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A Review on Motion Detection and Tracking Techniques

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ABSTRACT

Object tracking is a process of segmenting a region of interest from a video scene and keeping track of its motion, position and occlusion. The tracking is performed by monitoring objects' spatial and temporal changes during a video sequence, including its presence, position, size, shape, etc. Object tracking is used in several applications such as video surveillance, robot vision, traffic monitoring, Video in painting and Animation. Also, tracking of an object mainly involves two preceding steps object detection and object representation. Object detection is performed to check existence of objects in video and to precisely locate that object. The detected object fall into various categories such as humans, vehicles, birds, floating clouds, swaying tree and other moving objects. This paper presents a brief survey of different object detection, object representation and object tracking algorithms available in the literature including analysis and comparative study of different techniques used for various tracking stages.

KEYWORDS: *Object detection, Object representation, Object tracking, Background subtraction, Background Modeling, Point based tracking, Kernel based tracking, Silhouette based tracking*

I. INTRODUCTION

Object tracking is a technique or method used to track the number and direction of objects traversing a certain passage or entrance per unit time. This is a complex problem and time consuming. The resolution of the measurement, depend upon the technology that is used. The device is commonly used at public places like railway stations, shopping malls; air ports etc so that the movement of each individual object can be analyzed. Many different technologies are in use for tracking objects some of them are infrared beams, computer vision, optical, electromagnetic and thermal imaging. Ours is computer vision. There are various reasons for object tracking. The most important application is people counting, human computer interaction, medical imaging and security.

Object tracking is an important component of many computer vision systems. It is widely used in number of fields such as video surveillance, robotics, medical imaging, and human computer interface. Video cameras are inexpensive compared earlier days but manually reviewing, monitoring and verifying huge amount of data impractical, so from an environment automatically detecting and tracking people in a video surveillance system is challenging in computer. So due to this increasing need for automated video analysis has generated a great deal of interest in object tracking algorithms. The steps in video analysis are detection of moving objects that is to be analysed followed by tracking of such objects from frame to frame and analysis of tracks to recognize their behaviour of the objects.

Object identification is used find the object in image or video sequence. Humans are capable of identifying objects using less effort but it is challenging for computer vision. These types of systems can estimate the exact count of an object which is moving or stationary in the target region.

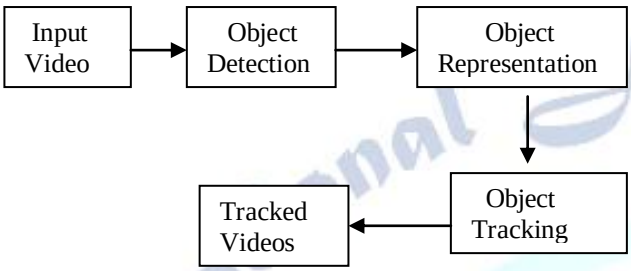

Figure 1: Phases of Moving Object Tracking

II. LITERATURE SURVEY

A wide range of application is there for object detection, tracking and identification in the field of surveillance, transport, physical security, retail shop and this paper point out the general problems regarding the object detection, tracking and identification. To track multiple objects, different methods are in use such methods have shown very good performance. Many global approaches have been explored to overcome errors occurred during detection.

Recently security concerns have grown tremendously, it is important for all to be able to safeguard their property from worldly harms such as thefts, destruction of property etc. As the technology is widely growing in modern world, therefore, it is necessary for the surveillance techniques also to be improved with the changing world. For this improvement many techniques were proposed and provide advantages and disadvantages, This section shows the related work of some researches work we provide it in this literature review.

A.Hybrid System of Motion Tracking Using Background Subracton and Frame Difference for Real Time and Recorded Videos.

In this paper [11] analyze the today's competitive generation, the security concerns have grown rapidly. The latest technology used for security concerns is motion detection system. Motion detection is broadly used in many computer vision tasks like pose estimation, human tracking, and human in danger and face recognition. It is a basic part for many computer vision tasks. By using these technologies, it is possible to monitor and capture every motion by inch and second of the area of interest. As motion detection system is real time and it is implemented widely, system is used to detect any motion in a real time video and once motion has been detected in the real time. We have even provided the provision of human identification using recorded video. Both the methods employed to detect the motion are background subtraction method and frame difference method. The proposed method makes background image using previous consecutive frames. This method detects the motion via a standard webcam in real-time YUY2_640x480 resolution. Experimental results showed that the proposed method is more robust in nature as it can avoid the noise in motion detection due to camera flicker and useful to reduce the number of false positive alarms. We additionally use the variant of MATLAB i.e. SIMULINK. It is efficient enough to track the human with its boundary condition.

