Computer Vision Based Moving Object Detection and Tracking

Suresh Kumar[1] , Prof. Yatin Kumar Agarwal[2]
[1]M.Tech. Scholar, [2]Professor
[1 2]Department of CSE, Greater Noida Institute Of Technology (GNIOT) Greater Noida, Uttar Pradesh, India

Abstract
To detect and track objects, some approaches of detecting and tracking moving objects in stationary scene are presented, including the detection methods of the time domain differential method, the background differential method, optical flow method and tracking methods of the Kalman filter and feature optical flow. Keywords-moving object detection and tracking; background model; Kalman filter; optical flow. Object tracking is an important task within the field of computer vision. It is a challenging problem. Many difficulties arises in tracking the objects due to abrupt object motion, changing appearance patterns of both the object and the scene, non-rigid object structures, object-to-object and object-to-scene occlusions, and camera motion. This paper selectively reviews the research papers with regard to tracking methods on the basis of the object, their motion representations and all detailed descriptions of representative methods in each category examining their advantages/disadvantages.

***Keywords**:- Object Representation, Object Tracking, Object Detection, Computer Vision*

I. INTRODUCTION

To develop the real world computer vision system, tracking of moving objects is very important task. The proliferation of high-powered computers, the availability of high quality and inexpensive video cameras, and the increasing need for automated video analysis has generated a great deal of interest in object tracking algorithms [1]. Applications are like automatic video surveillance, motion-based recognition, video indexing, humancomputer interaction, traffic monitoring, and vehicle navigation.
Real-time moving object detection and tracking [1][2] organically combines the image processing, automation and information science technology to form a kind of new technology that moving targets can be quickly detected in the images and target location can be extracted for tracking purpose. Moving picture sequence can provide more useful information for low signal to noise ratio (SNR) target detection, using image sequences can detect target which is difficult to detect in a single-frame image. Image sequences formed by the moving target can be categorized as two cases: one is the static background, the other is the varying background. The former case usually occurs in the camera which is in a relatively static state, produces moving image sequences with static background. Then we can use a temporal differencing algorithm or adaptive cancellation of the background method to remove the background interference, the calculation is simple; The latter case usually occurs in the target movement, while the camera is also in the relative movement state. Then it produces moving image sequences of changing background and leads that the changes of the moving target in the image are confused with the changes of the background itself. To deal with this case is complicated, if the cancellation of the background method [3] selected, it needs to do inter-frame image stabilization [2] and image registration [2]; else the prominent to an end method selected, it needs to do multi-frame energy accumulation and noise suppression.

2.RELATED WORK

There is much research work in the field of object tracking in videos over the past decades. Some of the work done has been discussed one by one below. Alexander Toshev, Ameesh Makadia et al. [5], Presented shape based object recognition in Videos Using 3D Synthetic Object Models. This paper sorted the problem of recognition of moving objects from the videos by synthetic 3D models. At first, from the video, the silhouette images of the moving object is extracted by feature tracking, motion grouping of tracks and co-segmentation of successive frames and then matched to 3D model

ISSN: 2005-4238 IJAST

silhouettes. As a result, the matching of every 3D model to the video. This approach can recognize objects in videos and estimate their rough pose by using only similar but not 3D models.

Mohammed Sayed and Wael Badawy [6], Presents a novel motion estimation method for mesh-based video motion tracking. The method called mesh-based square-matching (MB-SM) motion estimation method. This method is used in terms of computational cost reduction, efficiency and image quality. It is a modified version of the hexagonal matching motion estimation method. The MB-SM motion estimation is performed in two ways. First is the rough motion estimation using block-matching algorithm. Second is the fine motion estimation to refine the motion vectors generated from the first step. As result, MB-SM method has lower computation cost than the hexagonal matching motion estimation method while it produces almost the same PSNR values.

Minglun Gong [7], Proposed estimating 3D geometry and motion of dynamic scenes based on captured stereo sequences. A dynamic programming based technique is used for searching global optimal disparity maps and disparity flow maps under an energy minimization framework. As a result, both computations can benefit from each other and are capable of producing both 3D geometry and motion information for dynamic scenes in nearly real time.

Ming-Yu Shih et al. [8], In this paper, a method of moving object detection on moving platforms is proposed. This method composed of moving blob detection and shape refinement phases to provide robust moving object detection result. By fusing motion field's information from three consecutive frames, positions of moving blobs were precisely detected. Next, using motion compensated background models in intensity, r, and g color spaces, shapes of objects are well refined in the fused background subtraction process. By combining moving blob and contextual background information, alignment errors could be eliminated effectively to prevent foreground pixels from being adapted into background models.

