Relative comparison of Background Subtraction Techniques in Moving Object Detection

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Abstract

Moving object detection is a computer technology that deals with detection non stationary object in digital image & videos. There are many methods used to detect moving object like background subtraction, modified background subtraction, Gaussian mixture model, wavelet based & optical flow based method. The purpose of this paper is to do comparative study between background subtraction and modified background subtraction. The moving object detection method have been implemented using MATLAB and results are compared based on completeness of detected object, noise etc.

Keywords- Background Subtraction, Background Model, Motion Detection, Object Detection, Video Surveillance, Spatial Color Information, MATLAB

I. INTRODUCTION

Background subtraction in a technique in the fields of image processing & computer vision where in an images foreground is extracted for further processing generally an image region of interest are objects in its foreground. So this This technology is also called as foreground detection , background subtraction is a widely used approach for detecting moving object in video from static background hypothesis which is often not applicable in real environment. To detect the moving objects in a video sequence based on background subtraction approaches, a background model should be generated at the first time before subtract it from each image of the sequence and then segmenting the moving objects. But this detection can be difficult when the environment is influenced by illumination and weather changes. In The goal to solve the problem of environmental illumination changes in the background model and to classify pixels of the current image as foreground or background, a new method of background subtraction is presented in this. Firstly, the spatial color information is used to generate the background of each color space (R, G, and B) of the sequence. The absolute difference is computed to subtracting the background before compute the binary image of the moving objects using a threshold. This threshold is also used to update the background at each new image. The experimental results demonstrate that our approach is effective and accurate for moving objects detection and the use of spatial color information was robust to environmental illumination change.

II. METHODOLOGY

A. Background Subtraction

Background subtraction in a technique in the fields of image processing & computer vision where in an images foreground is extracted for further processing generally an image region of interest are objects in its foreground. So this This technology is also called as foreground detection , background subtraction is a widely used approach for detecting moving object in video from static background hypothesis which is often not applicable in real environment.

For motion detection, two images preferably of the same size are taken from video. In that one image is initialized as the background image in which the moving object is not present and the second image is the current image. And each image has two models one is the foreground and the other is background model. The foreground model is the model in which the moving object is present and background model is the model in which the moving object is not present. The first process for motion detection is image initialization. Image initialization is process that initializes the background image. For example, in the video the number of the frames with respect to the time, out of these frame one is initialized as the background image by tacking some assumption. Hence initialization of background is essential preprocessing operation for motion detection. And the preprocessing is done on

each frame and the preprocessing is done by the mean filter for reducing the noise from the image. After the preprocessing the frames are given to the background subtraction algorithm. That subtracted image is then segmented using Thresholding. The background subtraction algorithm is design in the Matlab.

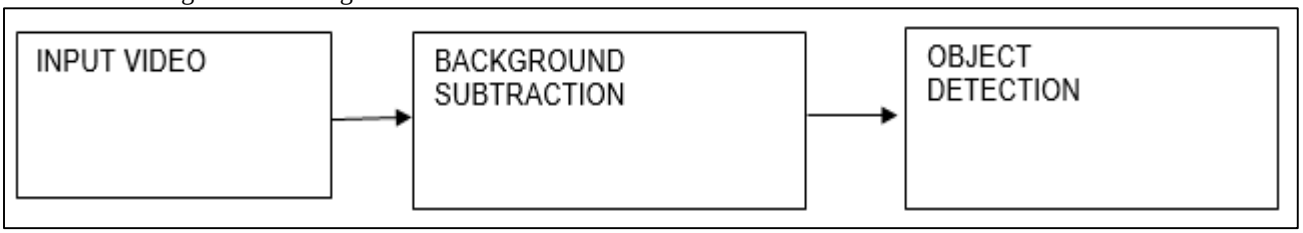

Fig. 1: Background Subtraction Algorithm

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B. Background Subtraction Flowchart