B. An Improved Motion Detection Method for Real-Time Surveillance by Nan Lu, Jihong Wang

In this paper [12], analyze the Real-time detection of moving objects is very important for video surveillance. In this paper, a novel real time motion detection algorithm is proposed. The algorithm integrates the temporal differencing method, optical flow method, double background filtering (DBF) method and morphological processing methods to achieve better performance. The temporal differencing is used to detect initial coarse motion areas for the optical flow calculation to achieve real-time and accurate object motion detection. The DBF method is used to obtain and keep a stable background image to cope with variations on environmental changing conditions and is used to eliminate the background interference information and separate the moving object from it. The morphological processing methods are adopted and combined with the DBF to get improved results. The most attractive advantage of this algorithm is that the algorithm does not need to learn the background model from hundreds of images and can handle quick image variations without prior knowledge about the object size and shape. The algorithm has high capability of anti-interference and preserves high accurate rate detection at the same time. It also

demands less computation time than other methods for the real-time surveillance. The effectiveness of the proposed algorithm for motion detection is demonstrated in a simulation environment and the evaluation results are reported in this paper.

C. Detection of Surveillance Video Sequence by Kuihe Yang, Zhiming Cai, Lingling Zhao

In this paper [13], a study the video surveillance, there are many interference factors such as target changes, complex scenes, and target deformation in the moving object tracking. In order to resolve this issue, based on the comparative analysis of several common moving object detection methods, a moving object detection and recognition algorithm combined frame difference with background subtraction is presented in this paper. In the algorithm, we first calculate the average of the values of the gray of the continuous multi-frame image in the dynamic image, and then get background image obtained by the statistical average of the continuous image sequence, that is, the continuous interception of the N-frame images are summed, and find the average. In this case, weight of object information has been increasing, and also restrains the static background. Eventually the motion detection image contains both the target contour and more target information of the target contour point from the background image, so as to achieve separating the moving target from the image. The simulation results show the effectiveness of the proposed algorithm.

D. Real Time Motion Detection Using Background subtraction Method and Frame Difference

In this paper [14] scrutinize today's competitive generation, the security concerns have grown rapidly. The latest technology used for security concerns is motion detection system. Motion detection is broadly used in many computer vision tasks like pose estimation, human tracking and face recognition. It is a basic part for many computer vision tasks. By using this technologies, it is possible to monitor and capture every motion by inch and second of the area of interest. As motion detection system is real time and it is implemented widely, system is used to detect any motion in a real time video and once motion has been detected in the real time, the warning system will activate by means of an alarm and capture the real time video. The methods employed to detect the motion are background subtraction method and frame difference method. The purposed method makes background image using 4 previous consecutive frames. This method detects the motion via a standard webcam in real-time YUY2_640x480 resolution. Experimental results showed that the proposed method is more robust in nature as it can avoid the noise in motion detection due to camera flicker and useful to reduce the number of false positive alarms.

E. Moving Object Tracking using Background Subtraction Technique and its Parametric Evaluation

In this paper [15] proposes efficient motion detection and people counting based on background subtraction using dynamic threshold approach with mathematical morphology. Here these different methods are used effectively for object detection and compare these performance based on accurate detection. Here the techniques frame differences, dynamic threshold based detection will be used. After the object foreground detection, the parameters like speed, velocity motion will be determined. For this, most of previous methods depend on the assumption that the background is static over short time periods. In dynamic threshold based object detection, morphological process and filtering also used effectively for unwanted pixel removal from the background. The background frame will be updated by comparing the current frame intensities with reference frame. Along with this dynamic threshold, mathematical morphology also used which has an ability of greatly attenuating color variations generated by background motions while still highlighting moving objects. Finally the simulated results will be shown that used approximate median with mathematical morphology approach is effective rather than prior background subtraction methods in dynamic texture scenes and performance parameters of moving object such sensitivity, speed and velocity will be evaluated.

F. Object Detection and Tracking using Background Subtraction and Connected Component Labeling

In this paper [16] Digital image processing is one of the most researched fields nowadays. The ever increasing need of surveillance systems has further on made this field the point of emphasis. Surveillance systems are used for security reasons, intelligence gathering and many individual needs. Object tracking and detection is one of the main steps in these systems. Different techniques are used for this task and research is vastly done to make this system automated and to make it

reliable. In this research subjective quality assessment of object detection and object tracking is discussed in detail. In the proposed system the background subtraction is done from the clean original image by using distortion of color and brightness. The subtracted image is then tracked using connected component labeling. They discussed a unique and improved algorithm for detection and tracking of moving objects. The approach is based on a new technique for identifying the foreground pixels. It detects the foreground object completely and also it eliminates the shadows of that objects Experiments have been performed and this algorithm achieves detection of foreground objects to be more precise for the simple scenario and is observed that it eliminates the shadow of the moving objects. For the relatively complex background the post-processing and filtering helps in improving the efficiency of the algorithm. Finally proposed algorithm is tested with a variety of images having various backgrounds and lighting conditions. The proposed system eliminates the shadow and provides 79% accuracy.

G. Real-time Moving Obstacle Detection Using Optical Flow Models

In this paper [17] , they propose a real-time method to detect obstacles using theoretical models of optical flow fields. The idea of our approach is to segment the image in two layers: the pixels which match our optical flow model and those that do not (i.e. the obstacles). In this paper, we focus our approach on a model of the motion of the ground plane. Regions of the visual field that violate this model indicate potential obstacles. In the first part of this paper, we will describe the method we used to determine our model of the ground plane's motion. Then we will focus on the method to match both the model and the real optical flow field. Experiments have been carried on the Cycab mobile robot in real-time on a standard PC laptop. we use a Cycab mobile robot, which provides odometric measurements and a digital video stream (a color camera is fixed on the front of the robot). We need to have synchronized odometry data and video stream (otherwise the detection will be incorrect). The robot is driven manually in a car park where pedestrians and cars are moving. To give an overview of our experimental results, we will use a video where two pedestrians are crossing in front of the robot.

