Simple People Tracking System Using a Static Camera

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Abstract- People tracking systems are used in surveillance applications. Nowadays surveillance systems are very common in offices, ATM centers, shopping malls etc. In this paper, a method to detect and track humans from a video input is explained. For the simplicity of the work the input video is taken from a stationary camera. In this method, there are 2 basic steps (i) Foreground Extraction using Gaussian statistical model and (ii) Tracking of human is done in RGB color Space.

Keywords –Foreground Extraction, Gaussian statistical model, Bounding Box

I. INTRODUCTION

Surveillance systems play one of the major roles in many applications regarding the betterment of present human lives. Detecting humans in video is very difficult process; we have to use either a skin color detection algorithm or edge detection algorithm. Since skin color detection is done easily using Gaussian background Model method here also we are using that one.[1] There are other methods used for human tracking in surveillance systems they are given in[4-6].
As a simple tracking system 1st we are using input video which has a person walking and trying to get the output which shows a bounding box around the person. The algorithm is implemented using MATLAB. Advantage of this method we are using shadow removal techniques in RGB color space so background flickers can be eliminated.

The remaining part of the paper is organized as follows. The proposed method and extraction algorithms are explained in section II. Experimental results for the algorithm implemented are given in section III. Finally the conclusion for the algorithm implemented is given in section IV.

II. PROPOSED ALGORITHM

A. Proposed method–

First we have to record a real time video using MATLAB model either we can use a web camera or the in-built laptop camera for recording the videos. It's better to have a single person walking video. By considering different threshold values and considering pixel range in each frames of the video we can make changes in algorithm so that it suits other videos also.

The basic steps involved in this method are given in Figure 1. The basic steps involved are: (i) Foreground Extraction and (ii) tracking. In foreground Extraction, analysis of the video is done by converting each pixel in each frame into corresponding Gaussian background model and from the selected pixel values. In this section we are doing some morphological operations to eliminate the unwanted movements in the video. In the tracking section, first we calculate the computed background, each frame is taken independently and subtracted to get difference frame. Finally connected components are calculated and bounding box are drawn on each frame.

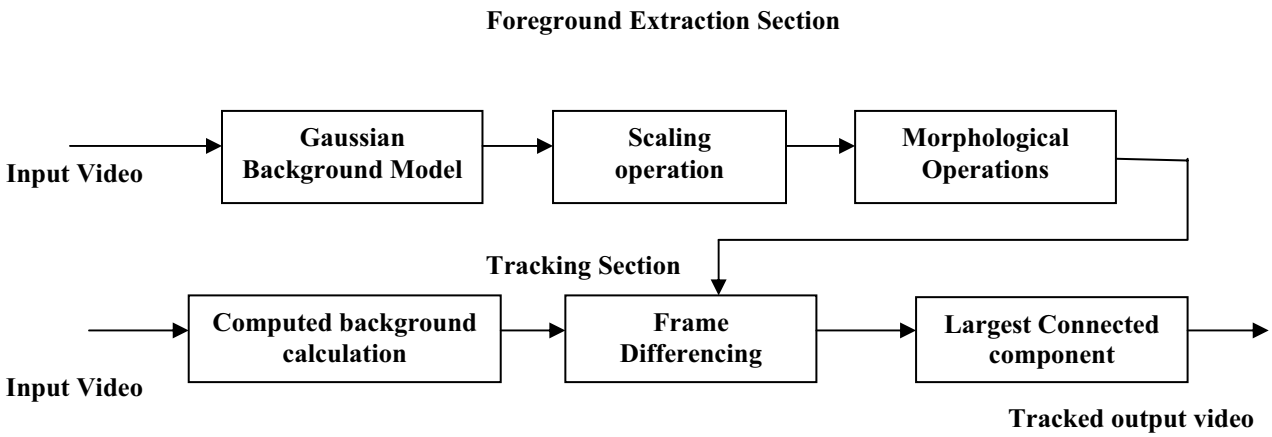


Figure 1. Basic steps involved

B. People tracking system algorithm –

The steps involved are separated into 2 sections. First is the foreground extraction in which we are extracting the moving area which includes both inanimate and human motions. In the second method we are tracking the humans with the help of the threshold value which is calculated from the foreground section.

