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Detection and Monitoring of Real - time Moving Object using PCA with Window Sliding

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***Abstract*: Moving object detection and tracking is commonly the primary step in applications like video surveillance. The main aim of project is moving object detection and tracking system with a static camera has been developed to estimate distance parameters propose a general moving object detection and tracking supported vision system using Principle component analysis and window sliding algorithm. This paper focuses on detection of moving objects in a very scene for instance moving people meeting one another, and tracking and detected objects as long as they stay within the scene. This can be done by Principle component analysis and window sliding algorithm with software and that could calculate distance, frame per time. This paper describes an algorithm to estimate moving object using image processing technique from the camera calibration parameter.**

Keywords*: *Principle Component Analysis(PCA); Object Detection and Tracking; Window Sliding.

INTRODUCTION

In recent days, capturing images with top quality and good size is very easy because of fast improvement in quality of capturing device with more cost effective however superior technology. Videos are a set of successive images with a constant interval. Therefore video will offer additional information about our object once scenarios are dynamic with respect to time. Therefore, manually handling videos are quite impossible. Therefore require an automatic device to process these videos. During this thesis one such attempt has been created to track objects in videos. Several algorithms and technology have been developed to automate monitoring the object in a video file. Object detection and tracking could be a one among the challenging task in computer vision. Primarily there are three basic steps in video analysis: Detection of objects of interest from moving objects, tracking of that interested objects in consecutive frames, and Analysis of object tracks to know their behavior. Simple object detection compares a static background frame at the pixel level with the present frame of video.

The existing technique in this domain first tries to find the interest object in video frames. One among the main difficulties in object tracking among several others is to choose appropriate features and models for recognizing and tracking the interested object from a video. Some common choice to select appropriate feature to classes, visual objects are intensity, shape, color and feature points. Detection of object and tracking of that object is a crucial task within the area of computer vision application. In object detection, find or detect interested object in consecutive frames of a video file. Tracking could be a process to find moving interested object or multiple objects in a video file or camera with respect to time. Technically, in object tracking estimate or outline the trajectory or path of an interested object in the frame plane because it moving around the image plane. Because of technology increasing in computational power, availability of excellent quality and low value video camera and therefore the need of automated video system people are sowing the more interest in object tracking algorithm. In a video analysis, there are three basic or main steps are there.

1. Detection of moving object from moving objects,
2. Tracking of that interested objects in consecutive frames,
3. Analysis of trajectory of object to understand the behavior of interested object.

Automated tracking of objects is utilized by several interesting applications. An correct and efficient tracking capability at the heart of such a system is crucial for building higher level vision-based intelligence. Tracking isn't a trivial task given the non-deterministic nature of the subjects, their motion, and therefore the image capture process itself. The objective of video tracking is to associate target objects in consecutive video frames. Mainly need to detect and track the object moving independently to the background.

I. RELATED WORK

Previous methods for object detection are vast, including object detectors (supervised learning), image segmentation, background subtraction, etc. [5]. This method aims to segment objects based on motion information and it comprises a component of background modeling. Thus, motion segmentation and background subtraction are the most related topics to this paper.

Object Detection and Tracking Techniques:

Object detection technique is an important task in any tracking algorithm to detect the interested object in either each frame of video or from that frame where the object first show up on video.

1. Motion Segmentation

In motion segmentation, the moving objects are continuously present within the scene, and also the background may additionally move because of camera motion. The target is to separate totally different motions. Standard approach for motion segmentation is to partition the dense optical-flow field [6]. This is typically achieved by mouldering the image into totally different motion layers

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[10], [11], [12]. The belief is that the optical-flow field should be smooth in every motion layer, and sharp motion changes solely occur at layer boundaries. Dense optical flow and motion boundaries are computed in an alternating manner named motion competition[9], that is typically enforced in an exceedingly level set framework. An alternate approach for motion segmentation tries to segment the objects by analyzing point trajectories[8].

2. Background Subtraction

In background subtraction, the overall assumption is that a background model is often obtained from a training sequence that doesn't contain foreground objects. Moreover, always assumes that the video is captured by a static camera [14]. Thus, foreground objects are often detected by checking the distinction between the testing frame and also the background model designed previously. A substantial range of works are done on background modeling, i.e. building a correct illustration of the background scene.

Typical strategies include single Gaussian distribution[15], Mixture of Gaussian[16], kernel density estimation [17], [18], block correlation[19], codebook model[20], Hidden Markov model[21], [22] and linear auto-regressive models [23-24]. Learning with sparseness has drawn lots of attentions in recent machine learning and computer vision analysis [25], and a number of other strategies supported the sparse illustration for background modeling are developed. One pioneering work is the eigen backgrounds model [26], wherever the principle component analysis (PCA) is performed on a training sequence. Once a replacement frame is arrived, it's projected onto the topological space spanned by the principle components, and also the residues indicate the presence of recent objects. Another approach which will operate consecutive is that the sparse signal recovery [27-28].

