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A Survey on Object Detection and Tracking System Using MATLAB

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Abstract

Object detection and object tracking is becoming a region of interest in today's era. The main goal behind object detection and tracking is to segment out the region of interest from a particular frame. A lot of researches have been done on this field and new algorithms are being updated to detect and track objects on an image or on a live camera. With the help of object detection methods like frame differencing, optical flow and background subtraction we can categories different object in a single image and can also identify a particular object on that image. The object can be classified such as human, birds, animals, tree, balls, vehicles and other objects. Object classification can be done on the basis of its colour, motion and texture. After identifying the object, its tracking can be performed with the help of Point tracking, Kernel Tracking and Silhouette tracking by which we can identifying its change in position, size, shape, by its consecutive frames.

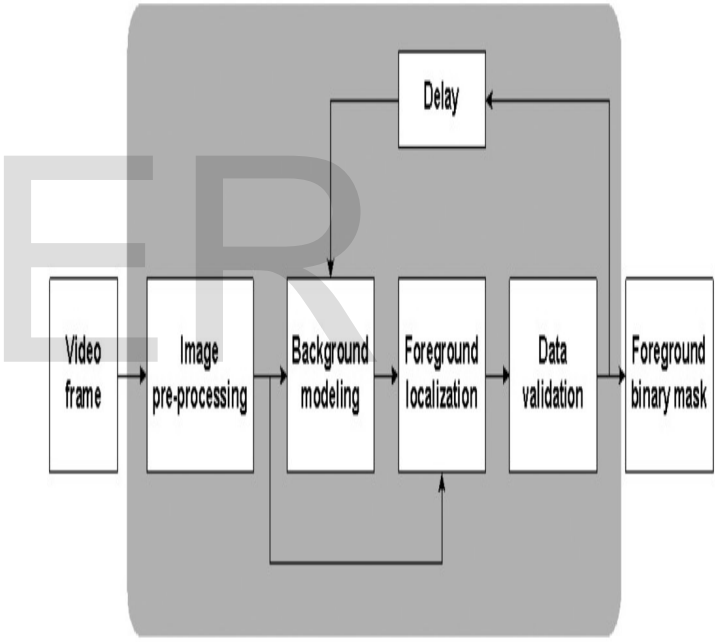
1 INTRODUCTION

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. The identification of regions of interest is typically the first step in many computer vision applications including event detection, video surveillance, and robotics.

A general object detection algorithm may be desirable, but it is extremely difficult to properly handle unknown objects or objects with significant variations in colour, shape and texture. Therefore, many practical computer vision systems assume a fixed camera environment, which makes the object detection process much more straightforward. An image, usually from a video sequence, is divided into two complimentary sets of pixels. This output or result is often represented as a binary image or as a mask [2]. It is difficult to specify an absolute standard with respect to what should be identified as foreground and what should be marked as background because this definition is somewhat application specific. Generally, foreground objects are moving objects like people, boats and cars and everything else is background. Many a times shadow is classified as foreground object which gives improper output.

Following are the basic steps for tracking an object, as describe in above Figure1.1.

1.1 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[3].



1.2 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, Colour based classification and texture based classification[3].

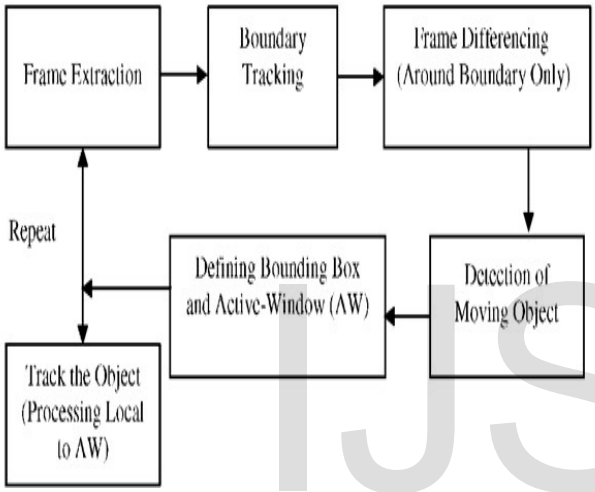
1.3 Object Tracking - Tracking can be defined as the problem of approximating the path of an object in the image plane as it moves around a scene. The approaches to track the objects are point tracking, kernel tracking and sil houette[3].

2 LITURATURE SURVEY

Object detection and tracking is a vast field of study in science and technology. Though this is a very crucial topic of study but still it is very less altered till 2004. But from last 5-6 years, after the sudden growth in study and development of robotics and

artificial intelligence, object detection showed a huge interest and increased courtesy among the researchers to work on it.
Object detection is a method of detecting an object from a video. A video is actually sequence of images, each of which is called frames, which is displayed in such a manner that human eye see it as bunch of continuous frames or a video. Object detection is done by comparing two different consecutive frames and pointing out the object of interest in both by its motion, shape or colour[1]. There are various object detection algorithm which can easily detect certain known objects from the image but it can be very difficult to detect unknown objects or object with similar shape, colour or texture. So to overcome such issues, many computer vision system uses fixed camera environment which make object detection method very easier and straightforward.

