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Statistical Review of Various Object Detection Techniques

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Abstract: The main and important objective of tracking an object is to segment a ROI from a given video scene. Once the object is tracked it is continued to track its motion occlusion and most importantly its position. Detection and classifications of objects are the previous steps to track an object in a given video. Object detection process is done to check the existence or presence of objects in a given video and also to exactly locate the existed object. After detection, the objects that are detected are classified into varieties of categories namely humans, pedestrian, vehicles and also other objects which are under motion. Object tracking process is done by monitoring the objects temporal as well as spatial changes throughout a given video sequence which includes the presence, size and position etc. Object tracking has been used in numerous applications like video surveillance, artificial intelligence, traffic monitoring and also in video animations. This work presents a short-term survey of various object detection algorithms which is available in literature survey together with analysis and also a comparative learning of diverse detection techniques used.

Keywords: Object detection, Background subtraction, frame differencing, optical flow, voting based detection

1. INTRODUCTION

In reality videos are a sequences of frames which are displayed in a fast frequency mode so that a human eyes be able to percept the continuousness of the content. It is more obvious that each and every techniques that make use of image processing be able to apply to an individual frames. Further, the contents or the information of the two consecutive frames will be generally closely related [1].The appropriate identification of these ROI are typically going to be the first phase in many of the applications which is based on computer vision and these applications comprises of event detection, motion detection and video surveillance. A common detection algorithm might be appropriate, but then it is tremendously difficult to appropriately handle the unknown objects and also objects with substantial variations in terms of color, texture and shape. Therefore, a lot of practical systems based on computer vision assumes of fixed camera environs, so that it makes an object detection procedure a straightforward [2]. An image is usually divided into a two complimentary groups of pixels, where first group consists of pixels which are correspond to a foreground objects and the second group consists of background pixels. This results are represented as mask or a binary image. It is pretty difficult to identify a complete standard with reverence to what must be recognized as foreground, also what must be marked as a background since this description is somewhat an application specific. Usually, foreground objects will be a moving objects alike people, cars, pedestrians and boats and also everything other is background [3]. Most of the times, shadow will be classified as a foreground object giving an improper and bad output.

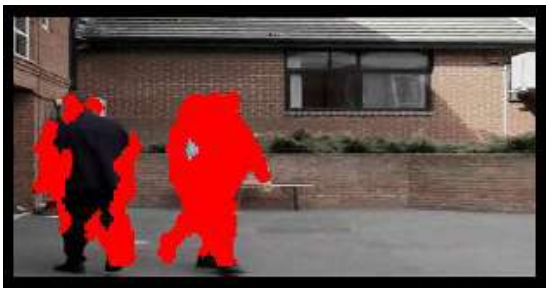
2. DETECTION METHODS

Since the moving objects remain as a prime source of information, maximum methods focuses on those objects which has to be detected. Detailed explanation of various approaches are listed and explained below.

A. Frame differencing

The existence of objects which are under motion are generally determined by computing the dissimilarities between the two consecutive frames. The calculation is very easy and also it's simple to implement too. For a diversity of dynamic environs, it has a very strong adaptability, however it is usually difficult to get complete summary of a moving object, which are in turn responsible to seem the unfilled phenomenon, resulting in an inaccurate outputs of objects which are moving [4]. The below example in terms of Fig.1 illustrates how the frame differencing works

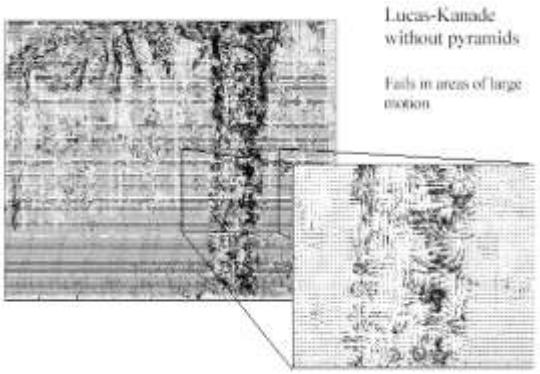
(a) Sample scene



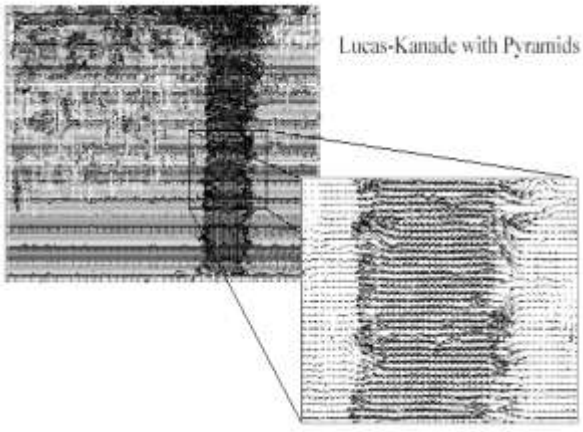
(b) Failure of Frame differencing
Fig.1. Example of Image differencing

B. Optical Flow

Optical flow technique [5] is used to compute the image field i.e., optical flow playing field, and also it does the clustering processing accordingly with the optical flow scattering characteristics of an image. This method might get complete information about the movement and also it can detect the objects which are moving from the so called background. Conversely, an enormous amount of calculation, sensitivity towards noise, and also poor noise performance, makes it as not appropriate for the real-time challenging occasions. Fig.2. illustrate the examples of how the optical flow approach results.