The various steps in the extraction algorithm is explained below:

We can use either skin color thresholding or edge detection algorithm to find humans in the image. But considering a video analysis both are time consuming process so we use the statistical approach to find the moving region. From[] it is clear that by using Gaussian Background Model we can separate the moving area corresponding to skin color. So we are calculating the Gaussian Background Model for each pixel values in each frame which output the mean and standard deviations using the equation given below,

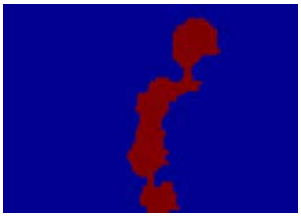
$$\mu = \frac{1}{p} \cdot \sum_{i=1}^{p} [I(i)]$$

$$\sigma = \frac{1}{p} \cdot \sum_{i=1}^{p} [I(i) - \mu] \qquad (1)$$

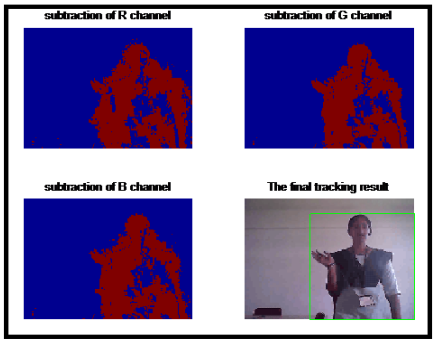
Where p is the Pixel value, I is the intensity corresponding to that pixel, μ is the mean and is the standard deviation. Then we calculate the average value for background deviation which is used as the threshold value for the tracking section. Under scaling operation output pixels are selected in the range of .25 to .75 deviation range, others are discarded. So that next operations are done in these pixels only which will increase the processing speed.

To show the foreground extracted image some morphological operations like dilation after erosion is done to eliminate the unwanted objects under motion. Foreground Extracted video frames are shown in figure no:2.(b)

(a)



(b)



(c)

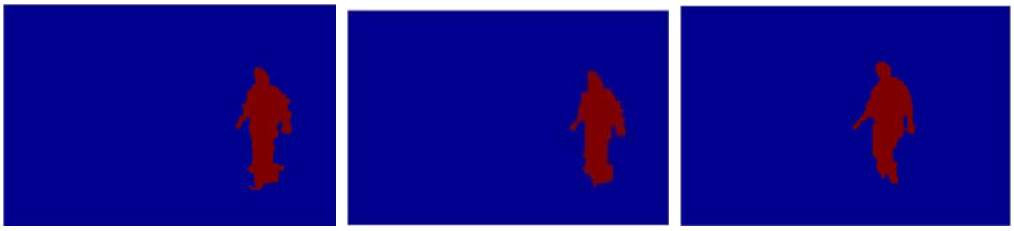
Figure 2: (a) first frame of the recorded video, (b) Foreground extracted output of first frame, (c) final tracking result of first frame.

In the tracking section we are taking the input video again and each frame is added to the earlier to make the computed background frame. In the frame differencing step each frame is subtracted from the computed background. The output is separated into Red, Green, Blue planes and check whether each pixel value is greater than the threshold calculated in the foreground extraction section. By doing this we can eliminate the shadow effects and background flickers. Next we find the largest connected component by using bwlabel instruction and bounding boxes are drawn using regionprops instruction. Tracked output for the first frame in the video is shown in figure no: 2 (c).

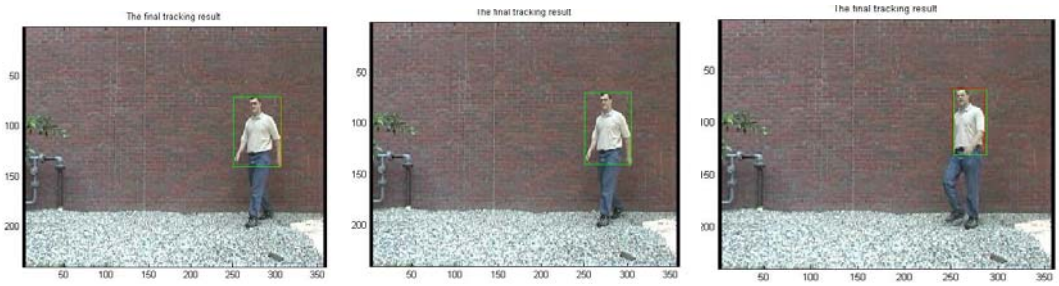
III. Experiment and Result

The input used is obtained from the recorded video using MATLAB model itself. So that analysis in real time can be done. If the input video contains the motion of object similar to the skin color which cannot be eliminated. Output obtained from the video is shown in figure no: 2 and figure no: 3. Video is recorded for 2 minutes and analysis of 75 frames is done.

(a)



(b)



(C)

Figure no:3 (a)input video frames, (b) foreground extracted output, (c) tracked output.

IV.CONCLUSION

Surveillance systems are mainly done for security applications. As we all know human skin color varies depending on races there are some problems with this code. There are so many problems regarding the illumination changes, shadow removal, occlusion handling much more researches have to be done in this field. By connecting one or more static cameras to a common pool we can increase area under observation but care should be taken in camera hand off action. We can improve the tracking by using the Gaussian mixture model to represent the foreground extraction and also foot location algorithm can be used to detect humans. In which the pixels from head to foot are considered to draw the bounding box.

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