International Journal of Soft Computing and Engineering (IJSCE)
ISSN: 2231-2307, Volume-3 Issue-5, November 2013

Time Varying Moving Object Acceleration/ Deceleration Detection in Region of Interest Using Motion of Center of Gravity

E.M.C.L Ekanayake, J.V Wijayakulasooriya

***Abstract*— The basic focus of this research is to design an improved algorithm upon the existing algorithm to detect and index moving objects on the road. The algorithm in use involves both the image subtraction approach and image dilation method. The image sequences acquired through a digital video during the day time was processed to analyze the characteristics of object movement in the Region of Interest (ROI). Basically this developed program can index moving objects and remove unwanted noisy shadows within the ROI. In addition it also represents how objects enter into the ROI and how they exit from ROI. Moreover it can characterize a particular object's moving directions and its characteristics such as velocity, acceleration and deceleration. Those features could also be derived from analyses of the images.**

***Index Terms*—Image Processing, Video image analysis, image morphology, image dilation, image thresholding.**

I. INTRODUCTION

Video image processing applications related works are rapidly increasing using video sources such as camera (image). The process of sequence of images can be used to classify several object classification systems. In this paper we discuss how to analyze and detect moving object characteristic such as moving condition (acceleration/deceleration). In this process we use stationary camera mounted on high elevation on side of the road. The high level of image description can represent accurate trajectory of moving object. But in this approach we use low quality video source to reduce cost and speed up the computational process. We address here how to use low cost and high efficiency approach for real time video processing.

In most cases object identification methodology is based on image substation from static background. Hence we also use this method for object isolation and track. The most challenging difficulty for detecting exact object on road is dynamic background changes due to sunlight and irregular moving habit of vehicle in road. This cause unexpected breakup of trajectory in object sequence. The other important thing is vehicle body shape. It also depends on light reflection and nature of the surface. Those things change actual shape and condition of moving vehicles.

The Proposed methodology uses image subtraction with image morphology technique for extracting moving objects. The final analysis was based on moving object center of gravity (horizontal coordinates) path against the no of frames.

Manuscript Received on November, 2013.

Mr. E.M.C.L Ekanayake, Postgraduate, Department of Electrical & Electronics Engineering, University of Peradeniya, Sri Lanka.

Dr. J.V Wijayakulasooriya, Department of Electrical & Electronics Engineering, University of Peradeniya, Sri Lanka.

II. LITERATURE REVIEW

Moving object sequence detection in moving frame flow is an important step in video surveillance. In this process errors may occur in several ways. It's depends on present dynamic background changes, light condition weather condition, illumination and reflection. Therefore this approach needs high level techniques for exact target object from image sequence. There are more literature concerning on those types of application and it also depends on several factors. For detect object, an advance blob detection [1] technique method is discus on dynamic template within each moving frames. But in this scenario it is very difficult detect cluster of moving objects in sequence. All of these methods basically bind with optical flow, space time continuity and template matching and background subtraction methods. The popular method was detect moving objects is optical flow [3] method. The motion flow vectors can be used to extract moving objects. However, the computational difficulty of optical flow is very high, so real-time implementation is difficult or expensive and its need high-level processing capabilities. A contour based object detection [2] method also use optical flow mechanism with edge detection. It is rather efficient that conventional rectangular detection method. Another method is the space-time continuity method which extracts objects by detecting the surface generated by motion boundaries in the space time domain. This method can immediately recognize the objects during the flow of sequence, but it is also computational difficult and requires additional storage of many frames in memory. Template matching process, it has to keep all existing blocks (shapes) and compare with each. This systems needs more computing power for recognize the exact shape in database. Segment and track closely interacting objects and deforming on video is very challenging in real time image processing [4]. This method it uses dense point trajectories for track moving object in video sequence. The spatial information of color and gradient dynamically change due to various things such as light. Hence this method can't segment group of moving objects. The Gaussian mixture [5] background model can easily detect single separated object in static background. Track object by frame differencing [6] is very fundamental approach and widely use for bound moving object. In this paper we also use this simple method for detect moving object and analyze the direction. And also paper discuss on time-space variation for moving direction and acceleration characteristics of object (vehicles).

Proposed methodology is based on image subtraction and time-space variation on specified region on interest to calculate exact position

Published By:
Blue Eyes Intelligence Engineering & Sciences Publication

and analyze the movement of center of gravity on each shape.

III. METHODALOGY

Experimental image sequences are taken from road side of high way nearby university using web cam. Input images are read directly from a recorded video with indeo5 video compression technique. The video recording is 30 frames per second rate and with a frame size of 320x240.

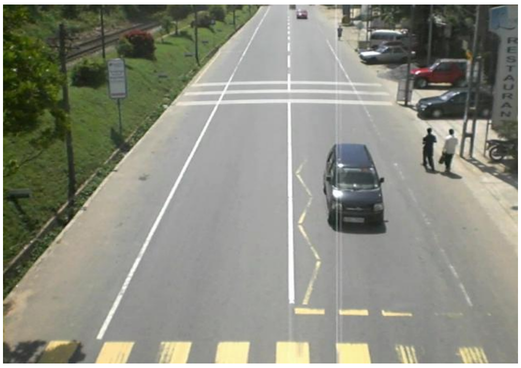

Figure 1: sample image of moving object

A. Video Image thresholding

Convert color image into binary image. For that step, the method was the conversion with binary value (black & white) function and the threshold value (T) was kept as 0.4.

