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A Novel Robust Approach for Moving Object Detection and Tracking in Video Surveillance System

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ABSTRACT

Video object detection and tracking is the important stage in the computer vision applications such as robotics, man-free control systems, and the visual surveillance. Several factors affected during tracking process, which leads to the drift in the object. The detection of moving object is important in many tasks, such as video surveillance and moving object tracking. In this paper, a review has been made on a video surveillance scenario with real-time moving object detection and tracking. The design of a video surveillance system is directed on automatic identification of events of interest, especially on tracking and classification of moving objects. The object tracking and detection is used to establish a correspondence between objects or object parts in consecutive frames and to extract temporal information about objects such as trajectory, posture, speed and direction.Tracking is detecting the objects frame by frame in video. It can be used in many regions such as video surveillance, traffic monitoring and people tracking. In static environment segmentation of object is not complex. In dynamic environment due to dynamic environmental conditions such as illumination changes, shadows and waving tree branches in the wind object segmentation is a difficult and significant problem that needs to be handled well for a robust visual surveillance system.

Keywords: Object Detection, Object Tracking, Occlusions, Video Surveillance

I. INTRODUCTION

Object detection and tracking is one of the critical areas of research due to routine change in motion of object and variation in scene size, occlusions, appearance variations, and ego-motion and illumination changes. Specifically, feature selection is the vital role in object tracking. It is related to many real time applications like vehicle perception, video surveillance and so on. In order to overcome the issue of detection, tracking related to object movement and appearance. Most of the algorithm focuses on the tracking algorithm to smoothen the video sequence. On the other hand, few methods use the prior available information about object shape, color, texture and so on. Tracking algorithm which combines above stated parameters of objects is discussed and analyzed in this research. The goal of this paper is to analyze and review the previous approach towards object tracking and detection using video sequences through different phases. Also, identify the gap and suggest a new approach to improve the tracking of object over video frame The main objective of computer vision is to allow computer to capture motion and indulgent of human vision. Video object tracking has been emerged as important and challenging topic in research. The base of video object tracking is to estimate the motion of the object in each frame of the input sequence of images. Object can be defined as item, thing, entity of interest which used for further research .For example, person on the road fish on sea, vehicles in stand, etc.

Tracking is concept about movement of an object which are moving under the action of given forces. Increase use of computer based applications object tracking technique has been very essential in the field of video surveillance, healthcare, traffic control, robotic system etc. In video surveillance system object tracking is used to identify and track doubtful object behaviour. It is mainly focused for object detection and calculating various movement types in the systems. Object tracking in traffic used to track the vehicles and observe the

current traffic in order to avoid any jams. Mainly, Video object tracking is useful in nationalized banks, parking areas, shopping malls for observing activities of human. It is difficult due to assigning 3D into 2D image which leads to information loss. Object tracking is affected by the sudden distraction in image, noises and the sudden illumination changes of the object. Occlusions are main problem in the object tracking.

Hence proper method must be selected or proposed on account of the where object tracking is being used. In this paper different techniques are discussed and used for object tracking.

II. BASIC CONCEPTS OF OBJECT TRACKING

In this section, we describe the object shape representations and detection which used for object tracking.

An object generally from a video sequence, is separated into two pixelset. The first set contains the pixels which related foreground objects while the second one contains the background pixels. This result will be in binary or as mask. It is complicated to identify to what should be foreground and what should be background to be marked .Usually foreground objects are moving objects like people, van and tree and remaining one is considered as background. Mostly, shadows are taken as foreground object and give improper output. The basic steps for tracking an object are described below.

- ✓ Representation of Objects
- ✓ Detection of Objects
- ✓ Tracking of Objects

A. Representation of Objects:

we cannot perform the tracking object without any idea of what to track In that case, Object representation gives the way to follow the the various methods how the objects can be represented e.g., ellipse, contour, point, etc.

Generally objects are represented

- ✓ Shape
- ✓ Appearances.

This figure shows centriod ,multiple points, rectangular patch, elliptical patch part-based multiple patches, object skeleton, complete object contour, control points on object contour, object silhouette of object representation methods.

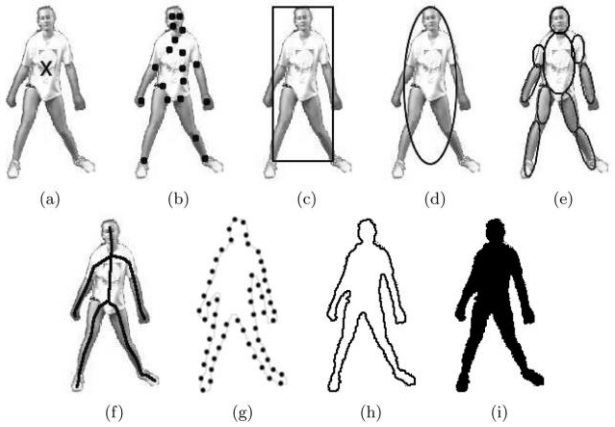

Figure 1. Object Representations

This figure shows [2] centriod, multiple points, rectangular patch, elliptical patch part-based multiple patches, object skeleton, complete object contour, control points on object contour, object silhouette of object representation methods

B. Detection of Objects:

Once the object representation method is determined next object detection method are used on the objects in the frame of the video. Object Detection identifies objects in the video sequence and then it clusters the pixels of those objects. Several techniques like frame differencing , Optical flow and Background subtraction are used for detecting the objects.

