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A Novel Real Time Motion Detection Algorithm For Videos

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Abstract
Real-time detection of moving objects is vital for video surveillance. Background subtraction serves as a basic method typically used to segment the moving objects in image sequences taken from a camera. Some existing algorithms cannot fine-tune changing circumstances and they need manual calibration in relation to specification of parameters or some hypotheses for dynamic changing background. An adaptive motion segmentation and detection strategy is developed by using motion variation and chromatic characteristics, which eliminates undesired corruption of the background model and it doesn't look on the adaptation coefficient.

In this particular proposed work, a novel real-time motion detection algorithm is proposed for dynamic changing background features. The algorithm integrates the temporal differencing along with optical flow method, double background filtering method and morphological processing techniques to achieve better detection performance. Temporal differencing is designed to detect initial motion areas for the optical-flow calculation to produce real-time and accurate object motion vectors detection. The double background filtering method is obtain and keep a reliable background image to handle variations on environmental changing conditions that is designed to get rid of the background interference and separate the moving objects from it. The morphological processing methods are adopted and mixed with the double background filtering to obtain improved results. The most attractive benefit for this algorithm is that the algorithm does not require to figure out the background model from hundreds of images and can handle quick image variations without prior understanding of the object size and shape.

Keywords – Background Model, Optical Flow model, Image Segmentation, Background detection**.**

I. INTRODUCTION

Increased computational speed of processors has enabled applying vision technology in several fields for instance: Industrial automation, Video security, transportation and automotive. Background subtraction forms significant element of many of these applications. The central idea behind this module is always to utilize the visual properties of this very scene for building an improved representation that could be used when it comes to the classification belonging to new observation as foreground or background [1,5].

Background subtraction involves calculating a reference image, subtracting each new frame from this image and threshold the result. Generated results are basically a binary segmentation of a given image which highlights regions of non-stationary objects. The only form of the reference image is naturally a time-averaged background image [7-8]. This method is prone to many problems and requires a learning period absent of foreground objects. The motion of background objects following the training period and foreground objects motionless during the training period will be considered as permanent foreground objects. Additionally, the approach cannot handle gradual illumination changes in the scene. Such issues result in the necessity that any solution must constantly re-estimate the background model. Many adaptive background-modeling methods have been proposed to contend with these slowly-changing stationary signals. Friedman and Russell modeled each pixel inside a camera scene by an adaptive parametric mixture model of three Gaussian distributions [4].Several techniques for moving object detection have already been proposed in [2]-[8], among them the two main representative approaches are dependent on optical flow and background subtraction. The most commonly used approach in presence of still cameras is background subtraction. The strategy in this strategy is to use a model of the background and compare the present image with a reference. In this way the foreground objects comprised in the scene are detected. The tec of statistical model according to the background subtraction is flexible and quick, however the background scene and the camera will have to be stationary if this method is applied. The optical flow is an approximation of the local image motion and specifies how much each image pixel moves between adjacent images. It could achieve success of motion detection within the presence of camera motion or background changing. In accordance with the smoothness constraint, the corresponding points in the two successive frames should not move more than a few pixels. For the uncertain environment, this means that the camera motion or background changing should be relatively small. The method based upon optical flow is complex, however it can detect the motion accurately even not knowing the background[2,4,6].

II. LITERATURE SURVEY

Friedman et. al.[9] use a mixture of three Normal distributions to model the visual properties in traffic surveillance applications. Three hypothesis are considered - road, shadow and vehicles. The EM algorithm is used, which although optimal, is computationally quite expensive.

In [7], this idea is extended by using multiple Gaussians to model the scene and develop a fast approximate method for updating the parameters of the model incrementally. Such an approach is capable of dealing with multiple hypotheses for the background and can be useful in scenes such as waving trees, beaches, escalators, rain or snow. The mixture-of-Gaussians method is quite popular and was to be the basis for a large number of related techniques [1,3]. In [3], a statistical characterization of the error associated with this algorithm is studied.

