Scientific Journal of Impact Factor(SJIF): 3.134

e-ISSN(O): 2348-4470
p-ISSN(P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 02,Issue 05, May -2015

AN ACCURACY IMPROVEMENT IN OBJECT DETECTION SYSTEM BASED ON VARIOUS CAMERA CONDITIONS

Kahar Priyank J[1], Rajiv Kumar Gurjwar[2]

[1]*Department of Computer Science, Parul Institute of Technology, Vadodara, GJ*
[2]*Department of Computer Science, Parul Institute of Technology, Vadodara, GJ*

Abstract —*Field of Image Processing consists of verity of operations like image recognition, image sharpening, image retrieval, video analysis, video processing and video quality enhancement etc. Video processing mainly concentrated on tracking the object or retrieving the object's properties from sequence of images, which is called as "frames". In this report we are going to discuss about different object detection method, their advantages, limitations, assumptions etc. Gaussian mixture model (GMM) is one of those method used for object detection. GMM gives accurate result for detecting objects with assumption of lighting condition, camera condition, video resolution etc. Existing work is also on the basis of this model. So, accuracy of object detection process can be improved by eliminating those assumptions.*

Keywords*-Gaussian mixture model, object detection, video processing*

I. INTRODUCTION

In the area of image and video processing different algorithms and models are used for detecting object in different environment. They are classified on the basis of their efficiency, their performance, time/space complexity, LOC etc. In this paper we are going to discuss about Gaussian mixture model (GMM) used for object detection.

1.1 Introduction of GMM

GMM is density based model. It is most statistically model used for clustering. It is used for Recognizing object color, detecting object, classification of pixels etc. There are 3 layers of GMM, i/p, hidden & o/p layer. From the incoming frame pixel value is determine and uses as i/p of GMM i/p layer. Value of that pixel used to classify the pixel and calculate conditional probability, probability of pixel comes under particular class. Finally o/p layer gives class label of cluster. Weight updates performed based on pixel value. [From the previous frame to next frame][4].

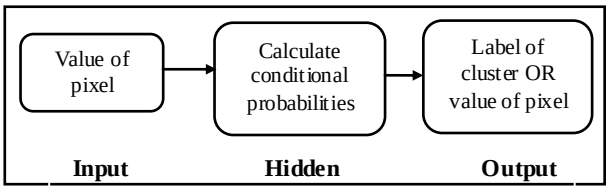

Figure 1: GMM Layers

II. LITERATURE SURVEY

A. In 2013, Qinghua Ji and Suping Yu present Motion Object Detection Based on Adaptive mixture Gaussian model & four frame Subtraction [1]. In this paper, adaptive GMM is used for detecting moving target. Classical GMM has the limitation of object detection in complex scene. There for they combine adaptive GMM & four frame subtraction method. Algorithm accepts video as a sequence of an image, combination of four frame method and GMM used for processing those images. From the video sequence four frames are selected to be read. Then image are subtracted in to 2, and then and operation performed to determine whether it is foreground image or background image. GMM does its regular work of detecting object. Domain analysis checks that result falls under which domain. Shadow, small noise etc. are filled by hole filling algorithm and finally get, moving target.

Although background subtraction[6] and frame difference method are common algorithms for target detection ,the two methods have their specific environment for using .The proposed method integrates these two methods putting forward a moving object detection algorithm which combines adaptive Gaussian mixture model with four frame difference based on dynamic threshold. This efficient method is presented, not only effectively overcoming the influence of illumination mutate but also solving the problem of double image. In this way, it is able to better detect the moving targets.

B. In 2099, Saeid Fazli, Hamed Moradi pour and Hamed Bouzari present Multiple Object tracking using improved Gaussian mixture model [2]. Human tracking in dynamic scenes has been an important topic of research. This paper presents a novel and robust algorithm for multiple motion detection and tracking in dynamic and complex scenes. The algorithm contains of two steps: at first, we use a robust algorithm for human detection. Then, Gaussian mixture model (GMM), Neighbourhood-based difference and Overlapping-based classification are applied to improve human detection

performance. The conventional mixture Gaussian method suffers from false motion detection in complex backgrounds and slow convergence [7]. We combine three above mentioned methods to obtain robust motion detection. The second step of the proposed algorithm is object tracking framework based on Kalman filtering which works well in dynamic scenes. Experimental results show the high performance of the proposed method for multiple objects tracking in complex and noisy backgrounds.