Sajjad Torkan, Alireza Behrad [9], proposed a new contour based tracking method using active contour. Original greedy snake as a parametric active contour has weak performance in tracking target with high velocity and large displacement between two successive frames. This is due to concave parts of target boundary, shrinkage of contour if it is far from target boundary and the lack of target motion information. To resolve this problem a greedy snake with adaptive curvature energy and additional field energy term as an external energy. Kalman filtering is used for handling large target displacement and contour concavities. Kalman filtering is also used for the estimation of target shape and centroid in current frame. Applied on wide variety of video sequences results showed that the algorithm capable of tracking target with high speed, large aspect change and contour concavities.

Baiyang Liu, Lin Yang et al. [10], proposed an adaptive tracking algorithm for lung tumors in fluoroscopy using online learned collaborative trackers. No shape or motion priors are required for this tracking algorithm. This saves many expensive expert annotations. Accurate tracking of tumor movement in fluoroscopic video sequences is a clinically significant and challenging problem. This is due to blurred appearance, unclear deforming shape, complicate intra and inter- fractional motion, and other facts. Current offline tracking approaches are not adequate because they lack adaptivity and often require a large amount of manual labeling. Therefore this adaptive online learning algorithm is general to be extended to other medical tracking applications.

Pengwei LIU, Huiyuan WANG et al. [11], presented an approach for handling target detection and tracking in dynamic scenes, in which, motion compensation is generated by pyramidal optical flow. Because In most cases of target tracking in video sequences, the scene is dynamic due to the mobile cameras and causes problems. Main contribution in this system is that it separates the values of pyramidal optical flow into two groups: one represents background and the other foreground. Experiments show that the algorithm achieves motion compensation very effectively. It is only applied in two-dimensional motion cases such as that the camera moves only up and down.

ISSN: 2005-4238 IJAST

Mark Ritch, Nishan Canagarajah [12], proposed a method to identify and track an object of interest within compressed MPEG-2 video using only motion information. The system is designed to detect interesting events taking place, such as moving object appearing and to track it without the need to decode the video. Iterative rejection is used as a basis for initial segmentation and those macro blocks whose motion vector is large than average are rejected. This is done by adopting a novel model based approach. Experimental results on a number of sequences demonstrate its effectiveness in identifying and tracking on object of interest from a compressed video stream without the need to fully decode each frame and that the system performed better than using iterative rejection alone as a segmentation method.

Huiqiong Chen, Derek Rivait and Qigang Gao [13], presents perceptual organization based method for real-time license plate identification and tracking. In this method, video content is described by Generic Edge Tokens (GETs), and an image is represented as a GET map. The structure provided by GETs allows edge detection to be performed faster. A MGET graph representation is proposed for coding motion content, in that a license plate is a sub-MGET-graph (SMG) which satisfies license plate model. The SMG representing the license plate is identified by perceptually grouping plate shape in the MGET graph. Experiments show that the method is able to effectively segment license plates from the video sequences. Whether the video clips were taken during the day or at night did not have a large impact on the program results. The application correctly identified 66 of these license plates, giving an accuracy of approximately 98.5%.

3.METHODOLOGY

Detection of objects in motion is the first step towards non-stationary object tracking. Object detection is the method of finding the non-stationary object in a video sequence. Some of the major and important methods of detecting the moving objects are Frame differencing, Optical flow, Background subtraction and Double difference etc. Object representation is the process of demonstrating the objects. Object representation can be categorized as shape representation, color representation, texture based representation and Motion oriented representation. Object tracking is the process determining the position of the moving entity in a sequence of video.

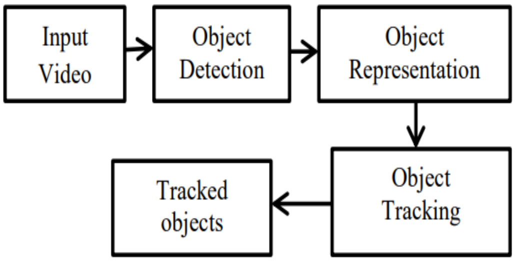

Figure 1: Phases of Moving Object Tracking

Certain types of tracking algorithms are point tracking, Motion tracking, Shape tracking, Feature tracking and Kernel based tracking. Step by step detail of the nonstationary object tracking is as shown in figure 1.

2.1) Object detection Object detection is the method for recognizing the nonstationary or moving object in a video sequence. This is the primary and main step towards moving object tracking

Different detection techniques are as despite in figure 2

ISSN: 2005-4238 IJAST

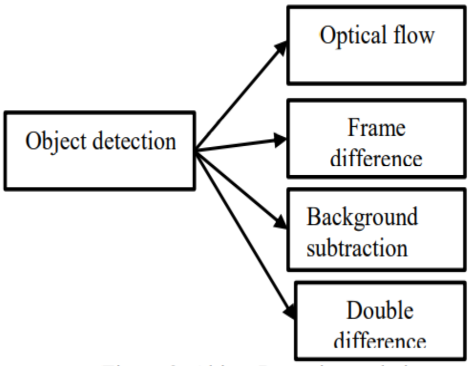

Figure 2: Object Detection techniques.

