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Using video images to recognize moving objects

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Abstract—Moving objects often contain almost important information for surveillance videos, traffic monitoring, human motion capture etc. Background subtraction methods are widely exploited for moving object detection in videos in many applications. Moving object segmentation is the application in video processing. Segmentation helps in detecting various features of moving objects for further video/image processing. In this paper object detection and segmentation is proposed and they are compared using SIFT algorithm (object tracking) and segmentation algorithm (edge detection and thresholding). The experiment results show that the proposed method gives best results.

Index Terms— Moving Object Segmentation, Background Subtraction, Edge Detection and SIFT(Scale Invariant Fourier Transform)

I. INTRODUCTION

Detection and segmentation of moving objects in video streams is an essential process for information extraction in many computer vision applications, including video surveillance, human tracking, traffic monitoring and semantic annotation of videos. Surveillance system uses video cameras to monitor the activities of targets (human, vehicle, etc.) in a scene [1]. In order to obtain an automatic motion segmentation algorithm that can work with real images there are several issues that need to be solved, particularly important are: noise, missing data and lack of a priori knowledge. One of the main problems is the presence of noise. For some applications the noise level can become critical.There are three conventional approaches to moving object detection: background subtraction, temporal differencing and optical flow [2].

Background subtraction is one of the most popular methods for novelty detection in video streams. Background Subtraction generates a foreground mask for every frame. This step is simply performed by subtracting the background image from the current frame. When the background view excluding the foreground objects is available, it becomes obvious that the foreground objects can be obtained by comparing the background image with

the current video frame. It focuses on two major steps: First, to construct a statistical representation of the background that is representative, robust to noise and sensitive to new objects; second, to build another statistical model called 'foreground' that represents the changes that take place on the scene[3]-[4]. By applying this approach to each frame one can effectively track any moving object. Moreover, a background image can be elegantly used to determine the foreground objects by comparing the input frame with the background image and marking the differences as foreground objects. This technique is commonly known as background subtraction or change detection.

In segmentation process the image/frame is splitted into a set of non-overlapping uniform connected regions such that any two adjacent ones are not similar. It is a difficult task due to the complexity and diversity of images and moving objects. Influencing factors range from illuminating, contrast and frames. Most of these segmentation algorithms are based on similarity, difference and particularly, can be divided into different categories: threshold, template matching, region growing, edge detection and clustering [5].

These methods have been proven to be successful in many applications, but none of them are generally applicable to all images and moving objects and different algorithms are usually not equally suitable for a particular application. Image segmentation is the partitioning of an image in objects of interest. This partitioning is done according to some subjective criteria and, usually, it aims to separate the objects in the image. Object segmentation techniques known as Region of Interest (ROI) has recently drawn much attention in image compression community. ROI applications include browsing, digital image archive, and telemedicine [6]-[7]. Many computer vision methods have been developed for analyzing image motion. These methods have addressed a diverse set of natural motion categories including smooth optical flow, discontinuous optical flow across an occlusion boundary, and motion transparency.

In this work, an algorithm for detection and segmentation of objects in the video frames is presented. The algorithm is based on object detection from background using the background subtraction method and segmentation using thresholding and edge detection. The performance evaluation using these methods with different sample videos is discussed in this work.

II. RELATED WORK

"Detecting Moving Objects, Ghosts and Shadows in Video Streams",Rita Cucchiara, Costantino Grana, Massimo Piccardi , Andrea Prati. Background subtraction methods are widely exploited for moving object detection in videos in many applications, such as traffic monitoring, human motion capture and video surveillance. How to correctly and efficiently model and update the background model and how to deal with shadows are two of the most distinguishing and challenging aspects of such approaches. This work proposes a general-purpose method which combines statistical assumptions with the object-level knowledge of moving objects, apparent objects (ghosts) and shadows acquired in the processing of the previous frames. This paper has presented Sakbot, a system for moving object detection in image sequences. This system has the unique characteristic of explicitly addressing various troublesome situations such as cast shadows and ghosts. Cast shadows are detected and removed from the background update function, thus preventing undesired corruption of the background model. Ghosts are also explicitly modeled and detected so as to avoid a further cause of undesired background modification. Actually, in scenes where objects are in constant motion (i.e., no ghosts are present), any common background suppression algorithm already performs effectively.

