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# Detection of Motion and Tracking Based on Consecutive Frame Using Differnce Hybrid Filtering Method

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**Abstract**

The object is defined by its location and extent in a single frame. In every frame that follows, the task is to determine the object's location and extent or indicate that the object is not present.. Tracking is usually performed in the context of higher-level applications that require the location and/or shape of the object in every frame. The detection of moving object is important in many tasks, such as video surveillance and moving object tracking. We proposed a novel approach is to detected the moving objects should be presented to higher-level analysis tools in order to identify further events and behaviors of interest typical of observation systems for open spaces. Then the background subtraction will be done by the algorithms to track object. The methods using for background subtraction are: Video surveillance applications, which combine recent scheme for the improvement of the system recital and system convergence, and a novel heuristic for better initializing the constraint for new created forms, and it evades the emergence of over-dominating form. Background subtraction function is constructed that gives the likelihood that a given pixel belongs to the allocation of background pixels. For the running average the previous known pixel values were fitted to the model of distribution. It allows the pictures by eliminating the background and analyzes the object exactly. In a further different frame activity has captured to analyze the varying objects in the video then the difference image is converted into gray image and then translated into binary image. Moreover, we discuss the important issues related to kalman filter is used to track the object and morphological operations are done to detect the object perfectly.

Keywords—KalmanFilter , object tracking, Background substraction, Morphological operations

## Introduction

Object detection and tracking is an important task within the field of computer vision. The proliferation of high-powered computers, the availability of high quality and inexpensive video cameras, and the increasing need for automated video analysis has generated a great deal of interest in object tracking algorithms. There are three key steps in video analysis: detection of interesting moving objects, tracking of such objects from frame to frame, and analysis of object tracks to recognize their behavior .

Actually videos are 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 [3].

An image, usually from a video sequence, is divided into two complimentary sets of pixels. The first set contains the pixels which correspond to foreground objects while the second complimentary set contains the background pixels. This result is often represented as a binary image or as a mask. 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 [4]. Generally, foreground objects are moving objects like people, boats and cars and everything else is background. Many times shadow is represented as foreground object which gives improper output.

**Motion Detection**

There are mainly two classes categorized for motion detection, i.e. pixel-based motion detection and region-based motion based algorithm. The pixel-based motion detection is based on binary difference by employing local model of intensity used in real time applications the latter is based on the spatial dependencies of neighboring pixel colors to provide result is more robust to false alarm. The region based motion detection algorithm include special point detection, block matching algorithm.

**A. *Temporal difference***

In this technique, its compare consecutive frames on a pixel by pixel basis in a motion sequence where a threshold is applied which decide them as either stationary or motion. So if the motion is occur it only changes in boundaries area or pixels also it does not show relationship of neighboring pixel, making it more prone to false signaling [8]. This technique mostly used in biophysics especially in mind image study.

**B. *Optical Flow***

It is 2-D velocity field stimulated in an image due to the projection of moving objects onto the image plane. Each shows the velocity of each pixel in the image. And assume that uniform illumination is present. Some approaches towards computing optical flow include gradient technique [6] which relates optical flow to spatial and temporal image derivatives, and the token matching or correlation method which matches windows surrounding a pixel from frame to frame, with the best match determining the displacement of the pixel from one frame to another [8]. However, only small movements can be accurately detected in the gradient technique due to the Taylor's approximation of the gradient constraint equation. As for the correlation method, matching in the presence of rotation is computationally expensive and window will be distorted if motion is not constant[8].

