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A Survey on Object Detection Tracking and Identification in a Video Surveillance System

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Abstract - Object tracking in a crowd remains one of the challenging problems of video surveillance system. The task of object tracking is one of the most important components of real time video surveillance and monitoring systems. Many researches are taking place in intelligent and automated security surveillance systems due to an increasing demand for such systems. They are useful in public areas such as airports, underground stations, retail shops, hospitals, banks, and mass events. One of the most critical requirements for surveillance systems is tracking of stationary foreground regions which are used for tracking of stolen objects or vehicles in parking area. Object tracking based methods are one of the choice to detect stationary foreground objects. This paper provides various techniques or methods that are used for detecting, tracking and identification of objects.

Keywords– Object tracking, object detection, identification, Bhattacharyya coefficient.

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.

II. RELATED WORK

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.

Grimson W E L et.al [1] developed a system that monitors activity in a site over extended periods of time. The system uses a set of sensors distributed over the site so that it could cover the entire site, and an adaptive tracker detects multiple moving objects in the sensors. This system classifies detected objects; learn common patterns of activities for different kinds of objects and to identify unusual patterns. Tracked patterns are used to classify common activity patterns. First, individual tracked

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objects can be classified into general classes, based on observed data. Two approaches are used to classify objects. First method, we cluster the tracker output using an entropy minimization algorithm by Wallace, the numeric iterative hierarchical cluster (NIHC) algorithm. The NIHC algorithm starts with randomly assigning data to clusters in a B-tree structure and it iteratively reduces the total Gaussian entropy of the tree. For each of the iteration, the algorithm greedily moves subtrees that will result in the largest decrease in the sum of the entropy of the subtrees.

Daniel J. Dailey, F. W. Cathey, and Suree Pumrin [2] developed a system which is used to estimate traffic speed using a sequence of images from an uncalibrated camera. They assert that there is no need for exact calibration to estimate the speed of the vehicle. The geometric relationships inherently available in the image was used and some common-sense assumptions was done which reduced the problem to one-dimensional (1-D) geometry, frame difference was the technique used to isolate moving edges and track vehicles between frames and parameters from the distribution of vehicle lengths to estimate the speed. The basic steps used to estimate speed from sequential uncalibrated images are obtain the sequential images from video camera, identify the moving vehicles in the sequential images that are captured, track all the vehicles between images, the scale factor in feet per pixel is estimated dynamically, using distance travelled and the interframe delay estimate the speed.

The algorithm operates on sets of sequential images taken from different video cameras. The images used for the work are grey scaled and sampled five times per second. To provide sufficient detail in the image to identify individual vehicles and to capture sequential images rapidly enough so that individual vehicles can be tracked between images without pattern recognition techniques the resolution and sample rate are selected. In order to remove high-frequency noise in the images at first the images are median filtered and then window-level-filtered is applied to enhance the intensity ranges and adjust the contrast and brightness in the images. In order to identify the moving vehicles in the captured images, the non-moving background is removed. The technique uses sequential frames to perform forward and backward differences between the frames for this interface differences is made with a differential operator applied to extract moving edges; and then applies a Sobel edge detector to the resulting image. The resulting images that are obtained are threshold to obtain binary image and thus moving edge is identified. They also performed dilation and erosion to the image. Dilation of an object is the translation of all of its points with regard to a structural element followed by a union operation. In order to close the curves in the moving edge image dilation is applied to the binary image. It also expands the overall size of the area enclosed. Erosion is used to shrink the object back to the original size.

Swantje Johnson and Ashley Tews [3][15] proposed a system consists of several existing subsystems with improvements in the detection and classification phases. The systems identify vehicle and people and are capable to determine their type and position. It is able to detect and classify people and vehicles outdoor in different weather conditions using a static camera and can distinguish people and vehicles by identifying recurrent motion such as arm and leg motion of the human in the tracked objects. The system can also tracks multiple objects. The tracking algorithm uses on the motion history of each object and determine the type of motion by any repeated, recurrent motion of the object's shape. This property is used to classify people and vehicles. The motion segmentation, tracking and classification steps are all dependent to each other. Motion segmentation consists of two steps first background subtraction is done then segmentation of foreground pixels. After segmentation the object is tracked which consist of sequence of steps, first the object model extraction in which the object is extracted and RGB histogram analysis is done to identify the object. In position prediction using the Kalman Filter the position of the tracked object in the plane is determined. In Priori Assignment the measured objects are a priori assigned to any existing tracks. During merging and splitting valid assumption is made when objects touch each other, a large rectangle is generated that contain all objects. This tracked object is used to classify the objects. This system is computationally more expensive and fails to deal with complete object occlusion

Pheng Ann, Heng Qian Chen [4] proposed a system that locates an object effectively in complex condition with camera motion, Partial occlusions, and clutter etc [6].In order to improve the tracking precision the diffusion snake is used to evolve the object contour. Initial target position is predicted and evaluated by the Kalman filter and the Bhattacharyya coefficient, respectively in the first object localization stage. The Bhattacharyya coefficient is used identify whether target region intersect the object region. If this coefficient is very small then the target region does not intersect the object region so we need to

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relocate the coefficient. The active contour is evolved on the basis of an object feature image generated with the colour information in the initial object region, in case of contour evolution stage. During the process of the evolution, similarities that occurs in the target region are compared to ensure that the object contour evolves in the right way. This method is having the following disadvantages

- It is time consuming;
- It cannot effectively track the object when the colour feature of the object is very similar to that of the background.

Michael, Fabian Bastian [5][7] proposed an algorithm that use novel approach detects and tracks a large number of dynamically moving persons in complex scenes. They do not use any additional scene knowledge and by using particle filter target location is predicted. Here tracking and detection is done using single and moving uncalibrated camera. Their tracking algorithm can estimate each object by particle filter. State transition density is used to estimate the probability density function. .For each person that is detected a separate particle filter is initialized. The size of the target was not included and it was set to an average size which yields a better result. Data association was used to decide the detector that guide the tracker. The algorithm that they employed was greedy data association. This data association algorithm can handle the false positive detection.

Rogerio Schmidt Feris et. al [8] used an approach for video detection and tracking in crowded environment. The algorithm used by them detects and track vehicles under partial occlusion. This system is also capable of tracking multiple vehicle in different weather condition. The partial occlusion is handled using Poisson image reconstruction. First the image was identified then intensity gradient is calculated and changes are made to it by adding zeros along border pixel and the image is reconstructed. They used an indexing based method to search a tracked vehicle. They have retrieved the vehicles using fine grained attributes. Multiple feature planes are used for selection of features. The most important disadvantage was it consumes huge amount of time because of using sequential methods. It is overcome using parallelism. A quantitative analysis was performed by them in real surveillance data.

III. CONCLUSION

This paper presents a survey on object identification, detection and tracking techniques that are able to detect an object. Many research issues have been highlighted here. There are a lot of challenges in object detection and identification; still research works are taking place in this field. Availability, efficiency of usage along with the increasing popularity of video on internet and versatility of video application heavily rely on object detection and tracking in videos. Object detection provides a good range of accuracy at different scenarios based on their application.

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