The foreground and background classification is based on the following observation: image blocks in the background should have little change in their color distortion. The brightness distortion is very helpful in detecting shadows. In the proposed adaptive background modeling and classification scheme, we use the image data in the past ?frames to compute the joint distribution of theses to build a background model. Based on these two features and background model, we classify the image block into foreground or background. It should be noted that the value of the size of the shifting window should be appropriately chosen. If it is too small, the background is updated very fast. This implies that the time duration of the shifting window should be quite large. However, if the time duration is too large, the background is updated very slowly. If a new object is introduced into the background or a background object is moved, before the background is updated, this object will be classified into the foreground and hence become part of the silhouette. To solve this problem, we utilize high-level knowledge about object motion to guide the adaptive update of the background model. Our basic idea is to track the object and predict its region in the scene. The image blocks which contain the object should be updated very slowly such that the object would not be updated as background [6,7].

Existing system drawbacks:
1) Adaptability to illumination change: The background model should adapt to gradual illumination changes.2) Dynamic textures adaptation: The background model should be able to adapt to dynamic background movements, which are not of interest for visual surveillance, such as moving curtains.3) Noise tolerance: The background model should exhibit appropriate noise immunity.4) Sensitivity to clutter motion: The background model should not be sensitive to repetitive clutter motion.5) Bootstrapping: The background model should be properly generated at the beginning of the sequence.6) Convenient implementation: The background model should be able to be set up fast and reliably.7) A self-adaptive background matching framework is not suited to select suitable background candidates of background model generation.8) The existing model is applied to extract moving objects of the video sequence depends on Cauchy distribution .

Existing System work flow:
In existing approach [5] novel motion detection method with anew background model and a Cauchy distribution model. Fig. 1 shows the flowchart of the proposed method. To facilitate the quick determination of the suitable background region, each pixel is checked by the temporal match method in the proposed background model at each frame. Subtracting the generated background model from each input frame and we can obtain the absolute differential values. Finally, we develop a conditional Cauchy distribution model to generate an accurate motion mask for the accurate detection of moving objects at each frame.