"Fast and Accurate Approaches for Imageand Moving Object Segmentation", Mahmoud A. Mofaddel and Walaa M. Abd-Elhafiez. In This introduces new two approaches for object extraction. The first one extracts the object in the image by separating the objects from the background. The second one extracts moving object in video sequences from the background. The proposed algorithm provides accurate results with different kinds of image. Simulation results demonstrated the efficiency of this method. In order to achieve object-based functionalities in image sequences, a new segmentation algorithm is applied to extract the video object planes (VOPs). This introduces two new algorithms, the first one is concerned with automatic segmentation of objects in image and the second one is concerned with moving object extraction in video sequences. The first algorithm(automatic segmentation of objects in image) is based on the edge detection process and the background subtraction process. The second algorithm presents a new technique for moving object extraction in video sequences. The proposed algorithm incorporates motion and luminance information in the wavelet domain. The performance comparison of these techniques is conducted. These segmentation algorithms can be performed in real-time for practical applications.

"CONTOURLET TRANSFORM BASED MOVING OBJECT SEGMENTAION", Manish Khare, Swati Nigam, Rajneesh Kumar Srivastava, Ashish Khare. Moving object segmentation is an important step toward development of any computer vision systems. In the present work, we have proposed a new method for segmentation of moving objects, which is based on single change detection method applied on Contourlet coefficients of two consecutive frames The proposed method is simple and does not require any other parameter except contourlet coefficients. Results after applying the proposed method for segmentation of moving objects are compared with other state-of-the-art methods in terms of visual as well as quantitative performance measures viz. In the present work, we have described a new method for segmentation of moving object using single change detection method applied in contourlet transform domain. Contourlet transform has higher directionality and it captures smooth contours. Single change detection method has been chosen as it provides automatic detection of appearances of new objects.

"Detection, Segmentation, and Tracking of Moving Objects in UAV Videos", Michael Teutsch and Wolfgang Kr¨uger. In this, a video processing chain for detection, segmentation, and tracking of multiple moving objects is presented dealing with the mentioned challenges. The fundament is the detection of local image features, which are not stationary. Finally, a quantitative evaluation of object segmentation and tracking is provided. In this , a processing chain is presented for precise tracking of multiple moving objects in UAV videos. Local image features are detected and tracked for frame-to-frame homography estimation. Stationary features are used for the compensation of camera motion and moving features to detect and cluster independent motion for initial object hypotheses.

"Object Tracking System Based on Invariant Features", S. Mahendran, D. Vaithiyanathan and R. Seshasayanan, Member, IEEE. . In this, we propose the use of Distance Metric Learning (DML) in combination with Nearest Neighbor (NN) classification for object tracking. Initially a video file is read and the frames in the video are accessed individually. The object in that video is first detected using canny edge detector. Feature extraction is done using Region Props which threshold the image and extract the features. Measure the gray level co-occurrence matrix and match the best similar one. The system is tested in real time object tracking. It performs well for action, expression, illumination and varying background. It tends to extract the feature and identifies the person in database. The database is used to store the person's images which are needed to be tracked. The proposed tracking system fails when person skin colour is not identified. Tracking can be made easier for multiple persons in a video by designing an effective algorithm. It also improves the accuracy of the tracking device.

"Real-time Object Detection and Tracking in an Unknown Environment", Shashank Prasad, Shubhra Sinha. In this the result of our research where our research team developed and implemented object detection and tracking system operational in an unknown background, using real-time video processing and a single camera. The proposed system has been extensively tested to operate in complex, real world, non-plain, light variant, changing background. The proposed algorithm for object detection and tracking in unknown environment was extensively tested to operate in complex, real world, non-plain and changing background was found to possess remarkable accuracy and precision of 99%. Our research team has tested the proposed algorithm to track assorted objects against an environment consisting of cluttered objects of varying sizes, shapes and colors. The implementation of the algorithm was found be extremely fast and robust. It also made tracking of objects highly feasible in light variant conditions.

"Real-time Object Tracking via CamShift-Based Robust Framework", Xin Chen, Xiang Li, Hefeng Wu, and Taisheng Qiu. In recent years, lots of object tracking methods have been presented for better tracking accuracies. However, few of them can be applied to the real-time applications due to high computational cost. Aiming at achieving better realtime tracking performance, we propose an adaptive robust framework for object tracking based on the CamShift approach, which is notable for its simplicity and high processing efficiency. . The experimental results demonstrate that the proposed tracking framework is robust and computationally effective. Aimed at the real-time tracking problems, an adaptive robust framework for object tracking is presented in this. We use the Kalman filter to predict the location of object, and then introduce a CamShift-based adaptive local search method for robust tracking, using the parameter resulted from the Kalman filter. The experimental results show the framework performs quite well in accuracy and robustness.

