An Efficient Hybrid Approach for Detecting and Tracking Moving Objects for Video Surveillance

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Abstract

In visual surveillance applications, detection and identification of an object in video frames stream is to be considered as critical task. In recent years, researchers designed many algorithms named Background Subtraction, Optical Flow and Temporal Differencing, etc., to detecting the real time moving object. Among these, background subtraction algorithm used widely because it has frame difference, approximate median, Gaussian mixture. The aim of the proposed work is to detect real time moving objects could be done efficacy with the help of mixture of Gaussian algorithm which requires less in memory and produce good in result. Here, unwanted noise can be removed by using wiener filter, select YC_bC_r color space for detecting the foreground object which is fit for light / indoor shadow. Further, test has been made on various video clip and from the experimental results, complexity is easily reduce as well as foreground objects are detected without noise by using Gaussian mixture model.

Keywords: Object detection; Wiener Filter; Background Difference; Gaussian Mixture; YC_bC_r;

1. Introduction

Video surveillance systems are widely used in recent years in monitoring humans and their behaviours. This is used to analyze the habitual and unauthorized activities of humans [1]**.** A human action recognition system process image sequences captured by video cameras monitoring sensitive areas such as bank, departmental stores, parking lots and country border to determine whether one or more humans engaged are suspicious or under criminal activity [13]. In all these applications extracting moving object from the video sequence is a key operation. Typically, the usual approach for extracting the moving object from the background scene is the background subtraction which provides the complete feature data from the current image [2]. Background subtraction techniques are mostly used for motion detection in many real-time vision surveillance applications. In these approaches, difference between the coming frame and

the background image is performed to detect foreground objects [3]. The Mixture of Gaussians technique was first introduced by Stauffer and Grimson in [4]. In Gaussian mixture method, first frame as Background image and convert it into gray scale and next frame as current image convert it also in gray scale. Then calculate mean of previous frames and initialize variables and use Gaussian probability density function to evaluate the pixel intensity value. It finds the difference of the current pixel's intensity value and mean of the previous values. If the difference of the current image's pixel value and the mean pixel value is greater than the product of a constant value and standard deviation then it is classified as foreground [5].

2. Related work

Pankaj Kumar et al [6] presents comparative study of different colorspaces for detect foreground and their shadows. In this study, they consider 5 type of color spaces "RGB", "XYZ", "YC_rC_b", "HSV", and the normalized "rgb" . A results conclude that YC_rC_b is best color space for object detection and robust to light.

Adesh Hardas et al [3] has applied background subtraction model for object detection which is moving and analyzing the performance of the proposed scheme in different color spaces namely "HSV", "RGB", "YCbCr". From that analysis, HSV and RGB are fit to outdoor shadow / dark and YCbCr is best for indoor shadow / light.

In this work [7], a GMM based Basic Background Subtraction (BBS) model is used for background modeling. The connected component and blob labeling has been used to improve the model with a threshold. Morphological operators are used to improve the foreground information with a suitable structure element.

In this method [8] developed two background/foreground segmentation approaches based on a foreground subtraction from a background model, which uses scene colour and motion information**.**

The proposed algorithm [9] has three stages called color extraction , foreground detection using Gaussian Mixture Model and object tracking using Blob Analysis . Initially color extraction is done to extract the required color from a particular picture frame, after color extraction the moving objects are detected using Gaussian Mixture Model and Blob Analysis is applied on consecutive frames of to observe the motion.

3. Proposed Scheme

The aim of proposed scheme is to detect or identify object and label it which are moving in sequence and series of frames of input video.

3.1 Input Video

The first step is to capture video clip through CCTV/ Camera and take as an input. In this system, AVI Video is taken due to capability for storing the audio and the video file.

3.2 YCbCr Color Space

It is used as a part of the color image pipeline in video and digital photography systems. Y is the luma component and CB and CR are the blue difference and red-difference chroma components. The equations of the RGB to YCbCr are formed in a way that rotates the entire nominal RGB color cube and scales it to fit within a (larger) YCbCr color cube [10].

$$\begin{aligned} Y &= 0.2989 \times R + 0.5866 \times G + 0.1145 \times B \\ Cb &= -0.1688 \times R - 0.3312 \times G + 0.5000 \times B \\ Cr &= 0.5000 \times R - 0.4184 \times G - 0.0816 \times B \end{aligned}$$

3.3 Wiener Filter

Wiener filters are characterized by the following[12]:

- Assumption: signal and (additive) noise are stationary linear stochastic processes with known spectral characteristics or known autocorrelation and cross-correlation
- Requirement: the filter must be physically realizable/causal (this requirement can be dropped, resulting in a non-causal solution)
- Performance criterion: minimum mean-square error (MMSE)

A Wiener filter is utilized in the wavelet domain in order to remove video noise [11].

3.4 Steps of the Proposed Algorithm

Following steps are explained the entire process of proposed method;

Step 1: In this scheme, the first step is to read the captured video clip as an input.

Step 2: Due to high computation complexity, video couldn't be process directly so it is extracted into frames at defined rate.

