Background subtraction using variable threshold RGB model

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Abstract*— Background subtraction is an essential step in video processing since it extracts the region of interest from an arbitrary image. So, it reduces computational complexity. It also helps in proper implementation of algorithms for further processing as per requirement. This paper describes a simple method to extract the foreground. The algorithm used, works well for indoor operation.

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I. INTRODUCTION

One of the most crucial and fundamental problems of many vision based systems like human detection in real time, human motion detection, video surveillance is to extract the foreground objects from background. The method that is used to discriminate moving objects from the background scene is called background subtraction. In this method the current image is subtracted from a reference image, which is acquired from a static background during a particular period of time. After performing the subtraction only the new objects are left. Several algorithms have been proposed to solve this problem. Background subtraction is often one of the first tasks in computer vision application with stationery camera.

In this paper, we have proposed a sturdy background subtraction technique. The method that we have proposed is called the variable threshold RGB model. This method is very simple to implement. Here at first we take a certain number of frames (we have taken 50) of the background images. Now, the mean and the standard deviation of the individual pixel are calculated for the background model. Then for every pixel in the test image the standard deviation is compared with the pre-defined threshold. If the deviation is larger than the threshold then the pixel is marked as the foreground pixel, otherwise it is a background pixel. The flowchart for this method is shown below:

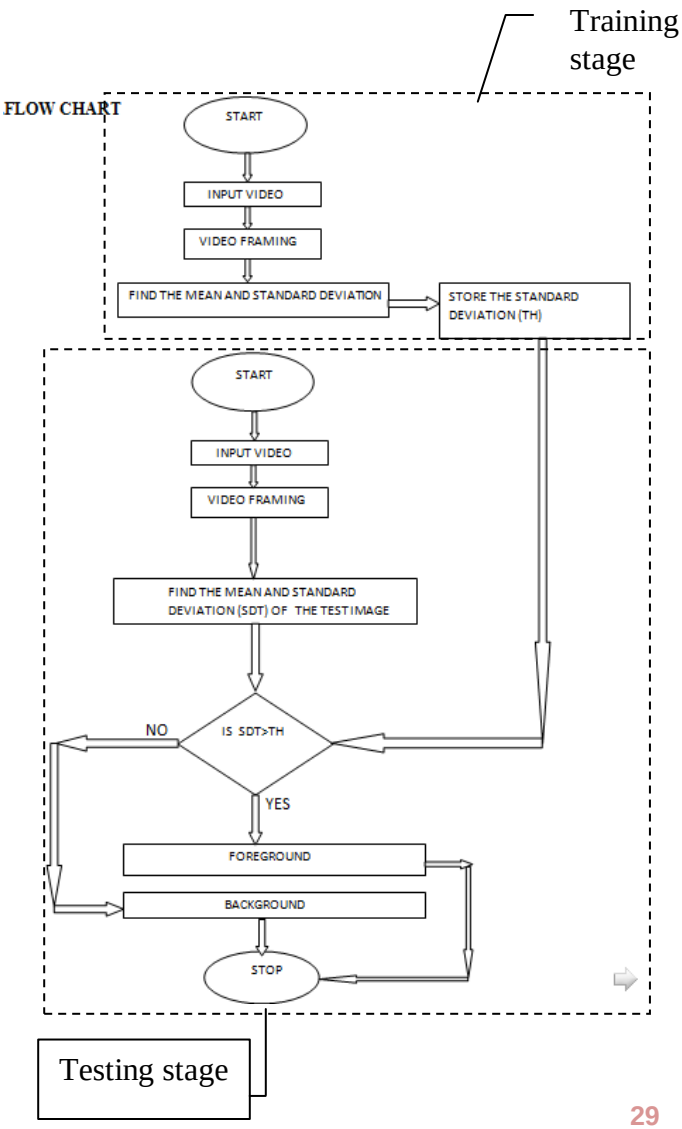


Figure 1. Flow chart of background subtraction

II. LITERATURE SURVEY

Various techniques were proposed in the past years for background subtraction. In background subtraction method we may use colour images or graycale. Some of the techniques that have been used are mentioned in this part.

The Robust multiple car tracking system by D. Koller [1] used an adaptive background model based on monochromatic images filtered with Gaussian and Gaussian Derivative (horizontal and vertical) kernel

.In tracking of groups of people by S. Mc Kenna, S.Jabri, Z. Duric , A Rosenfeld and H Wenchster[2] proposed a background model that combines pixel RGB and chromaticity values with local image gradients.

In their W4 system i.e Real time survillence of people and their activities Haritaoglu, Harwood and Davis used grayscale images to build a background subtraction model, where each pixel was represented by three values ; its minimum intensity value, its maximum intensity value and the maximum intensity difference between consecutive frames observed during the period.

A. Elgammal, R. Duraiswami, D. Harwood, and L. Davis in their Background and foreground modeling used a nonparametric background model based on kernel or gray scale images.

A real time adaptive visual surveillance system for tracking low-resolution colour by KaewTrakulPong and R. Bowden used colour images for background representation. They have modeled each pixel in the scene by a mixture of Gaussian distributions.

The above literature survey shows that there are several background subtraction model. But in this paper we have used a method called the variable threshold RGB model for background subtraction.