In this paper, GMM is improved for detecting multiple objects. This improvement done in 2 steps. First robust algorithm for human detection is used and then use of GMM. Conventional GMM suffers from false motion detection in snowy OR windy conditions. To overcome this limitation, improved GMM was introducing for multiple object tracking.

This paper presents a hybrid method that combines Gaussian Mixture Model, Neighbourhood-based difference and Overlapping- based classification algorithm for motion detection in dynamic and complex background. The proposed method provides robust detection for moving objects in dynamic video sequence. Multiple object tracking is performed using Kalman filter. The algorithm is able to automatically detect and track different objects in the scene without any prior knowledge. Robustness of the proposed combined method is shown by some experiments [2].

C. In 2013, Yu Xiaoyang, Yu Yang, Yu Shuchun, Song Yang, Yang Huimin & Liu Xifeng present A Novel Motion Object Detection Method Based on Improved Frame Difference and Improved Gaussian Mixture Model [3]. The existing motion detection methods include background subtraction and frame difference. But it is prone to exist some holes with frame difference method and it is difficult to build background model [8] using background subtraction method. So the test results did not achieve the ideal state.

Aim at these problems, this paper combines frame difference method improved by motion history image with background subtraction method based on improved Gaussian mixture model to detect the motion object. The experimental results show the method has achieved a satisfactory effect. In this paper, for object detection frame difference method and background subtraction method are used. Combination of this two method helps to improve efficiency of object detection. Pre-processing divides video into sequence of frame. Frame difference is the most efficient method for human motion detection, because it calculates the motion in to the frame. In this frame human makes large amount of motion compare to background. So, that difference makes algorithm to detect human.

In this paper, proposed a novel method combines frame difference with background subtraction to detect the motion object in the video with a stable background. In the algorithm, the improved frame difference was used to detect the motion object in the time domain and the improve background subtraction was used to detect the motion object in the space domain. Finally, the two parts were combined to obtain the complete motion object. The algorithm has processed a lot of videos and obtained satisfactory results.

III. COMPARISON OF OBJECT DETECTION METHODS

In all above methods GMM was improved by using another object detection method with it. But the common assumption in all method is the camera condition.

Table 1: Object and camera condition considered or not

possibilities of object and camera condition	4 frame subtraction with GMM	Human detection algorithm with GMM	Frame difference method with GMM
both are static	✓	✓	✓
object moving camera static	✓	✓	✓
camera moving object static	×	×	×
both are moving	×	×	×

In the process of object detection [10] there are multiple possibilities between object and camera which is listed in above table. Those methods give results with less accuracy if it tested under the following conditions.

IV. PROPOSED METHOD

Gaussian mixture model has a limitation of object detection in complex scene and less lightening condition. Amount of illumination also effects on the GMM result. Lighting, illumination and camera condition, such kind of assumption are also there, while using GMM is used for object detection.

So, by eliminating some assumption we can improve the accuracy of motion based object detection system. The most common assumption of Gaussian mixture model is "Camera Condition". It assumes that camera should remain static while capturing video.To improve the accuracy of motion based object detection system we can implement Gaussian mixture model for moving camera. Implementing motion sensor in GMM can remove the assumption of static camera. This work will be done on matlab R2013a software.

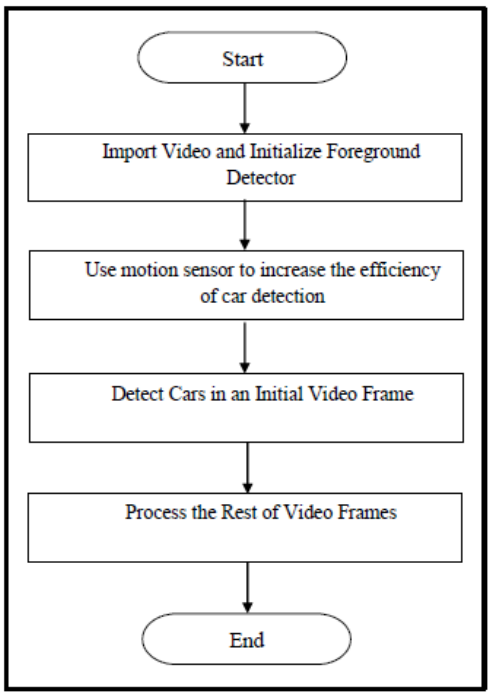

Figure 2: Proposed method with GMM [9]

V. EXPERIMENTAL SETUP AND RESULTS

For the experiment, we are considering object as well as camera condition. As existing method can work accurately in static camera condition, we are only concentrating on moving camera condition.

