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Object Detection and Tracking: A Review

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ABSTRACT

We propose a general framework for Object Recognition into regions and objects. In this framework, the detection and recognition of objects proceed simultaneously with image segmentation in a competitive and cooperative manner. Object detection is performed to check existence of objects in video and to precisely locate that object. Object tracking is performed using monitoring objects spatial and temporal changes during a video sequence, including its presence, position, size, shape, etc. A common approach for object detection is to use information in a single frame. The tracking method requires an object detection mechanism either in every frame or when the object first appears in the video.

Keywords- *Image objects detection, image segmentation, object detection, object recognition***.**

INTRODUCTION

Object tracking is an important task within the field of computer vision. 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. There are three key steps in video analysis: detection of interesting moving objects, tracking of such objects from frame to frame, and analysis of object tracks to recognize their behaviour. Therefore, the use of object tracking is pertinent in the tasks of: Motion-based recognition: that is human identification based on gait, automatic object detection. Automated surveillance: That is monitoring a scene to detect suspicious activities or unlikely events .Video indexing: That is automatic annotation and retrieval of the videos in multimedia databases. Human-computer interaction: That is gesture recognition, eye gaze tracking for data input to to direct traffic flow. Vehicle navigation: That is video-based path planning and obstacle avoidance capabilities.[11] In surveillance system three main important steps these are object detection, object tracking and recognition. The tasks of obtaining these three constituents have traditionally been studied separately sometimes with detection and recognition being performed after segmentation, and sometimes with

Detection being a separate process. But there is no commonly accepted method of combining segmentation with recognition. We show that our image object detection approach gives a principled way for addressing all three tasks simultaneously in a common framework which enables them to be solved in a cooperative and competitive manner. Image processing is a term which indicates the processing on image or video frame which is taken as an input and the result set of processing is may be a set of related parameters of an image. The purpose of image processing is visualization which is to observe the objects that are not visible.

i) Object Detection: Object Detection is to identify objects of interest in the video sequence and to cluster pixels of these objects.

Object detection can be done by various techniques such as frame differencing, Optical flow and Background subtraction.

ii) Object Classification: Object can be classified as vehicles, birds, floating clouds, swaying tree and other moving objects. The approaches to classify the objects are Shape-based classification, Motion-based classification, Color based classification and texture based classification.

iii) **Object Tracking**: Tracking can be defined as the problem of approximating the path of an object in the image plane as it moves around a scene. The approaches to track the objects are point tracking, kernel tracking and silhouette. The point also classified into Kalman Filter, Particle Filtering, Multiple Hypothesis Tracking (MHT).[2]Kernel Based Tracking are classified into Simple Template Matching, Mean Shift Method, Support Vector Machine (SVM) Layering based tracking. Silhouette Based Tracking Approached into Contour Tracking, Shape Matching.