3. Sliding-Window Approach

Assume that addressing objects that have a comparatively well-behaved appearance, and don't deform much. Then attempt to find them with a very straightforward direction. Build dataset of labeled image windows of fixed size (say, n × m). The examples labeled positive ought to contain large, targeted instances of the object, and people labeled negative shouldn't. Then train a classifier to inform these windows apart. Currently pass each n×m window within the image to the classifier. Windows that the classifier labels positive contain the object, and those labeled negative don't. This is often a search over location that may represent with the highest left-hand corner of the window[14,19,24].

4. Template Matching

Template matching is a technique for locating small elements of an image that match a template image. It's a simple method. During this technique template images for various objects are stored. Once an image is given as input to the system, it's matched with the stored template images to work out the object within the input image. Templates are often used for recognition of characters, numbers, objects, etc. It will be performed on either color or gray level images. Template matching will either be pixel to pixel matching or feature based mostly [28].

5. PCA Method

It presents an object detection system and its application to pedestrian detection in images, while not assuming any a priori data regarding the image. The system works as follows: during a first stage a classifier examines every location within the image at totally different scales. Then during a second stage the system tries to eliminate false detections based on heuristics. The classifier relies on the concept that Principal component Analysis (PCA) will compress optimally solely the sort of images that were used to figure the principal components (PCs), which the other kind of images won't be compressed well employing a few components. So the classifier performs one by one the PCA from the positive examples and from the negative examples; once it has to classify a brand new pattern it comes it into each sets of PCs and compares the reconstructions, assignment the instance to the category with the smallest reconstruction error. The system is ready to observe frontal and rear views of pedestrians, and frequently may detect side views of pedestrians despite not being trained for this task [1-3].

Object tracking, extract the corresponding features from a familiar image and so retrieve the image database to identify the images that are similar with it, also provide a number of the characteristics supported a query demand, and then retrieve out the desired images supported the given appropriate values. Within the whole retrieval method, feature extraction is essential; it's closely associated with all aspects of the feature, like color, shape, texture and area[4].

6.Kernel Tracking

It is performed by computing the motion of the object, described by a primitive object region, from one frame to subsequent [5]. Object motion is within the sort of constant motion or the dense flow field computed in future frames. Kernel tracking strategies are divided into two subcategories supported the appearance representation used i.e. template and Density-based appearance Model and Multi-view appearance model[13].

7. Contour Tracking

It permits detection of object boundary (e.g. active contours or Condensation algorithm). Contour tracking strategies iteratively evolve associate degree initial contour initialized from the previous frame to its new position within the current frame [5]. This approach to contour tracking directly evolves the contour by minimizing the contour energy using gradient descent[7].

II. IMPLEMENTATION DETAILS

System Overview

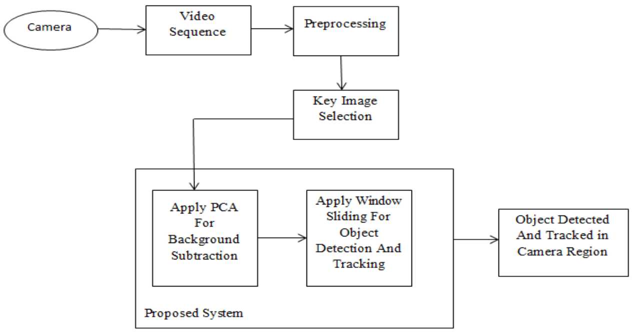

Figure 1. System Overview

The block diagram of the system that describes the operation of the detection and tracking or monitoring is shown. The input to the system is a video, and the output is a description of the objects found in the input image. In the image pre-processing step the region of interest (ROI) is determined, then, the image converted from RGB to gray scale image then to binary image and key image is selected. Then PCA algorithm is applied to remove the background of the selected image. After that by using window sliding approach the object is detected. In order to do that, the Euclidean distances between the previous image and the current image have been calculated and used to track the object. Finally, as a result system displays the detected object also the tracking of the object .

Advantages of proposed system

- The proposed PCA with Window sliding approach detect And tracks the real time object effectively.
- The proposed algorithm will improve efficiency and accuracy of system.

Proposed Framework is divided into different phases -
1. Video Sequence Collection
2. Key Image Selection
3. Background Subtraction
4. Object Detection
4. Object Monitoring or Tracking

Video Sequence Collection: Here the continuous still camera is mounted which captures the real time video sequence which is used for further processing.

Key Image Selection: The video sequence is divided into multiple frames, by using threasholding value the key images are selected which contains the object in the image.