**C. *Background Subtraction:***

Background subtraction is a technique for segmenting a foreground object from its background. The main step in background subtraction is background modeling. It is the core of background subtraction algorithm. Background Modeling must be sensitive enough to recognize moving objects [1]. Background Modeling is to yield reference model. This reference model is used in background subtraction in which each video sequence is compared against the reference model to determine possible Variation. The variations between current video frames to that of the reference frame in terms of pixels signify existence of moving objects. Currently, mean filter and median filter are widely used to realize background modeling [6]. The background subtraction method is to use the difference method of the current image and background image to detect moving objects, with simple algorithm, but very sensitive to the changes in the external environment and has poor anti-interference ability. However

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**Proposed Work**

In this paper, an algorithm of feature-based using Kalman filter motion to handle multiple objects tracking is proposed. The system is fully automatic and requires no manual input of any kind for initialization of tracking. Through establishing Kalman filter motion model with the features centroid and area of moving objects in a single fixed camera monitoring scene, using information obtained by detection to judge whether merge or split occurred, the calculation of the cost function can be used to solve the problems of correspondence after split happened. The algorithm proposed is validated on human and vehicle image sequence this result shows that the algorithm proposed achieve efficient tracking of multiple moving objects under the confusing situations. This paper presents a new algorithm for detecting moving objects from a static background scene based on frame difference. Firstly, the first frame is captured through the static camera and after that sequence of frames is captured at regular intervals. Secondly, the absolute difference is calculated between the consecutive frames and the difference image is stored in the system. Thirdly, the difference image is converted into gray image and then translated into binary image. Finally, kalmanfilter is used to track the object. Then morphological operations are done to detect the object perfectly.

## Methodologies

### *A. PREPROCESSING*

A new method is proposed which is a combination of both background subtraction method and consecutive frame subtraction method. In this method background image is formed by taking the mean value of previous consecutive frames and then current image is compared pixel wise with the background image to detect motion. The different approaches used in detection of motion are background subtraction method, consecutive frames and threshold comparison method. The main focus of this work is to obtain a background image from previous consecutive frames in real time by trigger method. Where the current image is compared pixel wise (pixel by pixel) or subtracted from background image to detect any motion. The image obtained after subtraction is called Difference Image. Values of pixels can be either positive or negative in difference image. Therefore implicit of difference image is taken and then values of pixels in difference image is compared with threshold value, then if the pixel value is more than threshold value then it means there is motion in the area being monitored and motion is detected. This method continuously keep making background image using previous frames in real time.

### *B.* Framework Detection

From the observations only person have the large intensity than threshold. Varying person is having the double threshold other persons. Here Sequential analysis algorithm is used, which is a statistical data analysis technique that minimizes the within-cluster sum of distance to partition a set of data into groups and image is converted into three or more clusters. The cluster with the lowest average intensity value is considered to be person, while the other clusters are considered other nearest person. So the classification is done and pixels are detected. Sequential analysis is faster and less restricted by the initial contour.

*Sequential analysis (node n = (s1, ....,sk), Sn , In)*
*Begin*
*(1) Stemp = φ.*
*(2) Itemp = φ.*
*(3) For each (i Sn)*
*(4) if ((s1, ....., sk , {i}) is frequent)*
*(5) Stemp = Stemp {i}*
*(6) For each (i Stemp)*
*(7) DFS-Pruning((s1,………….....,sk,{i}),Stemp, all elements in Stemp greater than i )*
*(8) For each (i In)*
*(9) if ((s1, ..... , sk » {i}) is frequent)*
*(10) Itemp = Itemp {i}*
*(11) For each (i Itemp)*
*(12) DFS-Pruning ((s1, ......,sk {i}), Stemp, all elements in Itemp greater than i)*
*End*

**Fig 1 : Sequential Algorithm**

This algorithm is able to detect the weak connections between floes and ensures that detected boundary area is closed to the initial contour does not need to be as close to the true boundary as for in the traditional snake algorithm. The distance transform of a binary image is the minimum distance from every pixel in an object to the background.

### *C.* Background Subtraction

In moving object detection, background subtraction is a frequently-used detection method, which carries out difference calculation by the current image and background image to detect the area of the moving object. Image subtraction is one of the popular techniques in image processing and computer vision technology. This object detection based on the codebook model is based on vector quantization and clustering.