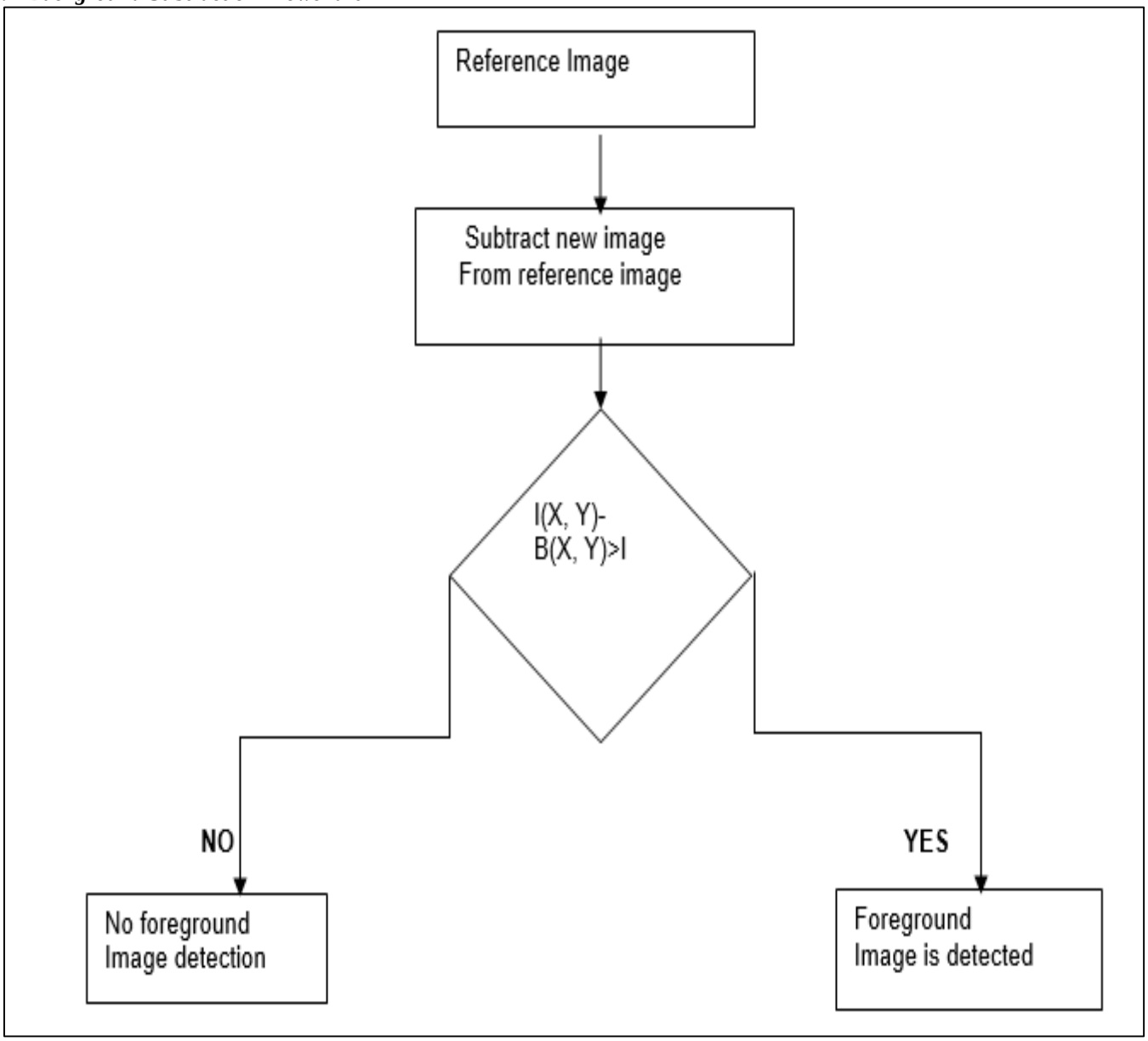


Fig. 2: Background subtraction Flowchart

C. Background Subtraction Modified Method

In the background subtraction modified method is includes background initialization, foreground detection and object detection. In the background subtraction modified method simplest way to model the background is to acquire a background image. Then using the background subtraction modified technique and the operation, the moving objects can be detected in each image of the given video sequence. In some environments effect the background is not available and can always be changed like illumination changes. In background subtraction Modified method includes background update shown in fig.2

1) Background Initialization

The background model is allowed to represent the pixels of the image sequence which has been steady in value for a long time. In this paper, the background initialization is made by using the median of the 100 first video images where objects were present. The background image must be updated in each new image of the sequence to adapt it over time to some environmental changes. For this reason, in the section C a selective maintenance scheme is adopted.