III. EXISTING METHOD

A. Overview

Distinguishing moving objects from the stationary is both a significant and difficult research problem. The first step among almost all of the visual surveillance systems is detecting moving objects. Both create a focus of attention for higher processing levels such as tracking, classification and behaviour understanding and reduce computation time considerably since only pixels belonging to foreground objects need to be dealt with. The proposed method aims at extracting the moving objects in an input image from their background. The method is based on using background subtraction algorithm for separating moving objects from their background.

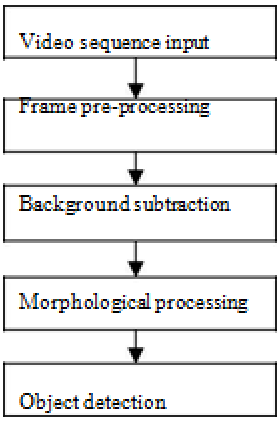

Fig. 1. Overview of the object detection.

B. Background Subtraction

Conventionally, assuming that the background is stationary, then the moving object can be determined by taking the difference between the background image and the input image. Background subtraction finds moving objects information by subtracting background model.

For gray video stream, only intensity (lightness) and for colour video stream, HSI (Hue-Saturation-Intensity) colour space background model is used. The HSI system separates colour information of an image from its intensity information, and has a good capability of representing the colours of human perception.

C. Morphological Process

A traditional way to remove the noise regions is using the morphological operations to filter out smaller regions. The close operation is effective for eliminating the background noise and the open operation is effective for removing noise within the object region itself. The operation shows the outline of the cell quite nicely, but there are still holes in the interior of the object (cell). To overcome this problem, the area enclosed by the boundary is tested. If the area of the holes is greater than 40% (determined by experiment) of the total area then the algorithm will combine this area with the total area enclosed by the boundary.

D. segmentation overview

Segmentation is the most important part in image processing. Image segmentation is the division of an image into regions or categories, which correspond to different objects or parts of objects. The image segmentation is based on two steps. In the beginning, the image is converted into binary images and then thresholding and edge detection is applied to segment objects. Every pixel in an image is allocated to one of a number of these categories. A good segmentation is typically one in which:

Pixels in the same category have similar grey scale of multivariate values and form a connected region. Neighbouring pixels which are in different categories have dissimilar values. Segmentation is often the critical step in image analysis: the point at which we move from considering each pixel as a unit of observation to working with objects (or parts of objects) in the image, composed of many pixels. If segmentation is done well then all other stages in image analysis are made simpler. There are three general approaches to segmentation, termed thresholding, edge-based methods and region-based methods.

In thresholding, pixels are allocated to categories according to the range of values in which a pixel lies. The boundaries between adjacent pixels in different categories have been superimposed in white on the original image. In edge-based segmentation, an edge filter is applied to the image, pixels are classified as edge or non-edge depending on the filter output, and pixels which are not separated by an edge are allocated to the same category.

Finally, region-based segmentation algorithms operate iteratively by grouping together pixels which are neighbours and have similar values and splitting groups of pixels which are dissimilar in value.

E. Edge detection

Edge detection is very important in the digital image processing, because the edge is boundary of the target and the background. And only when obtaining the edge we can differentiate the target and the background.

The four steps of edge detection

Smoothing: suppress as much noise as possible, without destroying the true edges.

Enhancement: apply a filter to enhance the quality of the edges in the image (sharpening).

Detection: determine which edge pixels should be discarded as noise and which should be retained (usually, thresholding provides the criterion used for detection).

Localization: determine the exact location of an edge (sub-pixel resolution might be required for some applications, that is, estimate the location of an edge to better than the spacing between pixels). Edge thinning and linking are usually required in this step.

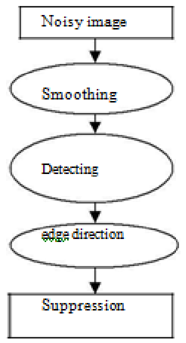

Fig. 3: Edge detection process

Edges are significant local changes of intensity in an image. They typically occur on the boundary between two different regions in an image. Edges are detected to identify the discontinuities in the image. Edges on the region are traced by identifying the pixel value and it is compared with the neighbouring pixels. In this edge based segmentation, there is no need for the detected edges to be closed. There are various edge detectors that are used to segment the image. In that Canny edge detector has some step by step procedure for segmentation which is as follows:

To reduce the effect of noise, the surface of the image is smoothened by using Gaussian Convolution.