H. Object tracking using frame differencing and template matching

In this paper [18] this author presented the object tracking and extracting system using frame differencing and template matching. The frame differencing is used frame by frame to detect a moving object in an efficient manner. The template image is used for matching purpose and generated dynamically which ensure that the change in orientation and position of object does not affect the system. It was observed that this method was highly effective and can be used as a surveillance tool in various applications. This method also provides better results for object extraction, which can be easily applied to a number of fields. This method can also be used to extract an object which is at a distant point. In future to improve the effectiveness more work can be done on it.

i. BSFD: Background Subtraction frame differencing algorithm for moving object detection and extraction by D. Stalin Alex [19] presents the two common algorithms of moving object detection, background subtraction and frame differencing and also their comparison. The background image used to process the next frame image is generated through the super position of the current frame image. This algorithm makes the object that keep long standings, however not to be detected as a part of background. It was observed that the algorithm can detect moving object more effectively and precisely. It rectified the disadvantages of background subtraction method and frame difference method proposed a dynamic updating of background image by frame differencing method and utilizes the power of the background subtraction method.

I. Detection and Tracking System of Moving Objects Based on MATLAB

In this paper [20], Moving Object detection and tracking are receiving a growing attention with the emergence of surveillance systems. Video surveillance has been in used in the monitor security sensitive areas (such as banks, department stores, highways, crowded public places and borders, and etc.). In this thesis, video surveillance system with moving object detection and tracking capabilities is presented. This thesis is committed to the problems of defining and developing the basic building blocks of video surveillance system. The video surveillance system requires fast, reliable and robust algorithms for moving object detection and tracking. The system can process both color and gray images from a

stationary camera. It can handle object detection in indoor or outdoor environment and under changing illumination conditions. This paper presents detection and tracking system of moving objects based on matlab. It is described for segmenting moving objects from the scene .The proposed system is capable of adapting to dynamic scene, removing shadow, and distinguishing left/removed objects both in indoor and outdoor. The proposed technique combines simple frame difference (FD), simple adaptive background subtraction (BS), and accurate Gaussian modeling to benefit from the high detection accuracy of Mixture of Gaussian solution (MoG) in outdoor scenes while reducing the computations .Thus, making it faster and more suitable for real time surveillance applications, This study used IFD(Inter-Frame Differencing algorithm) and bounding box method to track the objects.

III. PROPOSED WORK

A. Problem Definition

The motion detection system is implemented for real time applications, background subtraction method and frame difference methods are used for detecting the motion from video frames. In this system, motion is detected from the real time video. Motion detection is usually a software-based monitoring system which, when it detects the motion will signal the surveillance camera to begin capturing the event or shows the motion detection using graphical method or by indicating an alarm. Background motion detection method is a simple method for motion detection by a fixed camera which compares the current image with a reference image or background image pixel by pixel [21]. The values of pixels in difference image is compared with threshold value and if the pixel value is more than threshold value then it means there is motion in the area being monitored. It only applicable to tract the single object so not uses in other object detection.

B. Proposed work

In this paper, an algorithm of feature-based using Kalman filter motion to handle multiple objects tracking is proposed. The system is fully automatic and requires no manual input of any kind for initialization of tracking. Through establishing Kalman filter motion model with the features centroid and area of moving objects in a single fixed camera monitoring scene, using information obtained by detection to judge whether merge or split occurred, the calculation of the cost function can be used to solve the problems of correspondence after split happened. The algorithm proposed is validated on human and vehicle image sequencethis result shows that the algorithm proposed achieve efficient tracking of multiple moving objects under the confusing situations. This paper presents a new algorithm for detecting moving objects from a static background scene based on frame difference. Firstly, the first frame is captured through the static camera and after that sequence of frames is captured at regular intervals. Secondly, the absolute difference is calculated between the consecutive frames and the difference image is stored in the system. Thirdly, the difference image is converted into gray image and then translated into binary image. Finally, kalmanfilter is used to track the object. Then morphological operations are done to detect the object perfectly.

IV. CONCLUSION

In this paper, all the major aspects of object detection, object representation and object tracking have been addressed. Various methods in these aspects have been explained in brief and a number of merits and demerits were highlighted in each and every technique. Different object detection methods are temporal differencing, frame differencing, optical flow and background subtraction. It can be summarized as background subtraction is a simplest method providing complete information about object compared to other methods. Among the different methods of object representation, most of the researchers prefer texture based and color based object representation. Object tracking can be performed using various methods based on point, kernel, and silhouette. Advance study may be carried out to find efficient algorithm to reduce computational cost and to decrease the time required for tracking the object for variety of videos containing diversified characteristics.

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