Various Recent Algorithms used in Video Streaming Moving Object Detection and Tracking: A Review

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Abstract - In the recent world of technology, a wide research on the detection and tracking of the moving objects has been done. The main scope of the object detection and tracking is to locate the moving objects in consecutive video frames. The object detection and tracking combines various stages of the object extraction, recognition and tracking. In the object detection, the main approach is on the identification of objects in the videos sequence and cluster pixels of the objects. The classification is the next main approach on tracking of the objects. The computerised video surveillance, traffic monitoring, gesture identification, medical imaging, image analysis are the main fields where the object tracking and detection are wide application areas of research of moving object. In this paper, a critical review of different object detection and tracking methods such as frame differencing, optical flow, background subtraction, point tracking, kernel tracking and region based tracking is done. Along with that, different object detection and tracking methods are compared as well as various techniques for different phases of tracking are explained.

Keywords: - Object Detection, Object Tracking, Classification, Moving Objects.

I. INTRODUCTION

The process of the object detection can be done by using segmentation of the frames, optical flow and background subtraction. Object tracking is used in several applications such as video surveillance, robot vision, traffic monitoring. Object detection and tracking has become a hot research field which is based on the development of the various factors and techniques. The object detection is a method to recognise the stationary and non-stationary objects in the video sequence. The objects can be represented using shape, color, texture and motion based representation. The objects tracking is the process of finding the position of the moving objects in required sequence of the video. The object detection is classified into different categories which can be humans, birds, vehicles, swaying trees and moving objects. The object detection and tracking can be described in different steps:-

i) Detection of object.

ii) Tracking of moving object.

iii) Analyse the behaviour of moving objects and extracts the visual data.

Object Detection and tracking are closely related and the research is done on the computer vision and the behaviour detection.
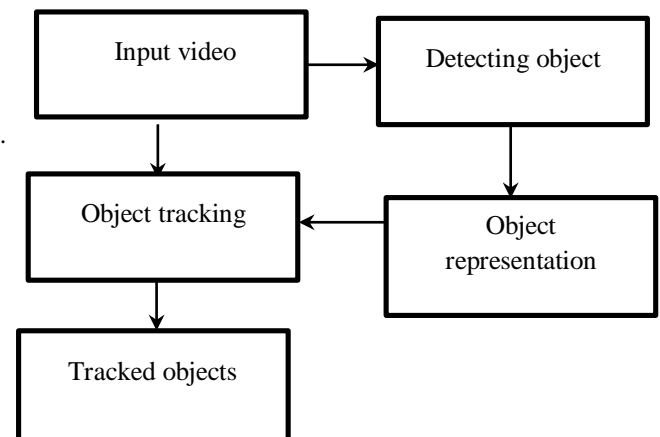

Fig.1 Overview of Object Detection and object Tracking

II. RELATED WORK

Bradley J. Koskowich et al., 2018[7] investigated a blend of techniques that enable to investigate and consider hyper-nearby natural wonders. Building up a novel use of mono plotting empowers perception of the after effects of profound learning object location furthermore, customary article following procedures connected to a point of view perspective on a parking area on elevated symbolism in real time. Also, they propose a general calculation to remove some scene understanding by rearranging the mono plotting procedure furthermore, applying it to advanced rise models. This permits to determine estimations of point of view picture regions causing object impediments. Associating the present reality and point of view spaces, a strong item follows the condition utilize both facilitate spaces to adjust following strategies when objects experience impediments. The novel composite of strategies opens roads for increasingly canny, powerful object following and itemized condition investigation utilizing GIS in complex spatial spaces gave video film and UAS items. *Young-min Song and Moongu Jeon et al., 2016 [8]* presented an online multiple object tracking (MOT) method based on tracking by detection. Tracking by detection has the inherent problems by false and miss detection. To deal with the false detection, we employed the Gaussian mixture probability hypothesis density (GM-PHD) filter because this filter is