The edge directions are taken into considerations for non-maximal suppression i.e., the pixels that are not related to the edges are detected and then, they are minimized.

Final step is removing the broken edges i.e., the threshold value of an image is calculated and then the pixel value is compared with the threshold that is obtained. If the pixel value is high than the threshold then, it is considered as an edge or else it is rejected.

Canny Operator

The Canny operator is a sort of new edge detection operator. It has good performance of detecting edge, which has a wide application. The Canny operator edge detection is to search for the partial maximum value of image gradient. The gradient is counted by the derivative of Gauss filter. The Canny operator uses two thresholds to detect strong edge and weak edge respectively. And only when strong edge is connected with weak edge, weak edge will be contained in the output value.

IV. PROPOSED METHOD

The rapid improvement in technology makes video acquisition sensor or devices better in compatible cost. This is the cause of increasing the applications in different areas that can more respectively utilize that digital video. Digital videos are a collection of sequential images with a constant

time interval. So there is more information is present in the video about the object and background are changing with respect to time. After studying the literature, it is seen that detecting and tracking of objects in a particular video sequence or any surveillance camera is a really challenging task in computer vision application. Video processing is really time consuming due to a huge number of data is present in video sequence. The area of video tracking is currently immense interest due to its implication in video surveillance, security, medical equipments, robotic systems. Video trackings a context for extraction of signicant nformation such as scene motion,
background subtraction, object classification, interaction of object with background and other objects from a scene, human identification, behavior of human with object and background, etc. Therefore it is seen that there is a wide range of research possibilities are open in relation to video tracking.

Object Detection and Tacking

In this chapter, we introduce the background of object detection and tracking, with object detection, object representation and object tracking. In this chapter we also discuss the literature surveys that have been done during the research work which provides a detailed survey of the literature related to motion detection and object tracking.

Feature Extraction Method

In this chapter, we discuss about some features of objects that can be extracted by feature extraction methods like Scale Invariant Feature Transform (SIFT), Kanade Lucas Tomasi (KLT) feature tracker and Mean SIFT.

Result

In this chapter, we discuss about experimental result on Object Detection and Tracking in video image using SIFT algorithm with static camera.

Conclusion and Future Work

In this chapter, we conclude the work we have done and proposing the work that can be done in future.

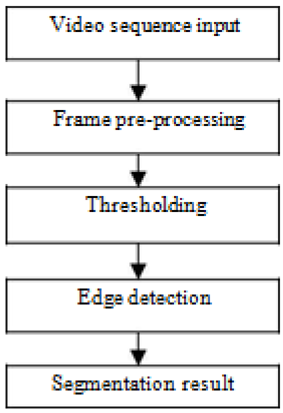

Fig. 4| Overview of the object segmentation

Scale Invariant Feature Transform

Scale Invariant Feature Transform (SIFT) is a methodology for identifying and concentrating local feature descriptors that are sensibly invariant to changes in enlightenment, scaling, pivot, image noise and little changes in perspective. This calculation is initially proposed by David Lowe in 1999, and afterward further created and moved forward.

SIFT characteristics have numerous preferences, for examples are follows:
SIFT Features are natural feature of pictures. They are positively invariant to picture interpretation, scaling, revolution, brightening, perspective, commotion and so on. Great strength, rich in data, suitable for quick and precise matching in a mass of feature database. Richness. Heaps of SIFT feature will be investigated regardless of the possibility that there are just a couple of object. Moderately quick speed. The pace of SIFT even can full ongoing process after the SIFT algorithm is advanced.

Better expansibility. SIFT is extremely helpful to consolidate with other eigenvector, and create much valuable information.

V. CONCLUSION

In this paper, two methods are presented for detection and segmentation of moving objects in videos. First method is for object detection using back ground subtraction and second method for segmentation using two approaches i.e. thresholding and edge detection Simulation results demonstrated that the proposed technique can successfully extract moving objects from various sequences. Sometimes the boundaries of the extracted object are not accurate enough to place them in different scenes, which require a nearly perfect boundary location. The comparison is based on the PSNR values of the sequences and shows an adequate variation for the two methods and it is found that SIFT algorithm method is better compared to threshold value technique.

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