2) Foreground Detection

In the background subtraction approaches, when the background image is generated the difference between the current image in the sequence and the background image is calculated. Then, a threshold operation is applied to decide if a pixel belongs to the background or to the moving object. The selection of the best thresh1old can be difficult. The most algorithms select it by testing a set of threshold values and then choose the one which is given the best results. So this is threshold is static for the all pixels of image and some pixel of the moving object can be classified as background. To solve this problem, the background subtraction technique is used to compute the threshold. This threshold will be selected when the result of absolute differences between the background and the current image is significant.

3) Background Update

A background subtraction algorithm should be able to solve some problems or critical situations like the presence of noise, light changes and temporal and permanent variation in background objects. These different critical situations can be handled in the different steps of the background subtraction. In this section, our focus is to update the background .the idea is to update a background pixel (x, y) by pixel value of the new image if this pixel is classified as background, and by the pixel value of the background at t-1 if the pixel classified as foreground.

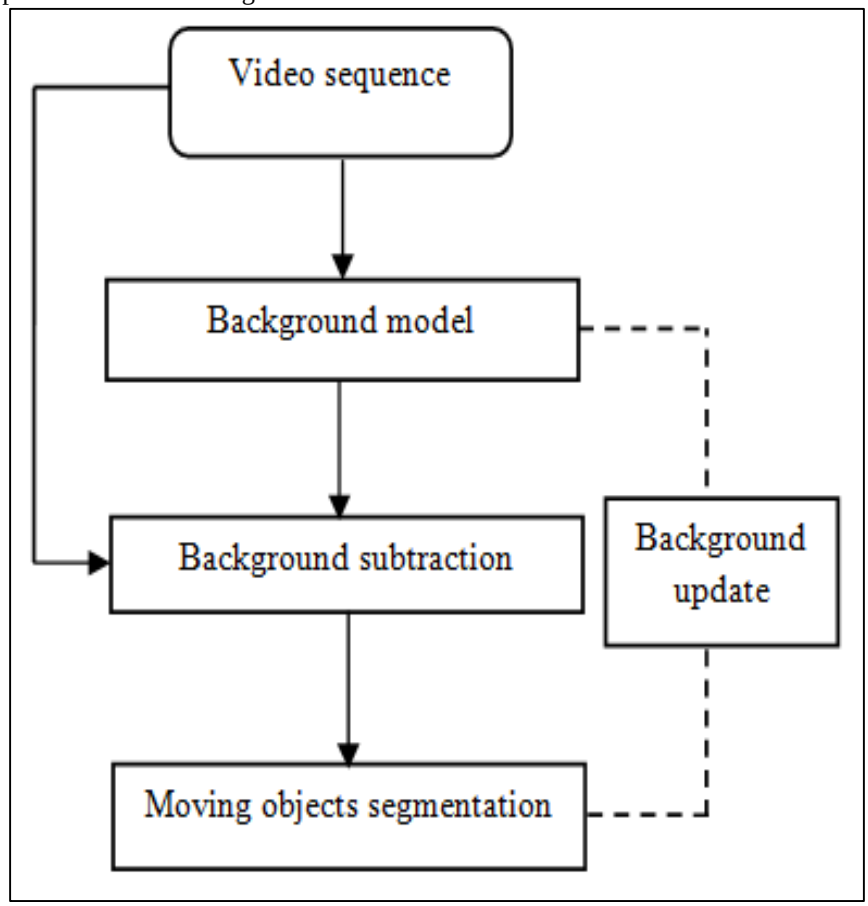


Fig. 2: Background Subtraction Modified Method Algorithm

D. Flowchart

1) Modified Background Subtraction

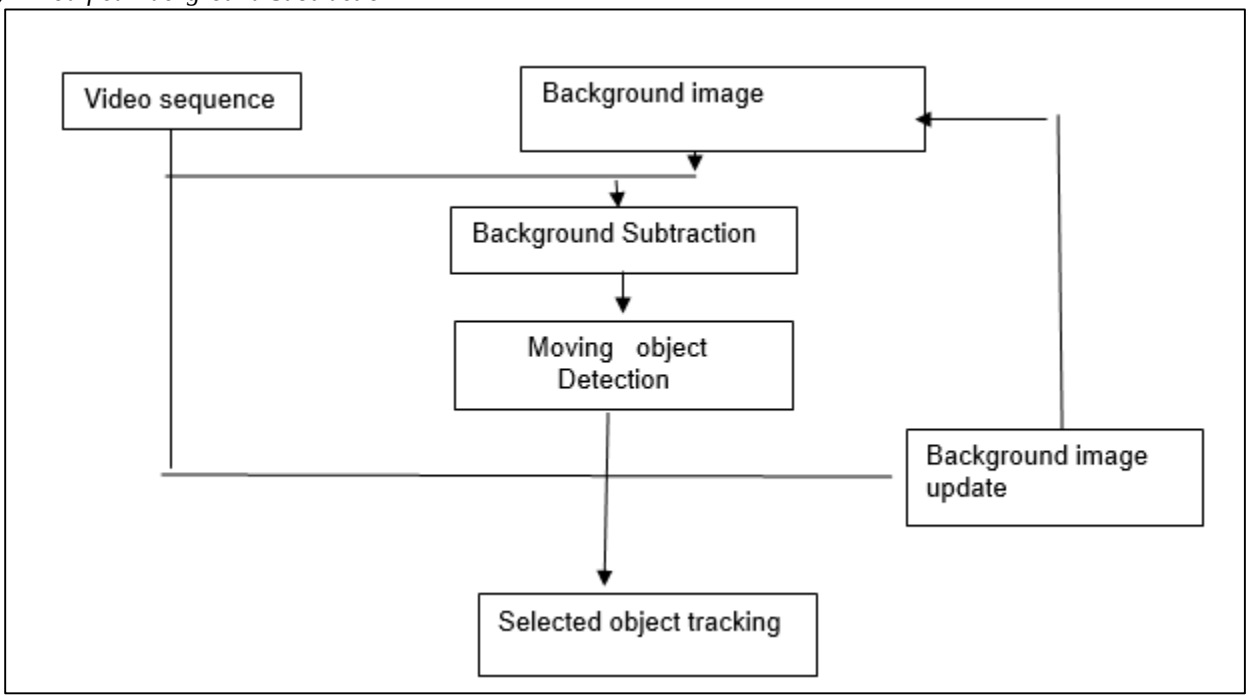


Fig. 4: Flowchart of Modified Background Subtraction

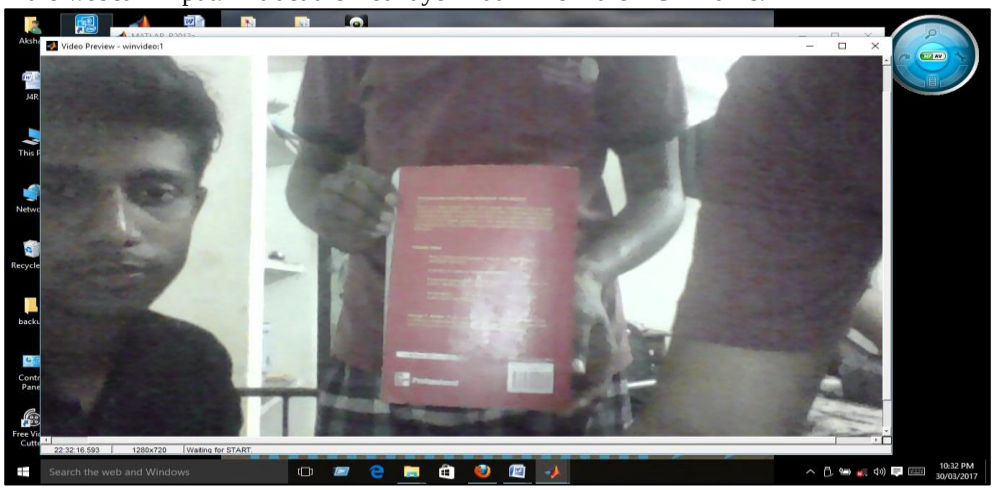
III. OUTPUT OVERVIEW

1) Background Subtraction

Input:

Input by Webcam:-

The background subtraction algorithm is used for the detection of the moving object in the surveillance area. The demonstration system has the set up for the implementation of proposed system in the Matlab software. Here the reference image is initialized in the code by webcam and then the subtraction of the current frame is done. And after the subtraction of the both frame the subtracted image is display on the screen. The subtracted image shows the moving object in the white color and the background is black. The coding is done in Matlab and the following results are obtains. In the Matlab coding the initialization of the web camera of lab-top is done and it will captured the video. We get input from webcam from this detection of red color done. For that we first acquire an RGB frame from the webcam input. Extract the Red layer matrix from the RGB frame.



Output:

The reference image which is initialized as the background image. This image is referred as background image because there is no any moving object. In the real time extraction the background image processing approach is used to provide the most complete

feature dataset, but it is extremely sensitive to dynamic scene changes due to lighting and extraneous events. Background image is not fixed and it must adapt to motion changes like tree branch move, changes in background because of objects entering in a scene, stay for longer period without motion. For detection of red color from frame we get grey image of the RGB frame. Subtracted the gray frame from the red frame then red color will be detected.

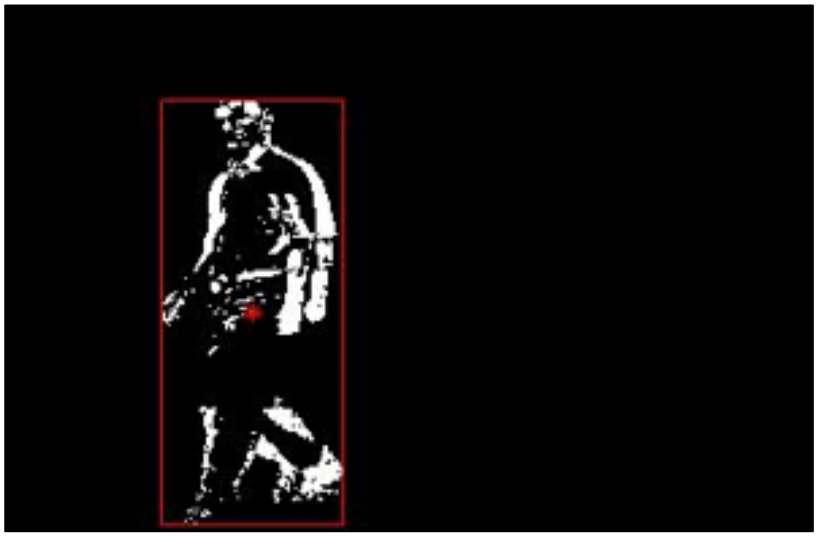
2) Modified Background Subtraction Technique

Input:

We get input from video surveillance to detect moving object. The video frame will get in sequence manner then background is initialization was done for subtraction of current frame to background frame of video.

Output:

After subtraction of current frame from the background frame by the Appling threshold value we get the output of the detected moving object. This method is modified method of background subtraction method.in this we get the perfect moving object detected output