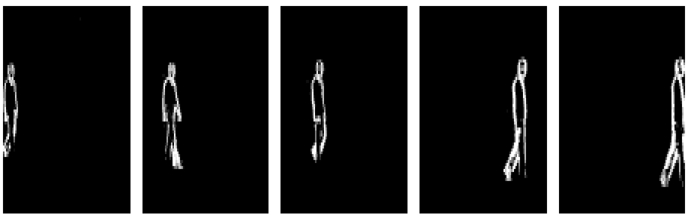

*Figure 2: Background subtraction*

It works well only in the presence of stationary cameras. The subtraction leaves only non-stationary or new objects, which include entire silhouette region of an object. This approach is simple and computationally affordable for real-time systems, but is extremely sensitive to dynamic scene changes from lightning and extraneous event etc. Therefore

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it is highly dependent on a good background maintenance model. By using the quantization and clustering idea, the changed pixel after image sequence analysis is classified and the code word set in a pixel called codebook.

### *D.* Consecutive frame difference method

Detection of moving object from a sequence of frames is captured from a static camera which is widely performed by frame difference method. The task of this approach is to detect the moving objects from the difference between the current frame and the reference frame. The frame difference method is commonly used method for detection of motion. This method adopts pixel by pixel based difference to find the moving object.

### *E.* Kalman Filter

. Kalman filer is an estimator that predicts and corrects the states of wide range of linear processes. It is not only efficient practically but attractive theoretically as well Precisely, the optimal state is found with smallest possible variance error, recursively. However, an accurate model is an essential requirement

In Kalman filer, we consider a tracking system where xk is the state vector which represents the dynamic behavior of the object, where subscript k indicate the discrete time. The objective is to estimate $\mathbf{x_k}$ from the measurement $z_k$ . Following is the mathematical description of Kalman filer, which for understanding we have sectioned into four phases. Here we provide Kalman filter algorithm.

*The algorithm steps are as follows:*

*Step 1: If the current image is the first frame, establishing motion model and assigning tracking window for each moving object in the scene. If the current image is the kth frame, and the moving object do not fall into any of those established tracking windows, we consider it is a new object, establishing a new Kalman filter motion model, initializing the model for tracking.*

*Step 2: Searching features for each object near the tracking window in the scene, calculate the value of the cost function, the minimum value is the best match.*

*Step 3: To judge whether there is a occlusion happened, if it happened, go to the merge or split treatment. If not, keep tracking the object until it disappeared.*

*Step 4: Turning to the handling of the next frame until the object disappeared, the tracking is complete.*

*1) Process equation*

$$\mathbf{X_k = AX_{k-1} + W_{k-1}}$$

Where *A* represents the transition matrix and $x_k$ the state at time *k* -1 to *k* . Vector $w_{k-1}$ is the Gassian process noise *N*(.) With following normal probability distribution *p*(*w*) .

$$P(w) \sim N(0,Q)$$

*2) Measurement equation*

$$\mathbf{Z_k = Hx_k + V_k}$$

Where H is the measurement matrix and $Z_k$ is the measurement observed at time k-1 to k respectively. $V_k$ is the Gaussian measurement noise N(.) with normal probability distribution p(v) .

$$\mathbf{p(v) \sim N(0, R)}$$

*3) Measurement update equations*

These equations are associated with the feedback of the system. The objective is to estimate a posteriori estimating $X_k$ which is a linear combination of the a priori estimate and the new measurement *k z* .These equations are given below:

$$K_k = P_k H^T (HP_K H^T + R)^{-1}$$
$$P_K = (1-K_K H)P_K$$

$K_K$is the Kalman gain which is computed by above the measurement update equations. After that a posterior state estimate $X_K$ and a posterior error estimate $P_K$ is computed by the measurement $Z_K$.The time and measurement equations are calculated recursively with previous a posterior estimates to predict new a prior estimate. This recursive behaviour of estimating the states is one of the highlights of the Kalman filter. Kalman filter used for tracking is defined in terms of its states, motion model, and measurement equations matrix $X_K$is an eight-dimensional system state vector.

