Study of Moving Object Detection and Tracking Using Image Processing Technique

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Abstract: *Visual surveillance is very active research topic in the previous few years due to its growing importance in security, law enforcement, and military applications. This work presents moving object detection (MOD) based on background subtraction under various types of wavelet transform for video surveillance system. This paper gives a new proposal for categorizing four types of moving objects in an intelligent transportation system. Cars, bicycles, motorcycles and pedestrians are classified based on their side views from a fixed camera. A moving object is segmented and tracked using background subtraction. For the categorization of a segmented object, a grouping of static and texture features based on the co-occurrence of its appearance and the movements of its local parts is proposed. And we proposed KNN classifier to classify the object. Experiments show the effect of the suggested classification system and the advantage of the suggested features in classification from a test video series and comparisons with several feature descriptors show.*

Key Words: *Input video, Frame separation, Motion detection, Segmentation, Subband differencing, wavelet transform, Morphological Filtering, object classification.*

1. INTRODUCTION:

Surveillance is the supervising of behavior. Systems surveillance is the method of supervising the activities of people, objects or processes inside systems for agreement to be expected or need norms in trusted systems for security or public control. The word surveillance is generally used to explain observation from a distance by a way of electronic equipment or other technical ways.

Fig. 1 Example of CCTV camera

At a basic level, computers are target as huge amounts of personal information are stored on them. Anyone who can access or remove a computer can retrieve information. If anyone can install software on a computer system, he can turn the computer into a surveillance device. Closed-circuit television (CCTV) is a group of video cameras, which is used for video surveillance. CCTV is commonly used in regions where is need for security, such as banks, airports and town centers. A basic CCTV system includes of the Camera, lens and power supply. Recording machine, VCR or a digital video recorder and monitor. Closed-circuit television or video surveillance makes use of video cameras to pass a signal to a particular place, on a limited set of monitors.

The major tasks in image surveillance system include motion detection, tracking and object classification. Our focal point here is on the detecting phase of a common visual surveillance system using stationary camera. The usual approach for MOD is through background subtraction that consists in preserving an up-to date model of the background and detecting a moving object as those that diverge from such a model. The background image is not set but must adjust to: Illumination changes, sudden (such as clouds), Motion changes, camera oscillations, high-frequencies background objects, modification in the background geometry.

2. LITERATURE SURVEY:

Number of problems arises while segmenting the video series because of changing background, clutter, occlusion, varying lighting conditions, automatic operation, bad weather conditions such as fog, rain, snow, camera angle, and real time processing requirements etc. [1-7]. Zhang [4] divided the segmentation techniques into six groups: - Threshold based techniques, Pixel classification based techniques, Range image segmentation, Color picture segmentation, Edge detection based segmentation and techniques based on fuzzy set theory. Background adaptation methods might also be categorized as: No Recursive and Recursive suggested by Cheung and Kamath [6]. A non-recursive technique estimates the background support sliding-window approach. Various attractive video object segmentation approach establish in literature [1-5] such as Running Gaussian Average, Temporal Median Filter, and Mixture of Gaussians. These techniques are either too time consuming (like GMM with online EM algorithm) or too space

consuming (like Temporal Median Filter proposed in .All the methods discussed as above for the segmentation of moving objects suffer from the difficulty of either slow speed or inaccurate segmentation of moving object due to non-removal noise in consecutive frames. The other drawbacks involve detecting only a moving object and the existence of spirit like looks in segmented object. Cheng *et al.* [11] suggested a discrete wavelet transform (DWT) based method on this technique, sub-band differencing method is used for segmentation of moving object in DWT domain. Other transform methods will not give good results for video applications because in video applications, objects are present in shifted form. Inspire by these fact, a new way for video segmentation by discrete wavelet is suggested in this paper. The DWT have advantages of shift variance and better directional selectivity as compared to others methods. The presentation of the recommended technique is compare with other standard techniques available in research such as **Frame Difference, Background subtraction, SOBS.** Performance of the planned method is found better in terms of visual performance and a number of quantitative measures viz. MSE, PSNR, correlation coefficient and similarity [12-15].

(a) Frame Difference

This method is through the difference between two successive images to determine the existence of moving objects.

Fig. 2 Example of frame difference method

The Frame difference is arguably the easiest form of background subtraction. Frame differencing is also known as temporal difference which uses the video frame at time t-1 as the background model for the frame at time t. This process is responsive to noise and deviation in illumination, and does not consider local consistency properties of the change mask. This method also unsuccessful to subdivide the non-background objects as they stop moving. As it employs only a particular previous frame, frame differencing might not recognize the interior pixels of a huge, equally colored moving object. This is usually well-known as an aperture problem. It has strong flexibility but it is normally difficult to get a complete sketch of moving object, likely to emerge the clear phenomenon, as an outcome the detecting a moving object is not accurate.