Table 2: Experiment setup

Camera Megapixel	**Camera resolution**	**Camera Condition**	**Object Condition**	**Frame per second(FPS)**
2 MP	1920 X 1080	Moving	Moving	30(max)
5 MP	2592 X 1944	Moving	Moving	60(max)
10 MP	3648 X 2752	Moving	Moving	60(max)
VGA	640 X 480	Moving	Moving	15(max)

Table 3: Dataset description

Video File Name	**Length of Video**	**Format of Video**	**Day/Night Condition**	**Frame per second(FPS)**	**Video Resolution**
SAMPLE1_480	00:00:48	.mp4	Morning	30	854 X 480
SAMPLE2_480	00:00:56	.mp4	Evening	29	854 X 480
SAMPLE3_CM	**00:02:38**	**.mp4**	**Midday**	**30**	**640 X 360**
SAMPLE4_CM	**00:00:57**	**.mp4**	**Evening**	**15**	**640 X 480**

All experiment done in this type of condition. Camera resolution given in table 2 shows the maximum video resolution that can be captured by particular camera. Dataset used for the experiment contains parameters shown in table 3. Each

parameter may effect on an accuracy of the result. Videos are taken in different day/night conditions, at different frame rate. Resolution and lengths of the videos are also different for evaluation the average accuracy of proposed work.

Experiment 1

File Name: SAMPLE3_CM
Format: .mp4
Day/night condition: Day (Evening)
Camera condition: Moving from left to right

Length: 00:02:38
FPS: 30
Resolution: 640 x 360

Figure 3: Detected cars with the help of motion vector

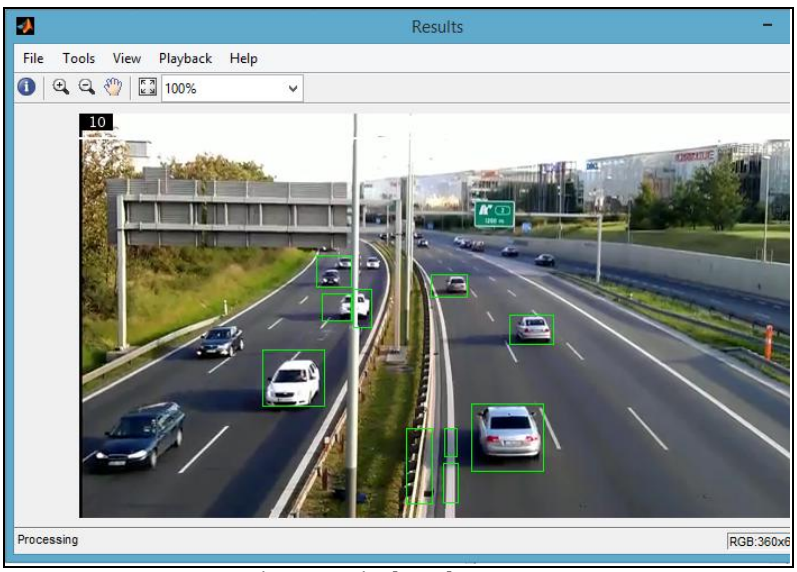

Figure 4: Final result

Experiment 2

File Name: SAMPLE4_CM
Format: .mp4
Day/night condition: Day (Morning)
Camera condition: Moving