### *F.* Noise reduction using morphological filter

The video capture device may provide noisy data. In order to get improved results, noise removal is a crucial step. So to eliminate that morphological operations, erosion and dilation, are applied to the foreground pixel map in order to remove noise that is caused by the first three of the items listed above. By applying these operations is removing noisy foreground pixels that do not correspond to actual foreground regions and to remove the noisy background pixels near and inside object regions that are actually foreground pixels.

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## V. Result and discussion

This section demonstrates some of the tested image sequences that are able to highlight the effectiveness of the proposed detection system. To fulfill our proposed work, we have used computing software called MATLAB, because MATLAB provides Image Acquisition and Image Processing Toolboxes which facilitate us in creating a good GUI and an excellent code. Using a video input object, live data is acquired and analyzed to calculate any motion between two adjacent image frames. These experimental results are obtained using the proposed detection and tracking algorithm.


**Figure 4 : Input Frame**

Figure shows the video sequence on which we superimposed the contour of the detected objects and the image for the corresponding frames, respectively. Obviously all the pixels above this line do not belong to the ground plane.


**Figure 5: Background Subtraction**

Figure is the result of subtracting the frame from the reference or background frame. The background subtraction is done from the clean original image by using distortion of color and brightness.

**Figure 6 : Tracking**

The result of comparing the appearance-based approaches with that of incorporating motion and appearance demonstrates that, motion can provide higher discriminative power than using appearance cue alone, which can improve the robustness to the outliers from the image registration, yet modeling motion and appearance cues jointly is vulnerable towards these outliers from either cue, since these outliers may be introduced into the joint kernel function, which will deteriorate its accuracy.

The detection results are presented qualitatively and quantitatively. The parameters for each algorithm were determined experimentally. For each sequence, several representative frames, the ground truth and detection results produced by each algorithm are presented. The detection results are shown as black and white images where white pixels represent foreground objects while black pixels represent background. The performance of each approach is also evaluated quantitatively using a) the traditional pixel wise evaluation metrics (precision, recall, F-measure) which are used commonly in evaluating background subtraction approaches and b) the component-based evaluation

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metrics which are designed from the perspective of object detection, here we use the correct detection rate, miss detection rate and false alarm rate.

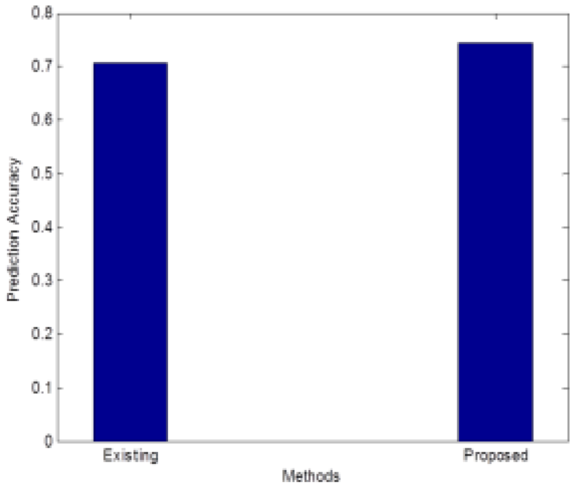


**Fig 7 Accuracy of our system compared with existing one**

As shown in figure 12 shows the accuracy of our proposed system compared with existing one. Detection results form single object and multiple objects from video frames. Results from proposed detection system, the detection result we can see that, the algorithm determine the legitimate region(s) as well as it extract all information of moving object.

## Conclusion

The paper presented an efficient motion detection basedon background subtraction using frame difference withthresholding and mathematical morphology. It will beenhanced with futures of connected component analysis andmorphological filtering for tracking and counting movingobjects. After the foreground detection, the parameters likeCount, velocity of the motion was estimated andperformance of object detection will be measured withsensitivity and correlation using ground truth. Finally theproposed method will be proved that effective forbackground subtraction in static and dynamic texture scenescompared to prior methods.It then allows the pictures by eliminating the background and analyze the object exactly. In a further different frame activity has captured to analyze the varying objects in the video then the difference image is converted into gray image and then translated into binary image. Finally, kalman filter is used to track the object. Then morphological operations are done to detect the object perfectly.

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