(b) Background subtraction

The basic system of background subtraction is to subtract the image from a referred image that models the background scene. Background modeling constructs a reference image representing the background. Threshold selection decides suitable threshold value used in the subtraction process to get a wanted detection rate. Subtraction process or pixel sorting classifies the kind of a known pixel, i.e., the pixel is the element of background (include ordinary and shaded background).

After background image B(X, Y) is obtained, take away the background image B(X, Y) from the present frame FK(X, Y). If the pixel differentiation is more than the set threshold T, then decides that the pixels show in the moving object, or else, as the background pixel. The moving object can be detected after threshold operation.

Its expression is as follows:

$$DK(X,Y) = \begin{cases} \text{if } (|FK(X,Y) - B(X,Y)| > T) \\ 0 \text{ others} \end{cases} \quad (1)$$

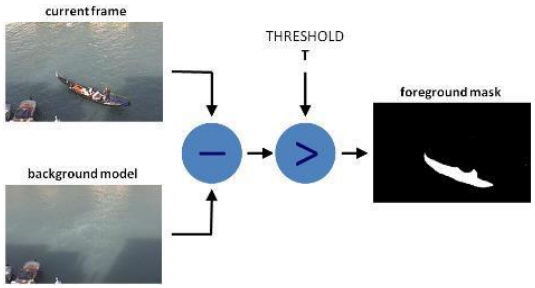


Fig. 3 Example of Background subtraction method

Background subtraction process is very susceptible to the changes in the outside environment. The system with a background model based on a particular scalar value that can pledge adaptation to slow illumination change, but cannot cope up with multi-valued background distributions. As such, they will be prone to errors whenever those situations arise. Processing time required to notice the object using this method is low but accuracy might not be good enough.

(c) SOBS (Self organizing background subtraction method)

There are many difficulties in developing a good quality background subtraction algorithm. Initial, it should be robust against changes in illumination. Second, it supposed to avoid detect moving background objects such as moving leaves, snow, rain, and shadows cast by moving objects. Some of the familiar issues in background maintenance are as light change, moving environment, transmit shadows, bootstrapping, disguise etc. The key problem of the background subtraction approach to detecting a moving object which is extreme sensitive to lively scene changes due to illumination and irrelevant events. Whereas background model finally adapts to "holes," they cause fake alarms for a short period of time. Therefore, it is extremely desirable to build an

approach to motion detection based on a background replica that automatically adapt to change in a self organize manner and without a priori knowledge. This is biologically inspired problem-solving process based on video awareness mechanisms. This process describes a method for the generating an active attention focus to monitor dynamic scenes for supervision purpose. The idea is to make the background model by studying in a self arranging manner many background variations, i.e., background motion cycles, seen as trajectories of pixels in time. Based on the studied background model via a map of movement and motionless patterns, this can notice motion and carefully revise the background model. Each node figured a purpose of the weighted linear grouping of received inputs, where weights resemble to learn neural networking. By doing this, every node might be represented by weight vector, obtaining collected weights related to arriving links. In this, the set of weighted vectors will be called a *model*. An incoming outline is mapped to a node whose model is "most similar" to the model, and weight vectors in a region of such node be updated. Thus, the system behaves as a aggressive neural network that implement a success take- all function with an linked mechanism, which modifies the neighboring synaptic plasticity of the neuron, permit learning to be limited spatially to the local neighborhood of the most active neuron. For each color pixel, consider a neuron map having n*n weight vectors. Each incoming sample is depicted to the weighted vector that is closest according to a suitable distance measure, and the weighted vectors in its neighborhood are updated. The entire set of weighted vectors operates as a background model that is employed for background subtraction in sort to identify moving pixels [1-10].

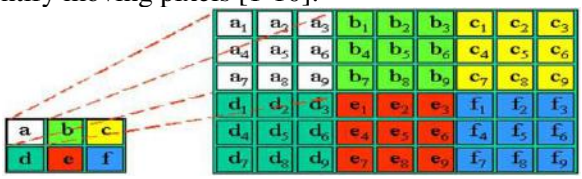


Fig. 4 (Left) Simple image and the (right) neuronal map structure

3. PROPOSED METHOD:

The proposed method is Background subtraction based effective MOD using, Wavelet transform.