A frame, from a video sequence, consist of different objects



which can be divided into two types, foreground and background objects. Foreground objects includes all the moving objects like, human, car, boats, animals and rest everything is considered as background objects. With the help of fixed camera environment background object can be easily separated from the foreground and object detection can be done

3 METHODOLOGY

Detection of moving objects and motion-based tracking are important components of many computer vision applications, including activity recognition, traffic monitoring, and automotive safety. The problem of motion-based object tracking can be divided into two parts:

1. Detecting moving objects in each frame
2. Associating the detections corresponding to the same object over time

The detection of moving objects, as done in Figure 1.3 , uses a background subtraction algorithm based on Gaussian mixture models. Morphological operations are applied to the resulting foreground mask to eliminate noise. Finally, blob analysis detects groups of connected pixels, which are likely to correspond to moving objects.
The association of detections to the same object is based solely on motion. The motion of each track is estimated by a Kalman filter[4]. The filter is used to predict the track's location in each frame, and determine the likelihood of each detection being assigned to each track.
Track maintenance becomes an important aspect of this example. In any given frame, some detections may be assigned to tracks, while other detections and tracks may remain unassigned. The assigned tracks are updated using the corresponding detections. The unassigned tracks are marked invisible. An unassigned detection begins a new track.
Each track keeps count of the number of consecutive frames, where it remained unassigned. If the count exceeds a specified threshold, the example assumes that the object left the field of view and it deletes the track.

Figure 1.3. Detection of Moving Objects

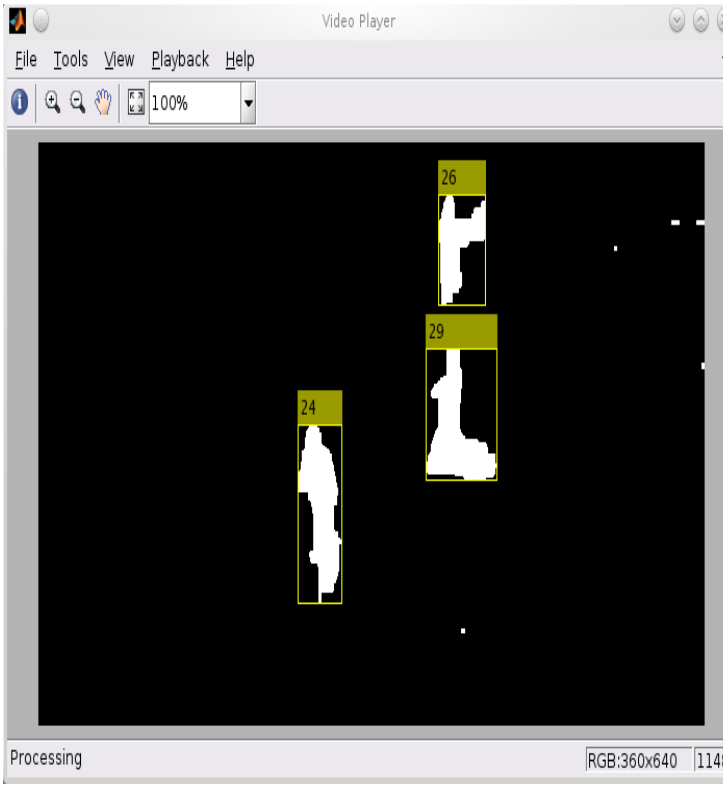


Figure.1.4 Motion Based Object Tracking

To obtain background subtraction, as done in Figure 1.4, the background has to model first. Then, the incoming frame is obtained, and subtract out from the background model. With the background model, a moving object can be detected. This algorithm is called as "Background Subtraction". The efficiency of a background subtraction technique correlates with three important steps: modelling, noise removal and data validation. Background modelling, is the backbone of the Background Subtraction algorithm. Background model defines the type of model selected to represent the background, and the model representation can simply be a frame at time (t-1) formula such as the median model. Model Adaption is the procedure used for adjusting the background changes that may occur in a scene. Noise removal is a procedure that eliminates noise in the scene. Data validation is involved with the collection of techniques to reduce the misclassification of pixels. In the recent papers, many background subtraction algorithms are proposed, because no single algorithm is able to cope with all the challenges in the sports applications. There are several problems that a good background subtraction algorithm must resolve. Therefore in this paper the most commonly used, background subtraction algorithms are discussed. [5]A Gaussian mixture model (GMM) was proposed for the background subtraction in Friedman and Russell, and efficient update equations are given in Stauffer and Grimson. In Power and Schoonees, the GMM is extended with a hysteresis threshold. This method uses a Gaussian probability density function to evaluate the pixel intensity value. It finds the difference of the current pixel's intensity value and cumulative average of the previous values. So it keeps a cumulative average (μ) of the recent pixel values. If the difference of the current image's pixel value and the cumulative pixel value is greater than the product of a constant value and standard deviation then it is classified as foreground. That is, at each t frame time, the Ipixel's value can then be classified as foreground pixel if the inequality: | It -μt| > k σ holds; otherwise, it can be considered as background, where k is a constant and σ is standard deviation. Here background is updated as the running average.[6].The proposed work has been developed using MATLAB on Intel i5 processor, 8GB RAM and Windows 10. The real time video sequences are acquired at the rate of 30 frames/second with the frame size of 640×360 pixels resolution.

4 CONCLUSIONS

In this survey paper all the main terminology of object detection have been addressed. These include object detection methods, feature selection and object classification. Most commonly used and well recognized methods for these phases have been explained in details. Different methods for object detection are like frame difference, optical flow and background subtraction. Most commonly used method is background subtraction. The advance forward feature of methods behind the object detection can be achieved by two main feature types like edge-based feature type and patch based feature type. This theory is already proven so yet no practical implementation done without this theory. Classification of objects is one of the most important parts of an object detection system. Among the many methods of object classification most of the researchers prefer texture based and colour based object classification. This study of review may open the paths to find efficient algorithms to reduce computational cost and to decrease the time required for detecting the object for variety of videos containing different characteristics and to increase accuracy rate.

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