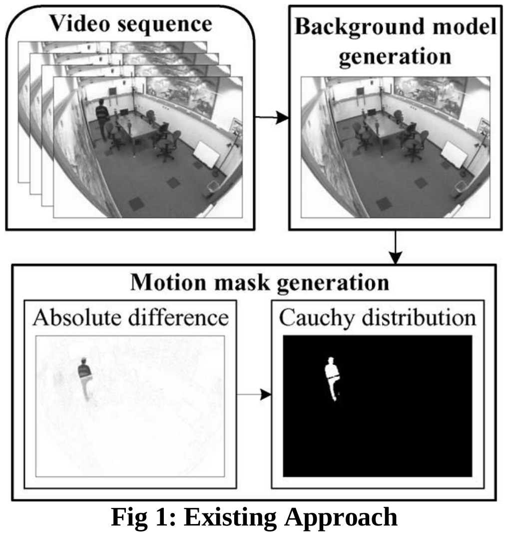


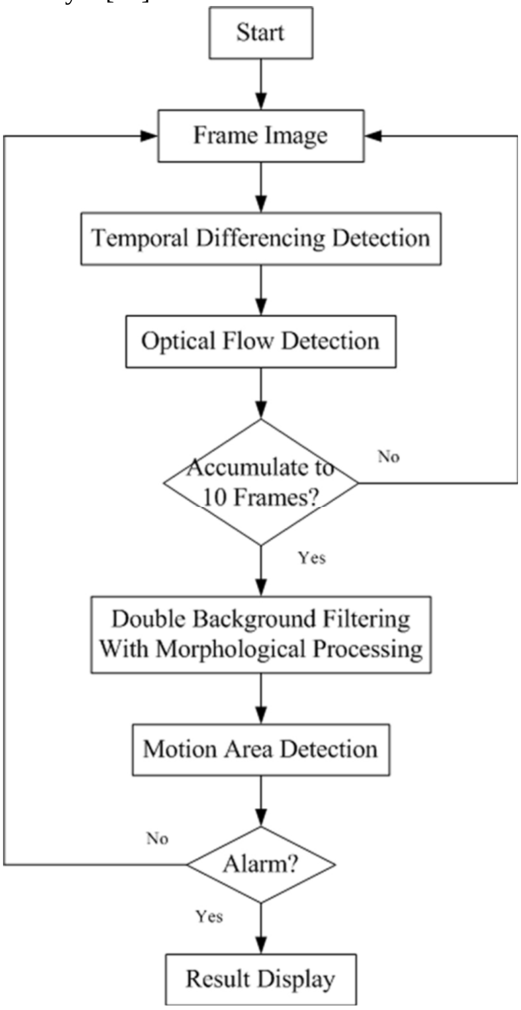
Fig 1: Existing Approach

III. PROPOSED SYSTEM

In the proposed system which comprises of five steps:

(1) Temporal differencing method, which is used to detect the initial coarse object motion area; Temporal differencing is based on frame difference which attempts to detect moving regions by making use of the difference of consecutive frames (two or three) in a video sequence.
(2) Optical flow detection, which is based on the result of (1) to calculate optical flow for each frame.
(3) Double background filtering method with morphological processing, which is used to eliminate the background interference and keep the foreground moving information[11];

(4) Motion area detection, which is used to detect the moving object and give the alarming in time.
5) Normal distribution based performance analysis[10].



Proposed Algorithm:
(1) Optical flow detection, in which frame-to-frame optical flow is calculated[11];
(2) Double background filtering, which is the method used to separate the background and foreground information;
(3) Region-based matching, the moving object is detected for alarming. The final processing result is a binary image in which the background area and moving object area are shown as white color, the other areas are shown in black color. The movement in space motion field, but on the image plane, the object motion is always embodied throughout the difference of varied image grayscale distribution in image sequences. So, in the event the motion field in space is transformed to image, it can be represented as optical flow field which shows the changing trend of grayscale of each one pixel upon the image. The optical flow can easily be consideration as transient velocity field which is caused by the motion of pixel[6].

The Normal Gaussian blur is a method of image-blurring or removal filter that utilizes a Modified Normal Gaussian function (which also expresses the usual distribution in statistics) for calculating the transformation to use to each pixel inside the image. The equation of a N function in one dimension is (1)

In two dimensions, it is the product of two such Normal Gaussians, one in every dimension: where x will be the distance seen from the origin among the horizontal axis, y happens to be the distance seen from the origin within the vertical axis, and s will be the standard deviation of the Normalized Gaussian distribution. When applied in two dimensions, this formula causes a surface whose contours are concentric circles with a Gaussian distribution from the center point. Values because of this distribution are chosen to build a convolution matrix which is put on the original image. Each pixel's new value is set to a weighted average of your pixel's neighborhood. The first pixel's value receives the heaviest weight (undergoing the highest Gaussian value) and neighboring pixels receive smaller weights the distance towards the original pixel increases[11].

$$NG(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{x^2}{2\sigma^2}} \quad \text{------ (1)}$$

$$NG(x) = \frac{1}{2\pi\sigma^2} e^{-\frac{x^2+y^2}{2\sigma^2}} \quad \text{--------(2)}$$

IV. RESULTS

Existing System Result:

Proposed Results:

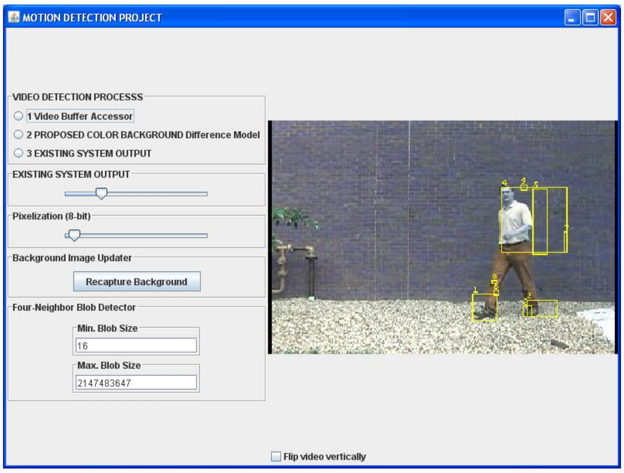


Fig 2: Proposed Motion Detection in color image

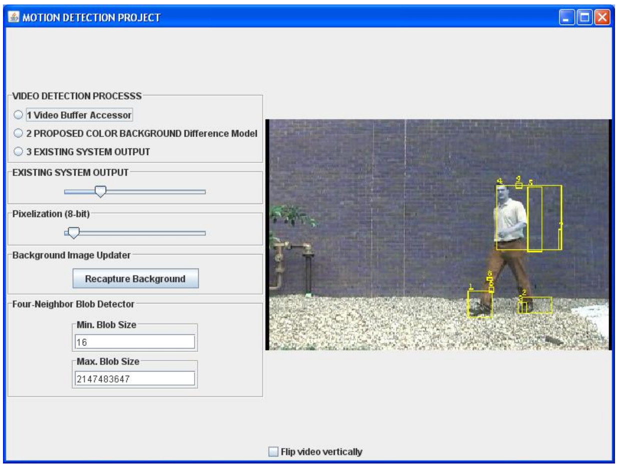


Fig 3: Proposed Motion Detection vector sequence identification

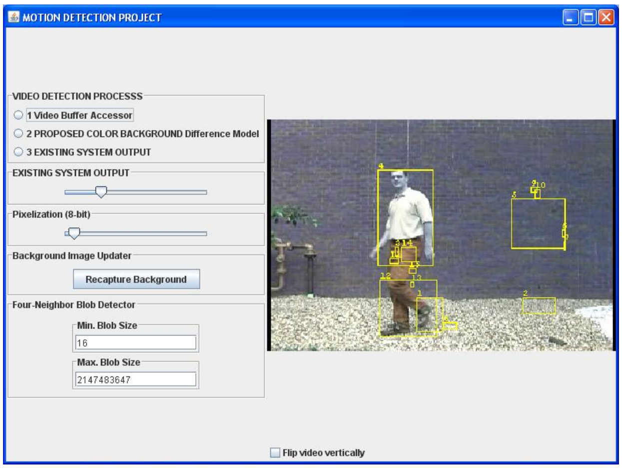


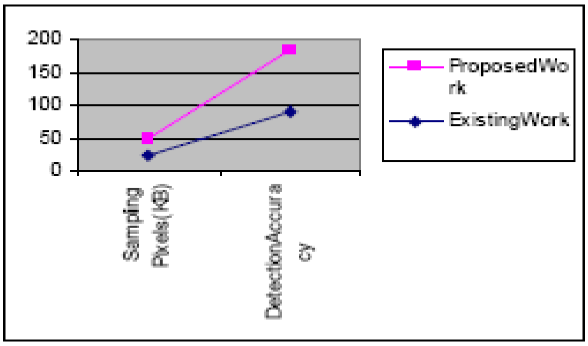
Fig 4: Proposed Motion Detection with background path recognition

Fig 5: Proposed Motion Detection in color image with background subtraction methodology.

V. CONCLUSION AND FUTURE SCOPE

Within this paper a robust approach is proposed for motion detection using temporal differencing method, optical flow method, double background filtering method and morphological processing using normalized Gaussian approach. The paper integrates the advantages of these all methods and presents a fast and robust motion detection algorithm using background filtering approach. Then the optical flow is applied based on the effect of temporal differencing method to calculate any possible movement pixel for any video frame. As a consequence of the temporal differencing method, the calculation need of the optical flow is reduced greatly and the moving area will still be detected accurately. In future this proposed system is implemented in online video background subtraction purpose for giving better view to the online videos to the users.

Result Analysis :



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