III. THEORITICAL BACKGROUND

In this method at first 50 frames of background images are taken. First the mean of the individual pixel is calculated for the R, G ,B values of the background model. Then the standard deviation is found out for the background model. Then for every pixel in the test image we again find the mean and the standard deviation. After the calculation we compare the standard deviation of the test image with that of the threshold value. If the compared value is larger than the threshold value, then the particular pixel is marked as foreground pixel, otherwise it is considered to be background. Figure 2 shows the results of background subtraction.

Mean

The mean is the simple average of the observations in the data set. The mean or the average (denoted by X) is found by adding all the observations (here pixels) in a sample (here frames) and dividing by the number of observations(n) in that sample. If the ith observation is denoted by Xi, , then the mean is calculated as:

$$\mu = \frac{\sum_i^n Xi}{n}$$

Standard Deviation:

The standard deviation measures the variability of the observations around the mean. If σ is the standard deviation, then it is given as:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N}(Xi-\mu)\text{^}2}{N-1}}$$

IV. IMPLEMENTATION

In this method, a first the video is extracted into RGB format. Then 50 frames are taken from the video and mean is calculated for each R, G and B separately. After that we have calculated the threshold by subtracting the values of pixels of current frame with the background frame. In this way we got a threshold value of each pixels for R, G and B separately.

Here, σ is the standard deviation of the test image and Th is a obtained threshold value.

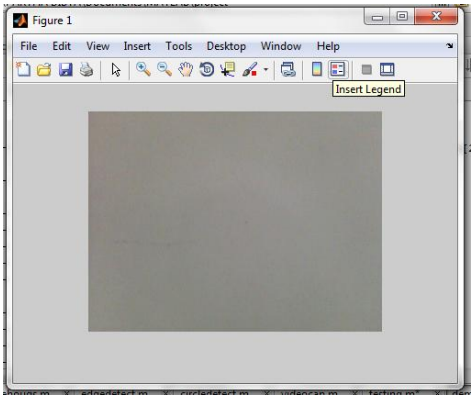
If σ > Th , then the pixel is said to be foreground.

If σ < Th, then the pixel is said to be background

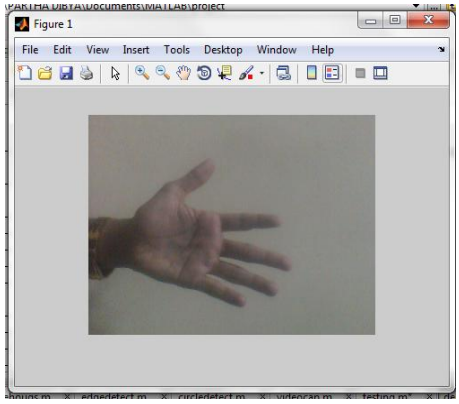
The foreground is denoted by higher intensity value and the backgrounds are denoted by the lower intensity value to differentiate between foreground and background.

V. RESULTS

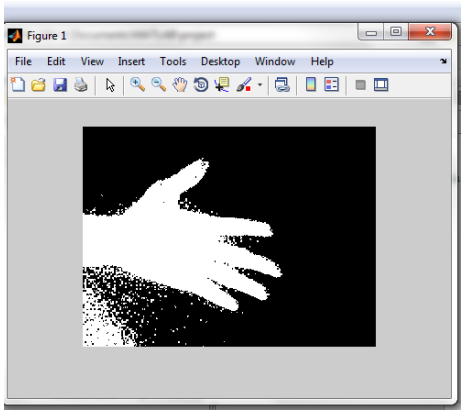
We have taken of the size the frames as 320x240. This algorithm shows various changes in the foreground. In figure(a) it is showing the background and figure(b) is showing the background with a foreground (hand).In the figure(c) the background subtraction image is shown.



(a)



(b)



(c)

Figure 2. (a) The background image, (b) the background image with foreground (hand) , (c)the background subtracted image

VI. CONCLUSION

We have evaluated the background subtraction for detection of any change in the foreground. We got the expected result but this method works properly in the indoor operation. We can improve this model by using GMM (Gaussian mixture model) and by HOG (histogram oriented gradient).

VII. ACKNOWLEDGEMENT

For this algorithm we have been guided by Karen Das, assistant professor of Don Bosco College of Engineering and Technology. We want to thank him for his continuous guidance.

VIII. REFERENCES

[1] D. Koller, J.Weber and J. Malik. “Robust multiple car tracking with occlusion reasoning”. In European Conference on Computer Vision, pages A:189–196, 1994.

[2] S. McKenna, S. Jabri, Z. Duric, A. Rosenfeld, and H.Wechsler.”Tracking groups of people”. Computer Vision and Image Understanding, 80(1):42–56, October 2000.

[3] I. Haritaoglu, D. Harwood, and L. Davis. W4: Realtime surveillance of people and their activities. IEEE Transactions on Pattern Analysis and Machine Intelligence, 22(8):809–830, August 2000.

[4] A. Elgammal, R. Duraiswami, D. Harwood, and L. Davis,”Background and foreground modeling using nonparametric kernel density estimation for visual surveillance”. Proceeedings of the IEEE, 90(7):1151–1163, 2002.

[5] P. KaewTrakulPong and R. Bowden,”A real time adaptive visual surveillance systemfor tracking low-resolution colour targets in dynamically changing scenes”. Image and Vision Computing, 21(9):913–929, September 2003