robust to noisy and random data processing containing many false observations. Thus, it was revised that the GM-PHD filters for visual MOT. Also, to handle miss detection and they proposed a hierarchical tracking framework to associate fragmented or ID switched trackless. Experiments with the representative dataset PETS 2009 S2L1 showed that our frameworks are effective to decrease the errors by false and miss detection, and real-time capability. ***Dong Hye Ye et al.,2018[9]*** presented a new approach to detect and track UAVs from a single camera mounted on a different UAV. Initially, they estimate background motions via a perspective transformation model and then identify moving object candidates in the background subtracted image through deep learning classifier trained on manually labelled datasets. For each moving object candidates, they find spatial-temporal traits through optical flow matching and then prune them based on their motion patterns compared with the background. Kalman filter is applied on pruned moving objects to improve temporal consistency among the candidate detections. The algorithm was validated on video datasets taken from a UAV. ***Mahalingam, T. and Subramoniam, Mvet al., 2018[10]*** proposed robust video object recognition and following system. The proposed method partitioned into three stages in particular discovery stage, following stage and assessment stage in which recognition stage contains Forefront division and Commotion decrease. Blend of Versatile Gaussian (MoAG) demonstrate productive frontal area division. Notwithstanding it the fluffy morphological channel demonstrated the execution for expelling the clamor present in the frontal area portioned casings. Moving article following is accomplished by the mass identification which goes under following stage. In this research, the assessment stage has included extraction and arrangement. Surface based and quality based highlights are removed from the prepared edges which were given for arrangement. For characterization we are utilizing J48 ie, choice tree based classifier. The execution of the proposed system is dissected with existing methods k-NN and MLP in wording of accuracy, review, f-measure and ROC. **Archana Nagendran et al., 2014[11]** proposed a technique for moving items in recordings caught utilizing a moving camera in complex scenes. The video arrangements may contain profoundly powerful foundations and enlightenment changes. Four principle steps are engaged with the proposed strategy. To start with, the video is balanced out utilizing relative change. Second, canny choice of casings was performed to extricate casings that have an extensive change in substance. This progression decreases intricacy and computational time. Third, the moving article was followed utilizing Kalman channel and Gaussian blend demonstrate. In this research, the detection of the moving objects and the proposed algorithm involves the reduction effect of moving camera.

III. DETECTION AND TRACKING TECHNIQUES

A. *Object Detection Methods*

Pre-processing, in picture information should be possible at locale as well as edge level dependent on the necessities of the application It may be programmed or manual and ought to be rough enough to yield includes that can sensibly catch the picture content. Segmentation is the way toward recognizing parts of the picture which includes activities, for example, limit identification, associated part naming, threshold [6]. Limit identification discovers edges in the picture [12]. Threshold diminishes the dimensions in the picture. Different items in the scene are characterized through limit arrangement while intrigued article can be analysed. This prompts separate forefront and foundation objects present in a similar scene which is known as the procedure of frontal area/foundation extraction.

The closer view contains the objects of intrigue and foundation is all different items present other than intrigued object of a similar picture. Highlight Extraction is next key errand in following video information is the discovery and following of moving articles, for example, individuals and vehicles through the video outlines.
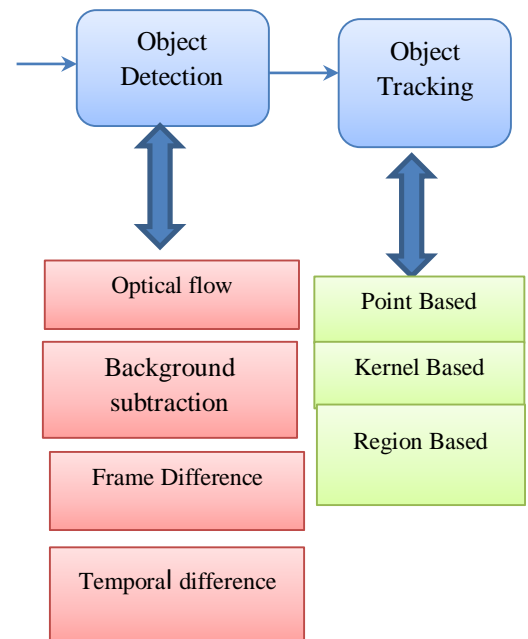

Fig.2 Objection detection and tracking overview methods

Highlights to be extricated relies on explicit applications, it can be state of item, separation of article from a predetermined point and so forth. Dissecting the highlights removed of item demonstrates its conduct which would help during the process of tracking.

1. Frame differencing: - Discovery of moving item from a succession of casings caught from a static camera is broadly performed by Frame differencing technique. The target of the methodology is to recognize the moving items from the distinction between the current casing and the reference outline. The casing distinction technique is the regular strategy for movement discovery. This technique receives pixel-based contrast to locate the moving article.

2. Optical Flow: - The optical stream depicts the course and the time rate of pixels in a period gathering of two coming about pictures. A two dimensional speed vector, passing on information on heading and the speed of development is doled out to each pixel in a given spot of the picture. For making estimation less intricate and snappier the trade present reality three dimensional (3-D+time) articles to a (2-D+time) case [13]. By delineate the image by techniques for the 2-D dynamic brightness limit of region and time I(x, y, t). Given that in the region of a removed pixel, change of splendour control does not happen along the development field.

3. Background Model: - The background model is also called as frontal and identification in the fields of image where the image is removed from further handling of the image. Generally an image's districts of interest are objects (individuals, vehicles, content, etc.) in its closer view. After the period of picture pre-taking care of (which may consolidate picture demonising, post planning like morphology, etc.) object confinement is required which may make usage of this methodology. Establishment subtraction is for the most part used system for recognizing moving articles in chronicles from static cameras. The reason in the procedure is that of recognizing the moving articles from the refinement between the present packaging and a reference layout, normally called establishment picture, or establishment illustrate. Some conventional methods used are:- Using plot differencing, Mean channel, Running Gaussian ordinary, Establishment mix models, etc.