IV. COMPARISON TABLE

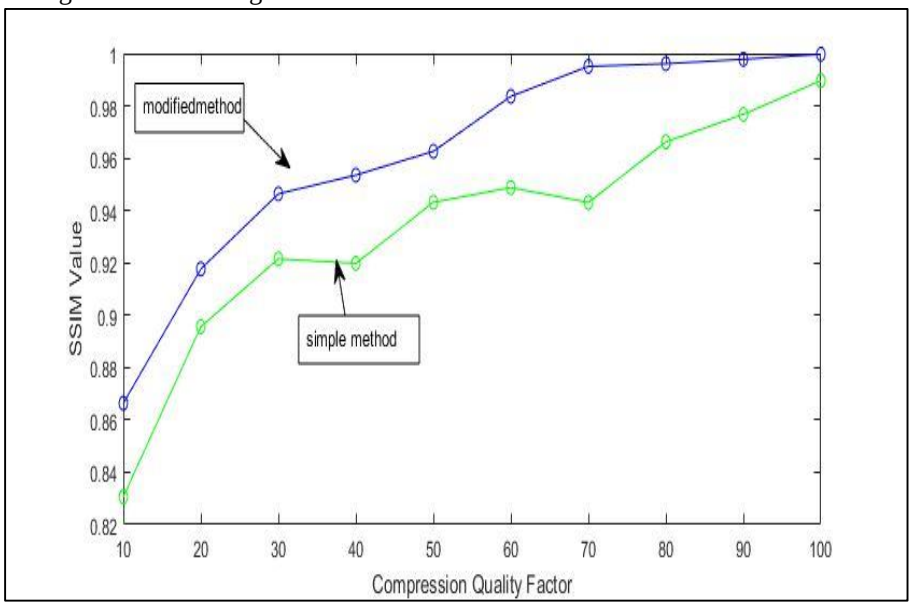
	Background Subtraction	*Background Subtraction Modified Method*
1	*Detects motion quite well despite data loss due to binary conversion of the subtracted image*	*Partially detects motion of only one cap*
2	*Minor visual detection*	*Minor visual detection*
3	*Great visual detection (detects movement of the whole body)*	*Unable to detect the motion of the belts*
4	*Detection of strong edges only*	*Unable to detect the upper cap and the belts*
5	*Detection quality almost similar to that of algorithm*	*Partially detects both the caps but cannot detect movements of the belts*
6	*Detects movement of the man but erroneously detects several portions of the still pavement as moving objects*	*Great visual detection – detects movement of both the caps and the lower belt; slightly detects movement of the upper belt as well*
7	*Detection of strong edges only (no false detection) However, detection quality is lower than that of Sober detection*	*Unable to detect the motion of the belts However, detection quality is better than that of Sober detection*

A. Graphically Comparison of this Two Method

While the final arbiter of image quality is the human viewer, efforts have been made to create objective measures of quality. This can be useful for many applications. Many objective measures of quality require the existence of a distortion-free copy of an image, called the reference image that can be used for comparison with the image whose quality is to be measured. The dimensions of the reference image matrix and the dimensions of the degraded image matrix must be identical. The Image Processing Toolbox provides several function that can be used to measure quality:

Compression Quality Factor:-While the final arbiter of image quality is the human viewer, efforts have been made to create objective measures of quality. This can be useful for many applications. Many objective measures of quality require the existence of a distortion-free copy of an image, called the reference image that can be used for comparison with the image whose quality is to be measured. The dimensions of the reference image matrix and the dimensions of the degraded image matrix must be identical. The Image Processing Toolbox provides several function that can be used to measure quality

SSIM:-he Structural Similarity (SSIM) Index measure of quality works by measuring the structural similarity that compares local patterns of pixel intensities that have been normalized for luminance and contrast. This quality metric is based on the principle that the human visual system is good for extracting information based on structure.



Compression quality factor	*Basic backgroud subtraction method SSIM value*	*Modified backgroud subtraction method SSIM value*
10	*0.83*	*0.87*
20	*0.9*	*0.92*
30	*0.92*	*0.95*
40	*0.92*	*0.96*
50	*0.94*	*0.97*
60	*0.95*	*0.98*
70	*0.94*	*0.98*
80	*0.95*	*0.99*
90	*0.97*	*0.99*
100	*0.98*	*1*

Use of above all data we got that the modified method of background subtraction method is best for object detection as compare to basic background subtraction method

V. FUTURE SCOPE

1) We are going to design a system which is favourable for the current situation of congested metro cities.
2) Detection of moving objects in video streams is the first relevant step of information extraction in many computer vision applications.
3) Traffic control, mall, hospitals

VI. ADVANTAGES

1) Easy to operate.
2) Minimum cost is required.
3) Easily available and one person can handle.

VII. CONCLUSION

In this paper, Moving object detection is a computer technology that deals with detection non stationary object in digital image & videos. There are many methods used to detect moving object like background subtraction, modified background subtraction, Gaussian mixture model, wavelet based & optical flow based method. We did the comparative study of above mentioned moving object detection methods. From the results obtained, we concluded that modified method is good than the subtraction method.

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