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Object Detection in Video Frames Using Various Approaches

kalaivani.R[1], Manicha chezhian.R[2]

Research Scholar, Computer Science, NGM College, Coimbatore, India[1]

Associate Professor, Computer Science, NGM College, Coimbatore, India[2]

Abstract-Visual analysis of motion is currently one of the most active research topics; this interest is driven by wide spectrum of promising applications in most areas. Video analysis concerns the detection, tracking and recognition of objects. The detection of object is generally performed in the context of higher level applications that require the location or shape of the detection, in every frame. Object detection segments objects of interest from a video scene and keep track of its motion, orientation and occlusion in order to extract useful information. This paper provides the art of detection of objects from video and also classifies the object detection approaches into various categories.

Keywords: video, object detection, segmentation, feature extraction, tracking, temporal clustering.

INTRODUCTION

The use of video is becoming prevalent in more applications such as detection of pedestrian, identification of anomalous behaviour in a parking etc. The increasing need for automated video analysis has generated a great deal of interest in object detection, and tracking of moving objects. The main task in analysing video data is detecting and tracking of moving objects such as people, vehicles through video frames. Video is an example of multimedia data as it contains several kinds of data such as text, image, and metadata, visual and audio. It is widely used in many potential applications such as security, surveillance, entertainment, medicine, education programs and sports [3]. The objective of video data mining is to discover and describe interesting patterns from the huge amount of video data. Video data contains several kinds of data such as video, audio, and text. The video contains sequence of image with some temporal information. The video content may be classified into i) low-level feature information, which includes colour, texture, shape and so on.ii) Syntactic information such as content of video includes salient objects, their spatial temporal [2] position and spatial temporal relationship between them.iii) semantic information, which describes what is happening in the video like spatial aspects presented by a video frame such as location characters and objects displaced in the video frame. The temporal aspects presented by sequence of video frames in time such as the characters actions and the objects motion presented in a sequence. The information about the objects in the video can be extracted by various methods detection of moving objects in video streams is the first step of information extraction in many computer vision applications including video surveillance, people annotation of videos.

Applications of object detection in video: Automated video surveillance: In these applications computer vision system is designed to monitor [2] the movements in an area to identify the moving objects and to report any critical situation. The computer vision system needs to discriminate between natural entities and humans which require a good tracking system. Robot Vision: In robot navigation, the steering system needs to identify different obtrudes in the path to avoid collision. Traffic Monitoring: Any vehicle that breaks the traffic rules or is involved in other illegal act can be tracked down easily. Animation: Object tracking algorithm can also be extended for animation.

RELATED WORK

Steps in dynamic object detection: The object in the video data can be detected by the Processes like Pre-processing, Segmentation, Foreground and Background Extraction, Feature Extraction, and object tracking.Pre-processing, in image data, the spatial segmentation can be done at region and/or edge level based on the requirements of the application. It can be automatic or manual and should be approximate enough to yield features that can reasonably capture the image content.. Segmentation is the process of identifying components of the image segmentation involves operations such as boundary detection connected component labelling, thresholding. Boundary detection finds out edges in the image. Thresholding reduces the gray levels in the image. Foreground, the process of separating the foreground and background of the image. The foreground contains the objects of interest. Methods of foreground extraction are **A**bsolute **A**ccumulative **D**ifference **I**mage (AADI), **P**ositive

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Accumulative **D**ifference **I**mage (PADI), and **N**egative **A**ccumulative **D**ifference **I**mage (NADI).

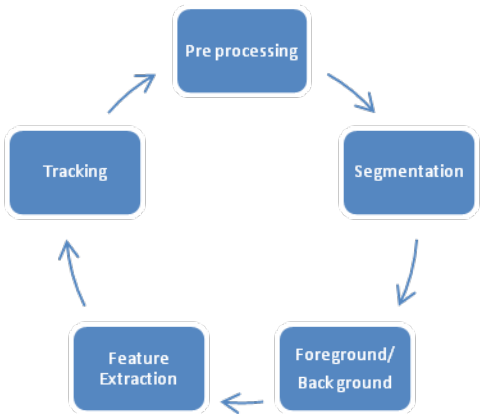

Fig 1: Object Detection Process Steps

Video segmentation, the first step in any video data management system is invariably the segmentation of the video track into smaller units. The video segmentation can be represented by a hierarchy of levels. Video refers to multimedia sequence comprised of both [8] sound and series of image. Scene, a collection of semantically related and temporally adjacent groups. Video group, an intermediate entity between physical shots and semantic scenes. Two kind of shots are absorbed into a video group. i) Temporal related and shots related in temporal series where similar shots are shown back and forth. ii) Spatially related, shots similar in visual perception.Shot,it is defined as a sequence of frames taken by a single camera with no major changes in the visual content. Key frame, the frame represents the salient visual contents of a shot. Since the adjacent frames are similar, one or more key frames can be extracted from the shot depending on the complexity of the content of the shot. The key frames extracted from the video streams are treated as images.