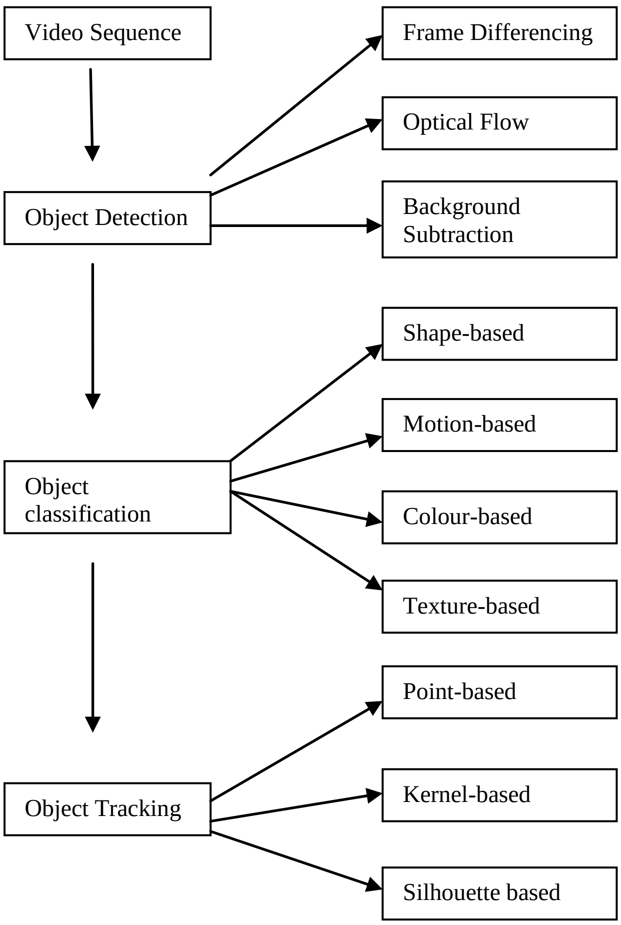

Fig 1: Basic steps for tracking an object

Videos are actually sequences of images, each of which called a frame, displayed in fast enough frequency so that human eyes can percept the continuity of its content. It is obvious that all image processing techniques can be applied to individual frames. Besides, the contents of two consecutive frames are usually closely related. Visual content can be modelled as a hierarchy of abstractions. At the first level are the raw pixels with colour or brightness information. Further processing yields features such as edges, corners, lines, curves, and colour regions. A higher abstraction layer may combine and interpret these features as objects and their attributes.[10] At the highest level are the human level concepts involving one or more objects and relationships among them.

Object detection in videos involves verifying the presence of an object in image sequences and possibly locating it precisely for recognition. Object tracking is to monitor objects spatial and temporal changes during a video sequence, including its presence, position, size, shape, etc. This is done by solving the temporal correspondence problem, the problem of matching the target region in successive frames of a sequence of images taken at closely-spaced time intervals.[8] These two processes are closely related because tracking usually starts with detecting objects, while detecting an object repeatedly in subsequent image sequence is often necessary to help and verify tracking.

LITERATURE REVIEW

Robust Object Tracking [1] In this paper, a robust object tracking algorithm based on a sparse collaborative model that exploits both holistic templates and local representations to account for drastic appearance changes. we mainly focus on the appearance model since it is usually the most crucial component of any tracking algorithm. The goal of object tracking is to estimate the states of a target object in an image sequence. The proposed model is adaptively updated with consideration of occlusions to account for appearance variations and alleviate drifts. Numerous experiments on various challenging sequences show that the proposed algorithm performs favorably against the state-of-the-art methods.

Survey on Real Time Object Detection [2] in this paper we concentrate on different object detection methods, tracking and recognition methods are discussed. The object recognition systems are going to include detection and tracking the object is in motion and its position relevant to scene. Chih-Hsien Hsia et al [1] proposed the merit of MDLDWT is reduced the cast and protect the fine shape information in low resolution.

Zupali S[3] In this paper presents a new algorithm for detecting moving objects from a static background scene to detect moving object based on background subtraction. Reliable background updating model is set up based on statistical. After that, morphological filtering is initiated to remove the noise and solve the background interruption difficulty. At last, contour projection analysis is combined with the shape analysis to remove the effect of shadow; the moving human bodies are accurately and reliably detected.

Ruolin Zhang [iv] In This Paper a tracking algorithm based on adaptive background subtraction about the video detecting and tracking moving objects is presented in this paper. Firstly, median filter is used to achieve the background image of the video and denoise the sequence of video. Then adaptive background subtraction algorithm is used to detect and track the moving objects. The simulation results by MATLAB show that the adaptive background subtraction is useful in both detecting and tracking moving objects, and background subtraction algorithm runs more quickly.

Saravanakumar, S [5] In This paper the multiple human objects tracking approach is used which based on motion estimation and detection, background subtraction, shadow removal and occlusion detection. Video sequences have been captured in the laboratory and tested with the proposed algorithm. The algorithm works efficiently in the event of occlusion in the video sequences.