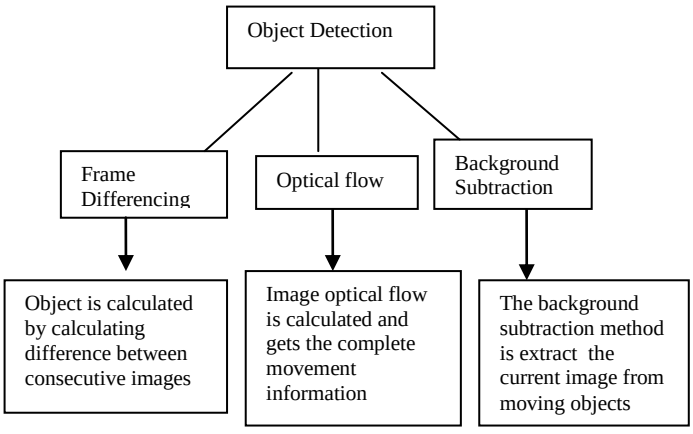

Figure 2. Object Detection Methods

C. Tracking of Objects:

After detecting the object, object tracking methods is used. Tracking is defined as the problem of approximating the path of an object in the image plane as it moves around a scene .Each object in an image will have different shapes and sizes. All images of shape and size are stored in workspace as library templates. By comparing the results of shape and size of the image produced by workspace with the stored value in the library templates, object in a frame can be recognized. The detection of object and their movement is an initial process for the tracking. The tracking must be supported by additional methods for clear cut object classification.

Object tracking is complex due to:

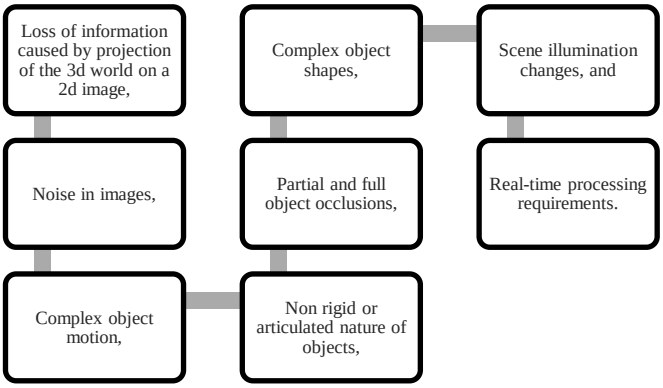

Figure 3. Complications of Object Tracking

D. Techniques of tracking

There are main three mainly methods focused
While tracking the object and the techniques of object tracking are

- ✓ Point Tracking,
- ✓ Kernel Tracking
- ✓ Silhouette

III. RELATED WORKS

The main objective of video tracking is to associate the target objects in consecutive video frames. In this section presents the research work of some prominent authors in the same field and explaining a short description of various techniques used for video tracking

1. In this paper [6], they proposed a robust tracking system based on the learning method of sparsity structure of the video, they perform a basic vector matrix for extracting the full targeted region. Here they present merging of various numbers of frames to predict the hidden object in the video. Then they provide tracking on that area.

Merits:

- The merging of various numbers of frames in the video will predict hidden object present in the frame.
- This increase the precision rate when compare with existing work.

Demerits:

- In this registration based targeted tracking system, this will consume more time to get the reconstructed frame result.
- If there is any sudden movement in the video, then this will also give misclassified result.

2. In this paper [7], they proposed tracking of text detection and tracking in the given video. This is done by using the line mapping method with sub graph grouping based on the edge region in that frame. Here for the edge detection, they presented canny edge detection method to extract a smoothened level region prediction. From this edge region, they perform Delaunay triangulation and edge pruning to extract the targeted text location .

Merits:

- By using the canny edge detection method, this will predict the thin line in the text.
- This can also predicts the text region in the basis of multi-scale text integration method.

Demerits

- Since in this method, they presented only the edge based tracking system which may results in misclassify the video frame border as text.
- Threshold for edge detection is in manual form.

3. In the paper [8], they proposed fast visual tracking system by using sparse representation of the target. The target is saved as the Dictionary features to get training for the classification process. Then from that training set, they perform Dictionary Learning process for the sparse representation of the frame. Then they extract coefficient for the sparse matrix and verify the target region present in the frame.