The process algorithm is described as follow:

1. Input video
2. Frame Separation
3. Image Sequence
4. Separation of Image Sequence in Current Frame Image and Background Frame Image
5. Apply wavelet transform for both background and current image
6. Subband Differencing
7. Soft threshold
8. Inverse wavelet transform
9. Threshold foreground detection
10. Noise removal
11. Morphological filtering
12. Detection of Moving Object
13. Classification of Object

A. Proposed Method Block diagram:

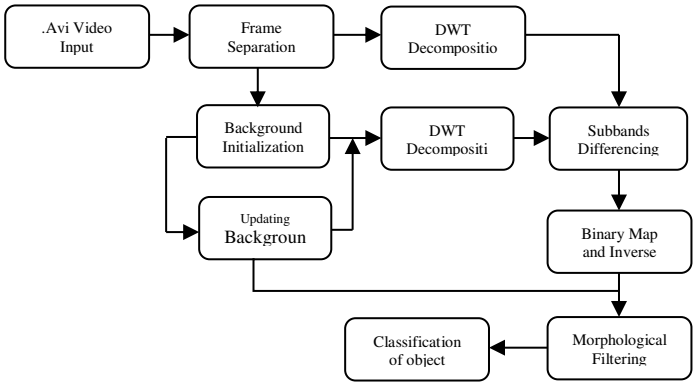


Fig.5 block diagram of proposed method

The proposed method is an approximate median filter based technique in discrete wavelet domain. It uses frame differencing to obtain video object plane which give the changed pixel value from consecutive frames. Primarily, we decomposes two successive frames (I_{n-1} and I_n) using DWT and then apply these approximate median filter method to sense frame difference. For every pixel location (i, j) the co-ordinate of frame

$$FD_n(i, j) = WI_n(i,j) - WI_{n-1}(i,j) \quad (1)$$

where $WI_n(i,j)$ and $WI_{n-1}(i,j)$ are wavelet coefficients of frame $I_n(i,j)$ and $I_{n-1}(i,j)$ respectively. Obtained result may have some noise. Applying soft Thresholding to remove noise. In presence of noise, equation is expressed as:

$$FD_n'(i, j) = FD_n(i, j) - \lambda \quad (2)$$

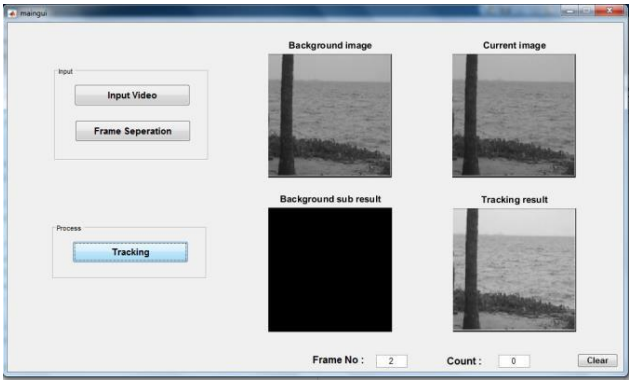
where $FD_n'(i,j)$ is frame difference without noise, λ represent corresponding noise components. For de-noising, soft thresholding technique in wavelet domain is used for estimation of frame difference $FD_n'(i,j)$**.** Inverse wavelet transform is applied to get moving object segmentation in spatial domain i.e. E_n. The obtained segmented object may include a number of disconnected edges due to non-ideal segmentation of moving object edges. Therefore, some morphological operation is needed for post processing of object edge map to generate connected edges. Here, a binary closing morphological operation is used. After applying the morphological operator M (E_n) is obtained which is the segmented moving object.

4. EXPERIMENTS AND RESULTS:

In this work the aim is to build such a surveillance system, which will detect motion even if the moving background, gradual illumination variations and camouflage and shadow into the background, thus

achieves robust detection for different types of videos taken with stationary cameras. To fulfill this aim, strong calculating software called Matlab is used which provides Image Acquisition and Image Processing Toolboxes which make easy for us create a good code.

Experimental results for MOD using the proposed methods have been produced for input video, that represent critical situation for video surveillance systems, and present qualitative results obtained with the proposed method and other three methods also.



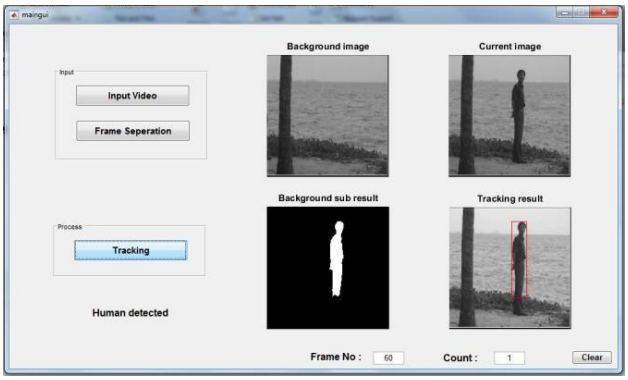


Fig. 5 Tracking

5. CONCLUSION:

In video surveillance, there are many interference factors such as target changes, complex scenes, and target deformation in the moving object tracking. In this paper moving objects detection using discrete wavelet transform domain have been proposed. From the obtained results and their qualitative and quantitative analysis, it can be concluded that the proposed method is performing better object detection and classification. Future work will address on techniques to get better results to improve the human detection methods and occlusion handling in surveillance applications.

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