Feature Extraction**,** key task in tracking video data is the detection and tracking of moving objects such as people and vehicles through the video frames. Detection of moving objects [1] in video streams is the first relevant step of information extraction in many computer vision applications. In feature based object detection one or more features are extracted and the objects of interest are modelled in terms of the features shape, size or the colour of objects .Shape based object detection is one of the complex problems are to the difficulty of segmenting objects of interest in the images. The detection and shape characterization of the objects becomes more difficult for complex scenes occlusions and shading. Colour based object detection [4] is unlike other image features colour is relatively constraint under viewpoint changes and it is easy to be acquired. Colour is not always appropriate as the sole means of detecting and tracking objects, but the low computational cost of the algorithms proposed makes color a desirable to exploit. Template based object detection: If a template describing a specific object is [12] available, object selection becomes a process of matching features between the template and the image sequence under analysis.

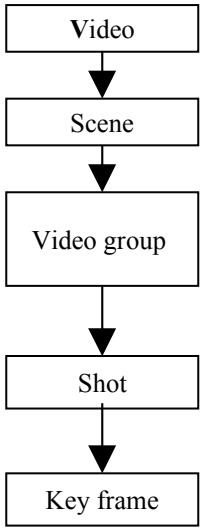

Fig 2: Hierarchy of Video Segmentation

Fixed template matching: Fixed templates are useful when object shapes do not change with respect to the viewing angle Image subtraction: In this technique the template position [11] is determined from minimizing the distance function between the template and various positions in the image.

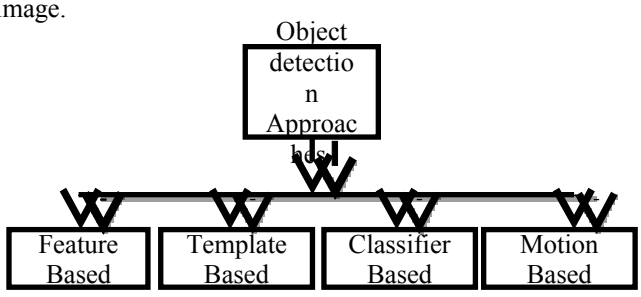

Figure 3: Object Detection Approaches

Object tracking, in the feature based object tracking discussed by yiwei Wang, John Doherty and Robert Van Dyck represents four features namely centroid, dispersion, grey scale distribution, object texture are used for tracking objects.

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Fig 4: Car Video

The features are, Centroid = (c_x, c_y) where

$$c_x = \sum (P_{i,j}{}^{*i}) / \sum(P_{i,j}),\ c_y = \sum (P_{i,j}{}^{*j}) / \sum(P_{i,j}),$$

$$\text{Dispersion} = (\sum \sqrt{(I-c_x)^2 + (j-c_y)^2} * p_{ij})/(\sum p_{ij}).$$

Grey scale distribution of the image is expressed in terms of grey scale range gr_m, mean of higher 10% values gr_n and mean of lower 10% value gr_r. Texture of the object t_x is defined by the mean of higher 10% values in the wavelet edge image.Block matching method for tracking, each block from the current frame is matched into a block in the destination frame by shifting the current [5] block over a predefined neighbourhood of pixels in the destination frame. The measure used is Mean Absolute Difference (MAD).

$$MAD = 1/mn \sum_{i=1}^{m} \sum_{j=1}^{n} | A(i, j) - B(i, j) |$$

5: RGB to Grey scale

Tracking based on domain knowledge, it reduces [6] complexity of the system, traffic monitoring system and motion can be approximated by simple affine transformations.

$$\mu(x) = s(x-x_m) + \mu_0,$$

Where s=scaling factor, μ_0= displacement between two consecutive frames, x_m=the centre of the moving image region. Compressed domain object tracking is based on colour and motion vector.

Fig 6: Video Segmentation

Video Clustering: Temporal data mining is a single step in the process of knowledge discovery in temporal data database that enumerates structures over the temporal data and any algorithm that enumerates temporal patterns from or fits model to temporal data [7] is a temporal data mining algorithm. Temporal data mining task include temporal data characterisation and comparison, temporal clustering technique, temporal classification, temporal association rules, temporal pattern analysis and temporal prediction and trend analysis. Temporal clustering is the method of grouping the dynamic time series data.

Fig 7: Object Detection

Temporal clustering includes two approaches to analyse. One is the measure of temporal[13] similarity and the other is the temporal optimal partition. Time series temporal data is a record of the values of any fluctuating quantities measured at different points of time. Time series analysis

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method has been applied into categories like representation of temporal sequence, the representation of data before actual temporal data mining techniques take place. Measure of temporal sequence is the method of measuring temporal characteristics element in given definition of similarity or given periodicity in the temporal sequence. Temporal data clustering separates the temporal data into subsets that is similar to each other; temporal data prediction predicts some fields based on other temporal fields, temporal data summarization is to describe a subset of temporal data by representing extracted temporal information in a model or in patterns, temporal data dependency describes time dependency among the data or temporal attributes of data.

III.CONCLUSION

This paper presents the study of object detection approaches and also provides brief review of each approach. From this discussion it can be seen that object tracking has many useful applications in various fields. Several researchers have explored and implemented different approaches for tracking, there are many challenging research problems facing video mining such as discovering knowledge from spatial temporal data and the detection of unusual and abnormal video events. To improve the result of video data mining, the new features can be constructed by analysing the heterogonous data like video text, audio and videos.

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