Length: 00:00:57
FPS: 15
Resolution: 640 x 480

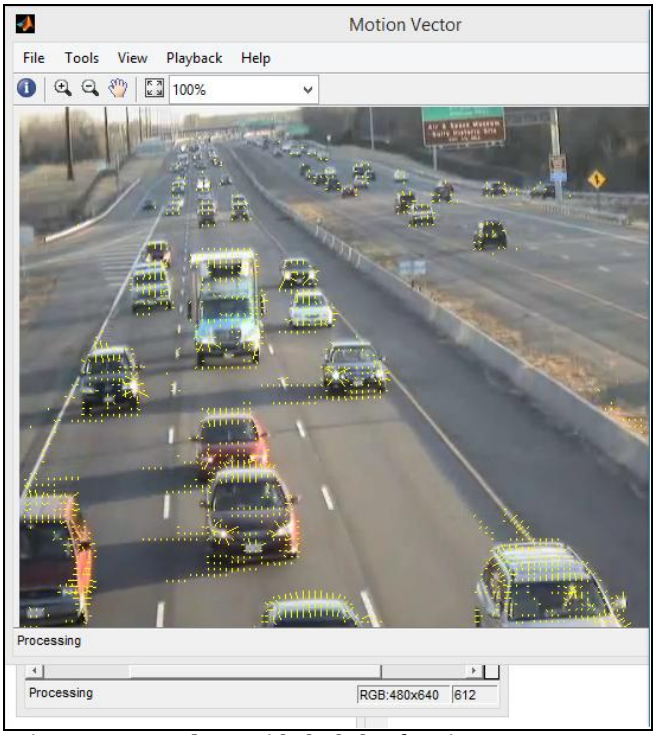

Figure 5: Detected cars with the help of motion vector

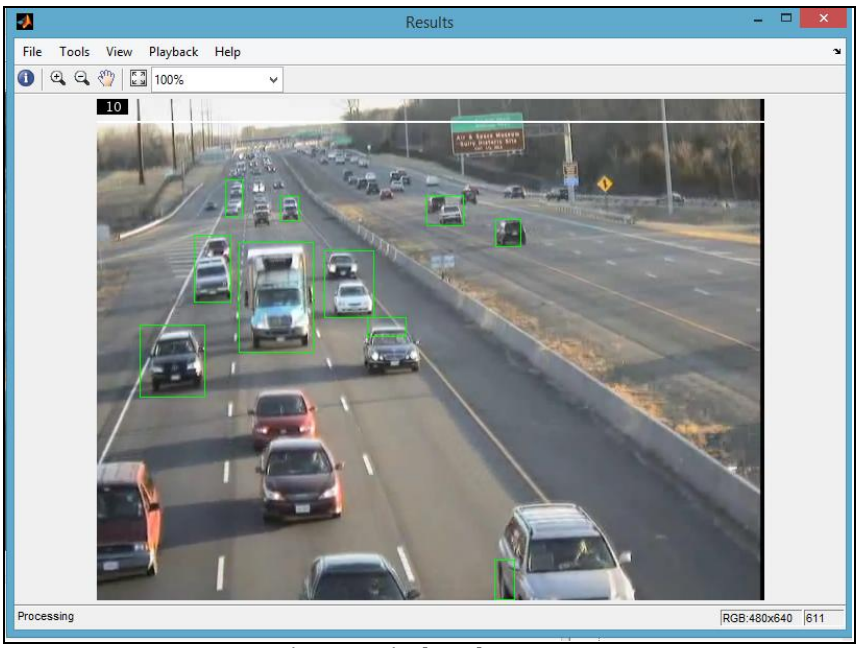

Figure 6: Final result

From Figure 3, 4, 5 and 6, we can see that proposed method can give batter result under moving camera condition. Detected cars showed with the green squares. And number of detected cars in a single frame is displayed on upper left corner.

VI. COMPARISION OF PROPOSED AND EXISTING METHOD

Now we compare proposed and existing methods by its results. We will compare both methods by counting originally detected cars from a single frame, number of false detection from frames.

In table 4, we can observe that proposed method have less no. of false detection compare to existing method. We can also observe that proposed method have high accuracy in detecting car compare to existing method.

Table 4: Comparison of proposed and existing method

File name	Frame No.	Total No. Of cars	Proposed method		Existing method	
			Detected cars	False detection	Detected cars	False detection
SAMPLE3_CM .mp4	570	7	6	**1**	4	**9**
	772	10	8	**2**	7	**10**
	1180	11	9	**4**	3	**42**
	2555	12	11	**3**	7	**19**
SAMPLE4_CM .mp4	52	7	4	**3**	2	**53**
	170	10	9	**1**	3	**39**
	280	7	7	**0**	5	**26**
	415	8	6	**4**	4	**31**