3.1 Optical Flow Optical flow is substitute standard from of object detection in which the optical flow arena of the image is calculated and grouping of those arenas is done rendering to appearances of the image. The motion among dual video frames occupied at time t and t+ δt at every single location is estimated in optical flow process. This technique gives the broad information regarding the movement of the object. And also detects the object accurately compared to that of background technique. This method is not widely used because of its huge calculation and it is very sensitive to noise. It is not good for real-time occlusion condition. 2.1.2) Background subtraction Background subtraction is the most widely used method for moving object detection. It can be of two types firstly by considering first frame as the reference frame or background image. Secondly by considering average of „n" frames as the background image. In this background subtraction method every pixel of on-going frame is subtracted with the pixels of the background image. The equation (1) and (2) shows the background subtraction method for first frame as the background image.

4.EXPERIMENTAL RESULTS

The algorithm can be implemented by Microsoft Visual Studio, test sequences use the 640×480 surveillance video. We do the experiment on a computer, and the experimental results are shown in Figure3.

(a)

(b)

Figure 3. Results of moving target detection on static background:(a)original frame;(b)result frame

ISSN: 2005-4238 IJAST

Experiment results show that the method proposed by this paper can effectively extract the moving target, especially when the velocity of target is not fast and the background is not very complicated, it can meet the requirements of real-time and accuracy.

5. CONCLUSIONS AND FUTURE WORK

We have presented the survey of object tracking methods and all categories of moving objects that is object representation, object tracking and object detection from any type of video. This will help us to significantly improve and facilitate the performance of certain computer vision tasks, such as tracking, video surveillance, motion-based recognition, video indexing, human-computer interaction, traffic monitoring, and vehicle navigation. Our future work will focus on: 1) Movement detection and capable of finding the objects which are in motion in every frame with respect to the previous frame. Till now in many proposed works, we have been plotting the movement of objects through videos but none of them is capable of plotting graph of the moving object if the background is changed at any instant. 2) The coordinates of tracked video in real time can import to any other software to work with the results calculated by our algorithm. 3) Our algorithm is capable of tracking the objects and making a 3d graph in mesh based scope in between any number of fps (frames per second) video.

REFERENCES

[1] Pengwei LIU, Huiyuan WANG et al., Motion Compensation Based Detecting and Tracking Targets in Dynamic Scene, IEEE, 2010, 703-706.

[2] Sajjad Torkan, Alireza Behrad, A New Contour Based Tracking Algorithm Using Improved Greedy Snake, IEEE, 2010.

[3] Baiyang Liu, Lin Yang et al., An Adaptive Tracking Algorithm Of Lung Tumors In Fluoroscopy Using Online Learned Collaborative Trackers, IEEE, 2010, 209-212.

[4] Alexander Toshev, Ameesh Makadia, Kostas Daniilidis, Shape-based Object Recognition in Videos Using 3D Synthetic Object Models, IEEE, 2009, 288-295.

[5] Makadia et al, Motion-based Background Modeling for Moving Object Detection on Moving Platforms, IEEE, 2007, 1178-1182.

[6] Mohammed Sayed and Wael Badawy, Motion-Based Video Object Tracking In The Compressed Domain, IEEE, 2007, 301-304.

[7] Minglun Gong, Object Tracking:A Survey, ACM Computing Surveys, 38(4), 2006.

[8] Ming-Yu Shih et al. , A Thesis, Thapar Institute of Engineering and Technology, Patiala, ME, 2006.

[9] Sajjad Torkan, Alireza Behrad Algorithm for Estimating 3D Geometry and Motion in Near Real-time, IEEE, 2006.

[10] Huiqiong Chen, Derek Rivait and Qigang Gao, Real-Time License Plate Identification by Perceptual Shape Grouping and Tracking, IEEE, 2006, 1352-1357.

[11] Pengwei LIU, Huiyuan WANG et al, A novel motion estimation method for mesh- based video motion tracking, IEEE, 2004, 337-340.

[12] Li-Qun Xu, Simultaneous Tracking And Segmentation Of Two Free Moving Hands In A Video Conferencing Scenario, IEEE, 2003, 49-52.

ISSN: 2005-4238 IJAST

[13] Mark Ritch, Nishan Canagarajah Particle Filter With Multiple Motion Models For Object Tracking In Diving Video Sequences, IEEE, 2008, 224-228.

[14] Harini Veeraraghavan, Paul Schrater and Nikolaos Papanikolopoulos, Switching Kalman Filter-Based Approach for Tracking and Event Detection at Traffic Intersections, IEEE, 2005, 1167-1172.

[15] Yumi Iwashita, Ryo Kurazume et al., Fast Implementation of Level Set Method and Its Real-time Applications, IEEE, 2004, 6302- 6307.

ISSN: 2005-4238 IJAST