K. Srinivasan [4] In this paper to find moving objects by subtracting the background images from static single camera video sequences in security systems. It aims to improve the background subtraction techniques for indoor video surveillance applications. The novel automatic threshold updating (ATU) algorithm is also developed and tested for various indoor video sequences which give better efficiency. [6] The statistical and temporal differencing methods are also presented. Finally, novel approach is compared with the existing methods.

COMPARISON BETWEEN VARIOUS METHODS

All the methods described for object detection, object classification and tracking have some advantages and disadvantages, which are as below:

Method	Advantages	Disadvantages
1. Frame Differencing	• Perform well for static background. • High accuracy. • Easiest method.	• It must require a background without moving objects. • Method having Computational time low to moderate.
2. Optical Flow	• It can produce the Complete Object moving information. • Contain enough accuracy.	• Require large amount of calculation. • High computational time.
3. Background Subtraction Method	• A very widely used method which is simple to implement. • Objects are allowed to become a part of the background without destroying the existing background. • It learns itself and does not need to be reprogrammed. Can be implemented in any applications. • Provide fast recovery. Having enough accuracy. Low memory requirement.	• Highly inaccurate. • Cannot deal with quick changes, Initializing the Gaussians is important. • Not a good subtraction when shadow, any other obstacles, are there. • Gives false positives • It does not survive with multimodal background. • Computational time is moderate.
4. Shape-Based	• Simple pattern matching approach. • Having unable to moderate accuracy	• More striking technique. Often used as a replacement to local features. Does not work well in dynamic situations. • Unable to determine internal movements well. Computational Time is low.
5. Motion-based	• Does not require redefined pattern motion detection. • Contain enough accuracy.	• Struggles to identify a nonmoving human object. • Method having high computational time.
6. Texture-based	• Provides improved quality with the expense of additional time. • Method having high accuracy.	• High computational time.
7. Color based	• Simple and straight forward. • Easy to interpret the result. • High accuracy.	• Different value is absolute so value may have different meaning. · Require atmospheric calibration. · Requires selection of thresholds. • High computational time.
8. Kalman Filter	• Used to track points in noisy images	• State variables are Normally distributed(gaussian)
9. Particle Filter	• No Limitation for the complexity of distributions	• The most efficient number of particles cannot be calculated
10.MHT(Multiple Hypotheses Tracking)	• Able to deal with entries of new object and exit existing object	• Computationally exponential both in time and memory.
11. Simple Template Matching	• The system is capable of handling entry and exit of object	• It is difficult to track multiple objects at the same time.
12. Mean Shift Method	• Does not assume any predefined shape on data clusters	• Inappropriate window size can cause modes to be merged, or generate additional "shallow" modes
13. Contour Tracking	• The selection of contour edges are not affected by noisy edges or small cross striped textures	• The method cannot preserve the contour which has high curvature
14. Shape Matching	• Less sensitive to appearance variations.	• objects of arbitrary shapes cannot be detected.

FUTURE SCOPE AND DISCUSSION

Survey on object detection and tracking observed that there is no common method of segmentation with recognition. We try to make the detection and recognition of objects proceed simultaneously with image segmentation in a competitive and cooperative manner. Object detection is performed to check existence of objects in video and to precisely locate that object. We create a system that is useful to find the object that is present inside the image. In this we first take a image as an input for which we have to find the object. After selecting the input image we have to focus on the target image.[7] After getting both input image and target image we compare the size of both the image. If the size of input image is greater than target image then we proceed with our system otherwise we are going to focus on the input image. The criteria get satisfied then we create the sub matrixes of both the images for example we create 3 X 3 matrixes. After creating the sub matrixes we compare both the sub matrixes of both the image. This Matrix can be created with the help of pixels present in both the images. If matching found then we concludes that the given object is found in the other image. [9] The object is shown as an output by creating red boxes on that object. The output object image is displayed and the co ordinates of that object that is the height and width from top and bottom in the form of coordinate.

This paper helps to understand basic idea of object detection and object tracking.

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