(a) Lucas-kanade-without



(a) Lucas-kanade-with
Fig.2. Example of how optical flow results

C. Background subtraction

Background modelling is the first step used for so called background subtraction. It has been the central importance for a background subtraction techniques. Background Modeling should be sensitive enough in order to recognize the moving objects [6]. Background Modeling yields the reference model. Later this model will be used in subtracting the background in which individual video sequence will be compared in contrast to the so called reference model which in turn aims at determining the possible Variations. These variations amongst the current frame and the reference frame with respect to pixels signifies the existence of an objects that are moving [6]. At present, mean and median filters [7] are more extensively used in order to realize the background modeling. However, this provides the maximum complete information about the object if background is well-known. Fig.3. gives a general background subtraction approach and Fig.4. Gives the results.

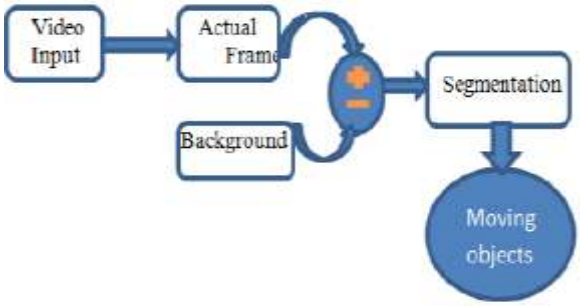


Fig.3. General Background subtraction approach

Fig.4. Background Subtraction

In [3], as described there are mainly two background subtraction approaches namely

1. Recursive algorithm

Recursive techniques [3, 8] does not keep up a buffer in estimating a background, Instead it recursively keeps updating a single model for each of the input frame. This results in input frames having an effect towards the present background model. On comparing to non-recursive-techniques, the recursive techniques will require a less storage. This technique also includes numerous methods like approximate median, GOM and adaptive background.

2. Non-Recursive Algorithm

Non-recursive-techniques in [8, 3] makes use of sliding-window method to estimate the background. It also stores the buffer of a preceding video frames which in turn evaluates the so called background image which is based on temporal variations in each of the pixel that are buffered. Techniques which are based on non-recursive are found to be highly adaptive since they it does not depend completely on the past beyond those individual frames that are stored in that buffer. Conversely, the storage necessity or requirement will be consistently significant if in case a huge buffer is desired to cope up with the slow-moving-traffic.

D. Motion Estimation based on voting

In order to estimate a proper motion of the moving objects, this voting based algorithm is developed and used. A powerful and also speedy voting based algorithm is developed for an indoor surveillance to evaluate the motion of the camera without tracking the features and also knowing clear knowledge of the camera motion. Due to the mobile camera, estimation of motion exploits the set of voting decision as of the group of these motion vectors which are found by edge feature or background in order to precisely estimate and also compensate in place of shifting motion. The VBME technique will decrease the time complexity and also avoid the incorrect tracking of feature due to edge characteristics and only it is employed [9]. Temporal sampling based on content and also spatial coding based on priority are the two algorithms which involve the voting based method.

1. Temporal Sampling Based on content

The calculation of movement vector is done by considering the two static-images. According to this sampling algorithm, information which is more important will be preserved prudently and also the redundant frames which are similar will be removed effectively [10].

2. Spatial Coding Based on priority

Spatial domain contains two parts i.e. important and also unimportant region. Algorithm based on spatial coding is used to encrypt those regions having important information in frame with greater visual quality. The regions without any important information will have a very low visual quality [10]. It also includes two key parts namely

(a) Set the priority to a region-based resulting in an edge detection of moving objects. The pixels in these contour maps is categorized into 3 distinct types namely moving edge, no edge and finally a static edge and also their respective priority will be high, low and medium.

(b) Generating image code which is based on the priority- In this SPIHT algorithm is adopted and used. This algorithms initially partitions each and every blocks by same priority. On a whole, the entire encoding process would upgrade the so called quality on those regions that are occupied at the moving objects edges but it degrades the other regions quality. Therefore, when the accessible bandwidth is under limit, the quality of those high-priority info can be maintained [10].

TABLE 1

(a) COMPARATIVE STUDY BASED ON ACCURACY AND COMPUTATION TIME

Methods		Accuracy	Computation Time
Background Subtraction	GOM	Moderate	Moderate
	Approximate Median	Low-to-moderate	Moderate
Optical Flow		Moderate	High
Frame Differencing		High	Low-to-Moderate
Voting Based		High	High-to-Moderate

TABLE 2

(B) COMPARATIVE STUDY AND THE COMMENTS ON DIFFERENT DETECTION TECHNIQUES

Methods		Comments
Background Subtraction	GOM	✓ On the positive side, it requires low memory ✓ On the negative side, it cannot cope up with the multimodal background
	Approximate Median	✓ On the positive side, it do not require any frame sub sampling ✓ On the negative side, its computation time requires a small buffer with an recent values i.e. pixel values
Optical Flow		✓ On the positive side, it gives the complete information about the movement ✓ On the negative side, it requires a large volume of calculations
Frame Differencing		✓ On the positive side, it is an easier method ✓ On the positive side, it requires background devoid of moving objects
Voting Based		✓ On the positive side, it performs well in static background

CONCLUSION

This paper gives a brief survey of various methods that has been used to detect the objects. Each available techniques are explained with a relevant examples for each of the techniques. The various methods are discussed in the above sections which includes frame differencing, background subtraction, optical flow and voting based motion detection. It is summarized that the background subtraction technique found to be a simple and easiest method which provides complete info of an objects compared to other methods.

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