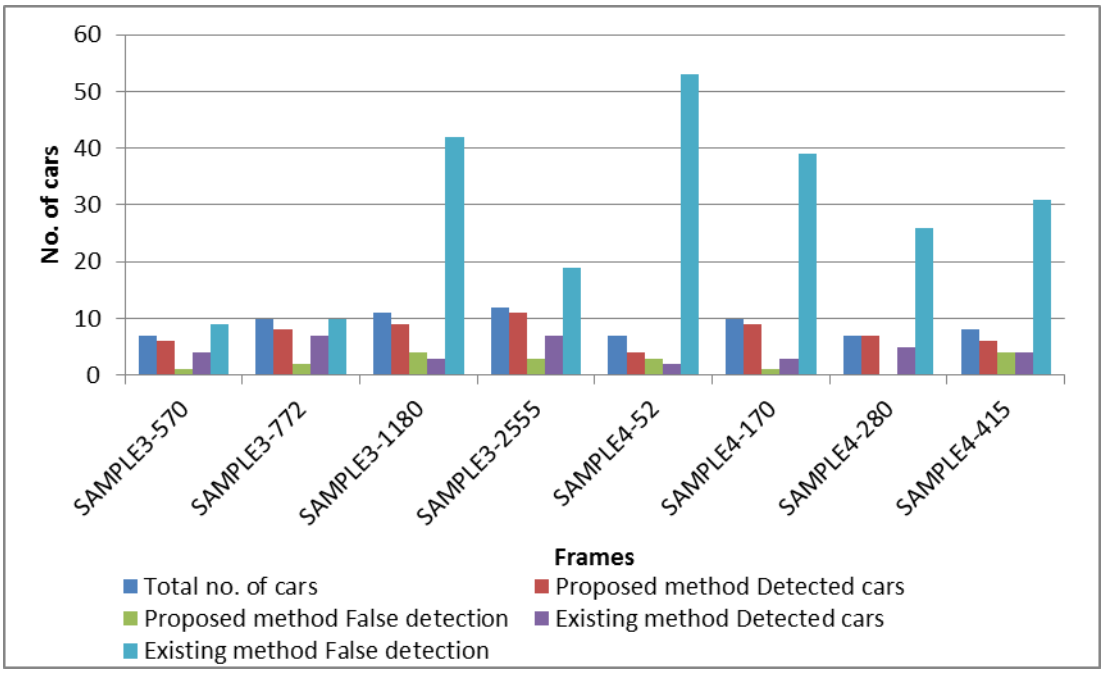

Figure 7: Comparative analysis graph

VII. CONCLUSION

In existing system, experiment result shows that how GMM gives accurate result under the fixed camera condition. Experiment result also shows that if we considered a moving camera condition for object detection by using GMM then accuracy decreases. Therefore, with the aim of improving the accuracy of object detection process we have implemented GMM with motion sensor. The experiment result of proposed method shows it can work under any camera condition (no matter if camera is moving or static). This is how proposed method improves the accuracy of object detection process and eliminates the assumption of static camera condition. In future, we can continue this work from implemented motion sensor. If we specify the motion property of an object then it may possible that it can give more accurate result. We can also specify the general configuration of camera in which the algorithm works accurately.

REFERENCES

[1] Qinghua Ji and Suping Yu, "Motion Object Detection Based on Adaptive mixture gaussian model & four frame Subtraction", published in IEEE international conference on computational & Information sciences, 2013.

[2] Saeid Fazli, Hamed Moradi pour and Hamed Bouzari,"Multiple Object tracking using improved Gaussian mixture model", IEEE international journal, 2009.

[3] Yu Xiaoyang, Yu Yang, Yu Shuchun, Song Yang, Yang Huimin & Liu Xifeng, "A Novel Motion Object Detection Method Based on Improved Frame Difference and Improved Gaussian Mixture Model", IEEE 2nd international conference on measurement, Information & control, 2013.

[4] "Introduction of Gaussian mixture model", available at: http://homepages.inf.ed.ac.uk/rbf/CVonline/LOCAL_ COPIES/RAJA/ CV.html
[5] Zhang Shunmiao, Lv Dongkai. "A Motion Detection Algorithm based on Surendra Background Updating and Background Subtraction" [J]. Journal of Nangjing Institute of Technology, 2011, 9(2):22–27.
[6] Dai Kexue. Prospects and current studies on back-ground subtraction techniques for moving objects detection from surveillance video [J].Journal of Image and Graphics, 2006, 11(7):917–919.
[7] D. Lee, "Effective Gaussian Mixture Learning for Video Background Subtraction," IEEE Trans. Pattern Anal. Machine Intel, vol. 27, no. 5, pp. 827-832, May 2005.
[8] Fakharian A., Hosseini S., Gustafsson T., "Hybrid object detection using improved Gaussia mixture model", The 11th Control AutomatIOn and Systems International Conference. 2011, pp.1475-1479.
[9] "Gaussian Mixture Model for car detection", available at:http://www.mathworks.in/help/vision/examples/detecting-cars usinggaussian- mixture-models.html
[10] Won Jin Kim and In-So Kweon "Moving Object Detection and Tracking from Moving Camera", IEEE, 8th International Conference on Ubiquitous Robots and Ambient Intelligence, 2011