Background Subtraction: By applying PCA algorithm to the selected key image the background subtraction is carried out which leaves the object

Object Detection: After subtraction of the background from the key image the Window sliding approach is applied, which detects the object effectively.

Object Monitoring or Tracking: After detection of the object the object tracking or monitoring is carried out by using distance manipulations

III. PROPOSED ALGORITHM

Principal Component Analysis Steps :

1. Transform an $N \times d$ matrix X into an $N \times m$ matrix Y:
2. Centralized the data (subtract the mean).
3. Calculate the $d \times d$ covariance matrix: C = $1/(N-1)\ X^T X$
4. $Ci,j = 1/(\ N-1)\ \sum^{N}_{q=1} X_{q,I} * X_{q,j}$
5. Ci, (diagonal) is the variance of variable i. o Ci,j (off-diagonal) is that the covariance between variables I and j.
6. Calculate the Eigen vectors of the covariance matrix (orthonormal).

Window Sliding algorithm :

1. Choose a threshold t and steps Δx and Δy in the x and y directions.
2. Construct an image pyramid.
3. For each level of the pyramid
4. Apply the classifier to each n × m window,
   a. Stepping by Δx and Δy, in this level to get a response strength c.
5. If c > t
   a. Insert a pointer to the window into a ranked list L, ranked by c.
6. For each window W in L, starting with the strongest response.
7. Remove all windows U!=W that overlap W significantly, where the overlap is computed in the original image by expanding windows in coarser scales.
8. L is now the list of detected objects.

IV. EXPRIMENTAL RESULTS

This Project uses still camera captured live video as input . In first window it takes images from video stream as input to system and in another window displays the images after applying proposed system algorithm as output. In the output frame window is used to cover the object entered in the camera region and that window is moving according to the movement of the object. This means that object detection and the tracking or monitoring is carried out using the prosed

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system which uses PCA and Window Sliding Algorithm. There are different experiments are considered and the proposed system satisfies the result according to the experiments performed.

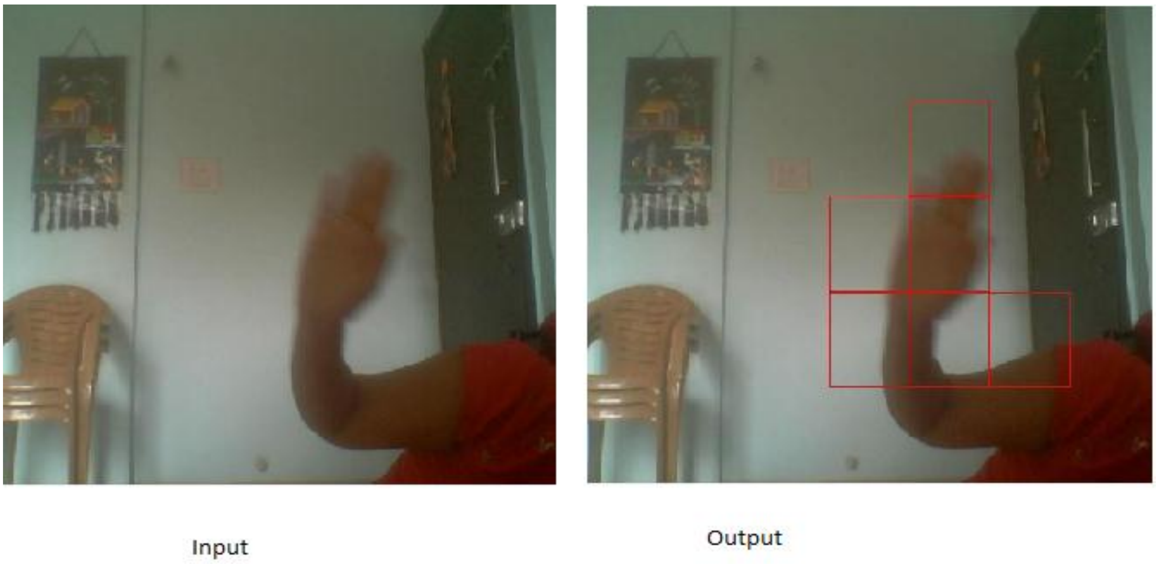

Fig.1.single object detection and monitoring

Fig. 3. Multiple object detection and monitoring

V. CONCLUSION AND FUTURE WORK

The various object detection and tracking techniques are available. The PCA method is used for efficient background subtraction with low computations. The window sliding technique is to give efficient detection of object. Tracking is another part which is used for finding the path of the object which is also obtained using window sliding approach. These techniques help in achieving the specified goal. Detecting multiple objects and their tracking would be an enhancement to this work. So these methods are conveniently used in the project work. These techniques help in easy access of the images. Thus object detection and tracking is effectively carried out for monitoring the real-time applications. In future, object detection and reorganization will be considered for the future research of this project.

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