Table 1: Comparison table of object detection methods

Methods	Benefits	Demerits
Frame Differencing	To recognize the moving items from the distinction between the current casing and the reference outline	Not recognised in complex pixel based contrast
Optical Flow	Depicts the course and the time rate of pixels in a period gathering of two coming about images.	Not recognise complex rate of pixels.
Background	Identify the moving object of the image in closer view.	Moving objects in blurred form of image.

B. Object Tracking Methods

Tracking can be characterized as the issue of approximating the Path of an object in the picture plane as it moves around a scene. The motivation behind an object tracking is to create the course for an item above time by discovering its situation in each single casing of the video. Tracking can be named point tracking, kernel based tracking and outline based following. The point trackers include location in each frame ; while geometric area or kernel based tracking require detection only when the object first appears in the scene. The object tracking methods described as:-

1. Point Tracking:- The representation of the feature points in the process of tracking The false detection of the object is the complex problem of the point tracking The point tracking approach is used when objects is detected as points[14]. The tracking is performed on the basis of the position and movement. The complexity is more due to the presence of the misdetections, and input and output of the objects. The matching of the objects from the different frames related to costs. The point tracking depends on the different factors which are Proximity, Maximum velocity, Small velocity change and rigidity.

i) Statistical method:- The Statistical method avoids the complex problem and estimates the state of objects. The method determines the movement of the probability of the movement of objects. This method is more complex than that of deterministic method.

*ii) Deterministic method:-*The growth of upcoming states in a system where there is no randomness in the system is called a deterministic system. The initial state of the deterministic model produces the same output as other model[15]. The Trajectory prototype assumes the movement of the objects in deterministic approach. The tracking of the people is created by prototype offline using ground truth data.

2. Kernel Tracking: - The approach based on computing the motion of the object is represented by primitive object area. The motion of an object from one frame to another is calculated to determine its next position using a motion model[16]. The estimation is done on different ways depends on the tracking. The motion of the behaviour of the objects is analysed using trajectory method. However, the identification of the object is done by enclosing the area of the object[17]. Kernel refers to the shape and appearance of the object. The kernel based tracking divided in different categories as:-

i) Template Based model:- This method is simple structure based on the appearance models. The method of tracking based on the different approach depends on the tracking of the single objects or the multiple objects. The method based on two different phases which described as:-

a) Single object tracking:- On this the basic approach based on template matching. The formation of templates based different features such as color or image intensity. The searching of the specific template pattern of an image. and then matching of template to specific part of the image. The previous frame generates the object template due to its flexibility and straightforward approach [18]. The method is time-consuming due to complex templates. The area of searching in next frame partially based on the objects location in the existing frame.

b) Multiple Object Tracking:- The interaction between the objects and the background of the image are the main factors which increases the complexity of the tasks of multiple objects. The considering of the images as the set of layers where the number of objects which is being tracked and that defines the number of layers in the image. The additional background layer is not included in the object. The background layer is used to recompense any background movement so that an objects motion can be considered from the recompensed image.

3. Silhouette tracking:- This method is also known as region based or region tracking. The representation of the objects can be done using tracking model such hands, heads representation of humans. The main goal of this method is recognise the present frame which matches the model[19]. The models are represented as color histograms, object contour, object edge which can be used for the tracking

i) *Contour Evolution*:-This method use the edge based features and the first contour in the present frame, to evolve a new contour for the present object position. The area of boundary some part of the object region which is overlapped by object region in present frame.

ii) *Shape Matching*:- The method used to measure the similarity and the resemblance between the shapes is the critical part of that method. In this approach, region based tracking is in the form of color or edge histograms, object edged and the combination of models. The change of object model updates every frame after detection of object motion [20].

Table 2: Comparison table of object tacking methods

Methods	Benefits	Demerits
Point Tracking	Insensitive to illumination change.	Need external mechanism to detect the object in every frame.
Kernel Tracking	When object recognised in scene, the object detection is done.	Due to geometric shape representation, the objects may not be defined.
Region Based Tracking	Handle large variety of large and complex shapes.	Does not handle occlusion explicitly.

IV. CONCLUSION AND FUTURE SCOPE

It is concluded that, tracking and detection of the objects plays an critical role in the recent world of technology. The different methods of detection and tracking are explained in this paper. When the scene of the object is recognised the objects are detected. The objects are detected in a way to represent the object and the tracking of objects over frames in a video or the moving objects. The object detection classified in to different categories which can be humans, birds, vehicles, swaying trees and moving objects. The motivation behind an object tracking is to create the course for an item above time by discovering its situation in each single casing of the video. In this review paper, the different techniques of objet tracking and object detection is described and comparison done between the methods.

The geometric shape representation, the objects leads to difficulty in the recognising the shapes of the objects. New techniques in object detection and racking in the future must be developed in order to detect the complex frames.

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