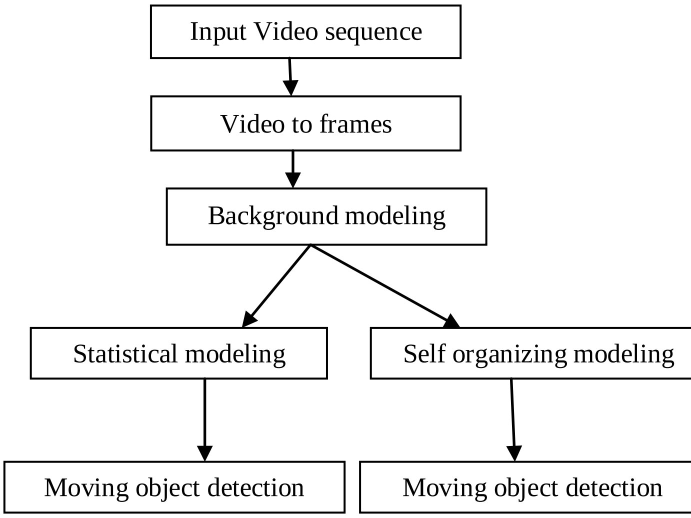

Fig.5:Block diagram of Proposed method

Object detection

An object is generally detected by segmenting motion in a video image. Here Two approaches for object detection as background subtraction and SOBS are compared. They are outlined in the following sections and performance is compared ([5],[6],[7],[8],[9]).

IV. PERFORMANCE COMPARISONS OF DETECTION TECHNIQUES

A generic comparison among object detection methods in terms of accuracy and computational time is done.We have provided the general trends of these techniques in each category based on various available comparative studies. The readers will have a general understanding about their performances and this will help them to conduct further investigation to find the appropriate technique suitable for their specific contexts.

- The MoG-based models compute at pixel level (or small block level) and provide moderate accuracy and relatively low computational time. It has been applied widely, and several improved models are introduced based on MoG. The MoG models are widely used as base model for performance comparisons of new models.
- Parametric models are tightly coupled with underlying assumptions, not always perfectly corresponding to the real data, and the choice of parameters can be cumbersome, thus reducing automation.
- The general non-parametric techniques provide high accuracy in dynamic background scenarios but require lower computational time.
- **Unimodal versus multimodal**: Basic background models assume that the intensity values of a pixel can be modeled by a single unimodal distribution . Such models usually have low complexity, but cannot handle moving backgrounds, while this is possible with multimodal models at the price of higher complexity
- Temporal differencing technique attained between 10% and 25% more accuracy than some well-known techniques

including MoG and has excellent capabilities to handle sudden illumination issues .

- Warping background techniques provide significantly better results (between 10% and 40% for various datasets) for separating background motion from foreground motion using neighboring pixel information compared to few classic methods including the non-parametric technique, and the implicit version claims to require less computational overhead .
- Optical flow methods have distinct advantages in moving object detection compared to background subtraction methods as they can handle camera motion and perform well in crowd detection; however, they require higher computational time and special hardware for real-time applications.
- Spatio-temporal-based methods are better in accuracy where noise is less as they consider motion in a holistic way. These methods showed promising results in unusual event detection scenarios, and they are good in terms of computational time.
- In cognizance of the shortcomings and deficiencies in the traditional method of object detection, we establish reliable background model, use dynamic threshold method to detect moving object and update the background in real time.We can see that this method have a very good adaptability in the high and low illumination environment, and have 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.
- Experimental results for moving object detection using the SOBS approach have been produced for input image. The number of weight vectors used to model each pixel has been fixed to 9 for all the reported experiments. Values for the distance thresholds should be chosen such that High values for allow to limit selectivity in the update of the background model during the calibration phase, enabling the inclusion into the initial background model of several observed pixel intensity variations. Lower values for should be chosen to obtain a more accurate background model in the online phase .Learning factor in has been fixed to 1 for all the reported experiments, while , that depends on scene variability, has been experimentally chosen . By applying the detection mask, we can observe that the object is almost perfectly detected, despite his camouflage and moving background. This is due to the fact that our model learns background motion trajectories captured by different weight vectors and, therefore, different color clusters, and to the adoption of distance, which allows a quite fair discrimination among colors.

V. CONCLUSION

A large amount of work has been done in the area of Moving human detection, there are still many open problems and new promising applications to explore. Detecting human beings accurately in a surveillance video is one of the major topics of vision research due to its wide range of applications. It is challenging to process the image obtained from a surveillance video as it has low resolution. A review of the available detection techniques is presented. In this paper, all available object detection techniques are categorized into background subtraction, optical flow and spatio-temporal filter methods. Future work will address on techniques to get better results to improve the human detection process and occlusion handling in surveillance applications.

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