Step 3: Third, these frames are having RGB color space so they are converted in to YCbCr . YCbCr color space has 1-luminance(Y) and 2-Chrominance components (Cb and Cr). YCbCr color space is found to be more robust to llumination change and thus, this color space is suit to light / indoor shadow. The block diagram of proposed method is shown in the fig.1,

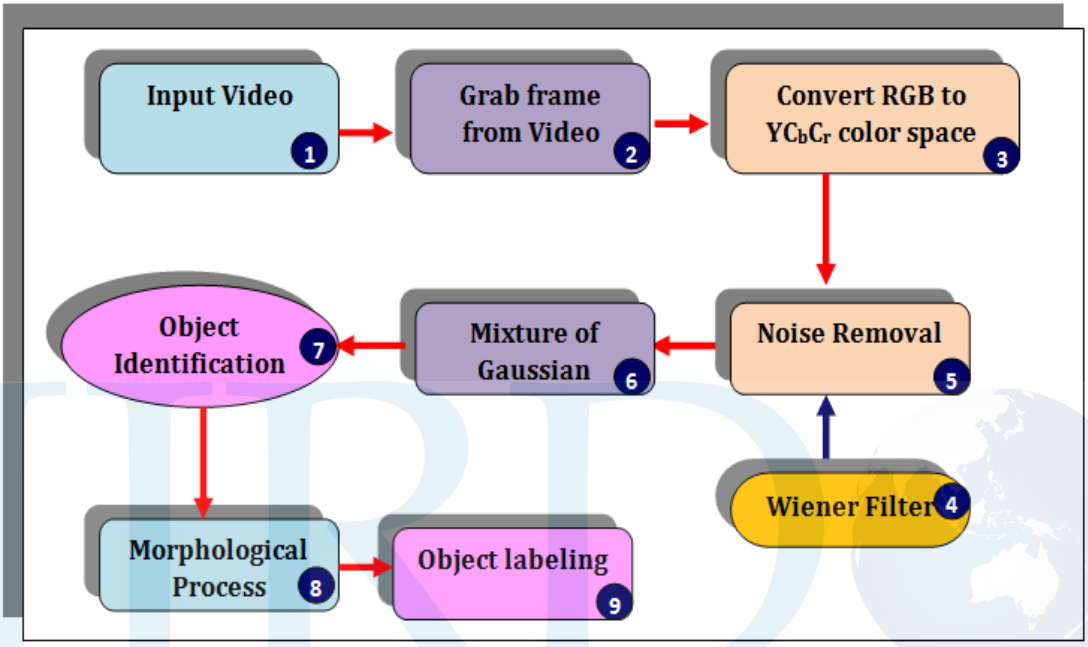


Figure 1. The flowchart of proposed work

Step 4: In fourth step, if frames are processed with noise then will obtain poor results so it could easily remove with the help of wiener filter which gives best outcome for subsequent process.

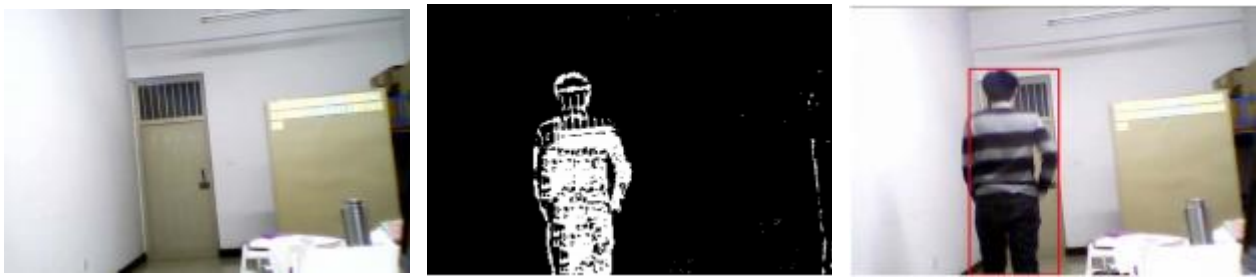
Step 5: Fifth, calculate number of Gaussian components and also calculate mean by employed standard deviation technique on pixels and determine the difference of pixel values from mean. If difference is greater than product of a constant then detect the moving object.

Step 6: Sixth, morphological process is done on detected object frames to fill up the unfilled holes, smoothing and extracting edges.

Step 7: In last step, label is given to detected object using shape based image retrieval technique. Here, moving object is label by rectangle box.

4. Result and Discussions

The real time video sequences are acquired at the rate of 26 frames/second with the frame size of 640×360 pixels resolution. We employ Mixture of Gaussian algorithm with threshold value followed by morphological operations to detect the moving objects. In fig 1 (a) represents the input video, (b) represents the foreground detection and finally (c) represents detecting the objects using the proposed method.



(a) Input Frame (b) Foreground Detection (c)Object Detection

Fig.1. Segmentation Results

5. Conclusion

Mixture of Gaussian algorithm based Detecting and Tracking Moving Objects for Video Surveillance is proposed in this research work. YC_bC_r color space is found to be more robust to illumination change and thus, this color space is suit to light / indoor shadow**.** Then, background subtraction based on codebook and Bayesian classification is researched and analyzed. Finally moving object is detected and tracked by finding colour. This method is useful for time efficient, and it works well for small numbers of moving objects. In future efficient algorithms to reduce computational cost and to decrease the time required for detecting the object for variety of videos containing diversified characteristics and increase accuracy rate.

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