Merits:

- This is robust for various expression changes.
- The sparse representation will reduce the feature dataset which increase speed of tracking.

Demerits:

- If there are any shadows present in the given video, this is also considered as the moving object.
- This system needs huge amount of training set for tracking a single target

4. In the paper [9] performs a discriminative structure prediction model from video frames. This compares the previous and current frame data to find the matching point from targeted image and video frames. This performs weight updating from the grid formation of present frame. According to the weight vale the target region was tracked by using the thresholding method from various parameters.

Merits:

- This track the target region in robust video type.
- This improves MOTA score compare to other methods

Demerits:

- Since this method suffer from shadow masking in the video frames.
- Same intensity grid may misclassify the targeted region**.**

5. In the paper [10] presents multi-target tracking system by link formation of objects with minimum cost data. This was achieved by using a Multi-way data association based optimization method to get the link between interacted objects in the current frame and targeted image. This verifies the neighboring pixel intensity of the video frame and provide contour over it. This contour represents the targeted region**.**

Merits:

- This track the target region even it is appear in the small object size.
- This reduces FP and FN of classification rate which improves the accuracy.

Demerits:

- In this the initial target region must be given by user in perfect manner.
- If the pixel intensity is relevant to target, then it also provides contour over it.

IV. PROPOSED WORK

This section illustrates the proposed work, and model for the extraction of the patterns from the video frame and the removal of shadows are described in detail

In the existing work , they performed targeted tracking system by merging the different frames. This extract the target region even it is in occluded state .In this stage, the best selection of matched frame was chosen by classification of image features with the fusion technique the frames are fused to get clear view of target region. Then from that reconstructed image, the target was tracked.

A. Limitations

- Due to verification of target region with multiple references of frames, this may consume bulk amount of training features to predict the matched point. .
- This method verify matching points from multiple number of frames with the given target image which may vary the region while sudden change in intensity

In this work, novel model of image normalization and feature extraction method is to minimize the limitations occur due to background variation and illumination changes. So, it consists of the following stages such as:

- ✓ Shadow detection
- ✓ Extraction of pattern
- ✓ Feature Classification
- ✓ Target Tracking

B. Analysis Parameters:

This proposed work can be compare with the existing and proposed techniques. The superiority of the proposed framework results are analyzed and evaluated in terms using the metrics such as sensitivity, specificity and accuracy.

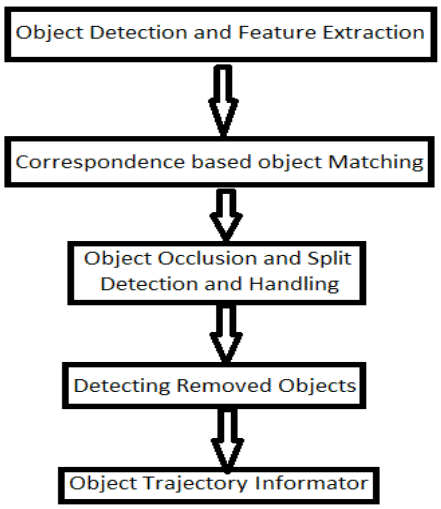

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Figure 5. Overall Flow of Proposed work

V. PSUEDO CODE

The basic steps for tracking is to read frames in video and filter them (noise removal) and form chain link formation to separate shadow region and increase the pixel intensity to normalized the image and form Grid pattern and extract the feature and classify the object.

A. STEPS

1. Video as an input is either taken from online mode or offline mode.
2. Video is converted to number of frames.
3. In order to detect moving object frame difference algorithm is applied. Here for detecting slow moving object kth frame is subtracted from (k-3)th frame.
4. Further apply Binary Thresholding Operation so as to separate moving object pixels from background and morphological operations such as erosion and dilation for avoiding detection of non-stationary objects.
5. Determine the centroid for the position of moving object in the given scene.
6. An image template is extracted from last frame grabbed by the camera implementing Dynamic Template Matching Algorithm.
7. The position of the tracked object is passed to camera set-up and camera moves left-right and up-down on basis calculated co-ordinates and Track the object

B. Expected Outcome

In our proposed video segmentation approach to be validated by experimenting with variety of video sequences. The proposed system has been implemented in Matlab (Matlab 13). The performance of the proposed approach is compared.

VI. CONCLUSION

In this paper, review on different object detection, tracking, recognition techniques, feature descriptors and segmentation method which is based on the video frame and various tracking technologies. This approach used towards increase the object detection with new ideas. Furthermore, tracking the object from the video frames with theoretical explanation is provided in bibliography content. The bibliography content is the most significant

contribution of research since it will lead to a new area of research. We have identified and discussed the limitation/future scope of various methods. Also, we have noted some methods which give accuracy but have high computational complexity. Specifically, the statistical methods, background subtraction, temporal differencing with the optical flow was discussed. However, these technique needs to concentrate towards handling sudden illumination changes, darker shadows and object occlusions.

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