(a) Threshold value (T) = 0.2

(b) Threshold value (T) = 0.4

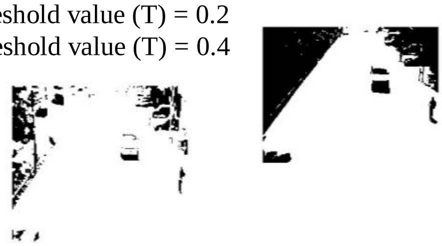

Figure 2.(a) Figure 2.(b)

Figure 2.(c) Figure 2. (d)

(c) Threshold value (T) = 0.4

(d) Threshold value (T) = 0.8

T=0.1T is close to 0 and detail of the image is less. T=0.9 then T is close to 1 and detail of the image is also less. T=0.5 Average level and details are clear and the widely used value. T=0.4

In this system for optimum detail of the image this value is used Images are converted into black and white images by using MTLAB function im2bw[8].

Figure 3-Black and White image

IV. MORPHOLOGICAL IMAGE PROCESSING

A. Image dilation was increases the boundary region of object.

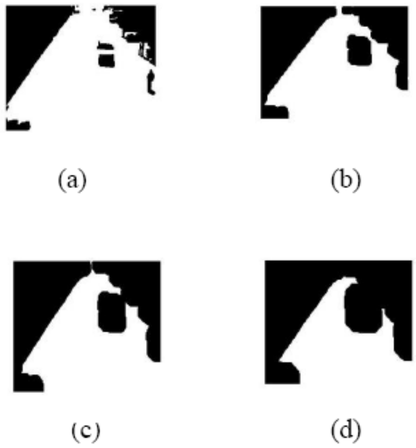

Figure 4.Different image dilation efforts

The Above figures clearly show affects of dilation[7] on image. It will increases boundary region uniformly .But it also control into some extend, because object also interfere with close-set boundary and objects. In this approach dilation process kept as in frame (b).

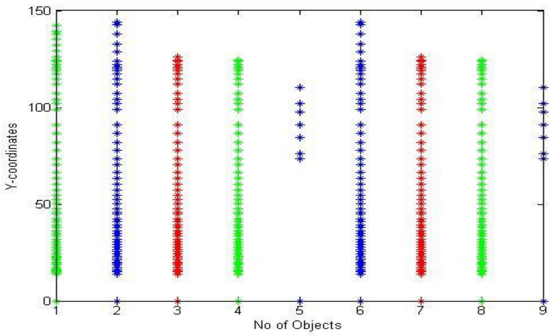

Figure 5.0-The graph of objects paths

The figure 5.0 clearly shows that nine objects at the frame. And long distance path can be counted as vehicles though the real image contains only three vehicles. This type of algorithm alone shows that error in results and have to optimize code for ignoring the shadow path (one and two path are identical). In this case identical paths can be considered as same object component closely moving towards the same direction and small dotted lines can be ignored as the noisy object (five and nine).

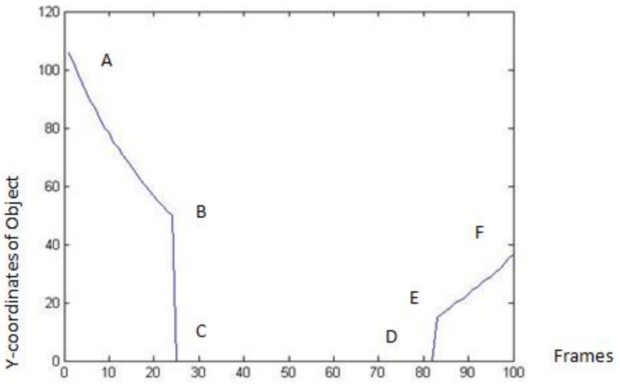

Figure 5.1 – Random object moving path (i)

The figure 5.1, an example plot thus obtained, shows an incoming traffic towards the ROI- Region of interest, indicated by the segment AB. The sharp decline of BC indicates that object has moved out of the ROI. Letters C, D indicate that there are no movements inside the ROI, which means that there is no object inside the area. Letters D, E indicates a sharp increase, which means an object, is moving towards the ROI from the opposite direction and letters E, F indicate an object moving away from the ROI in the opposite direction.

Further, the gradient in A-B and E-F can be used to derive, whether the object is accelerating or decelerating.

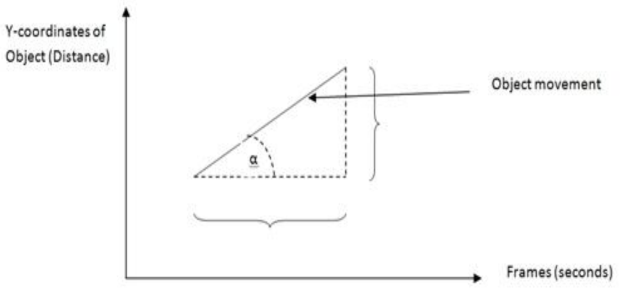

Figure 5.2 - The sample graph to calculate the gradient

In Figure 5.2, the graph clearly shows that gradient is directly proportional to the velocity. It represents distance vs. time relationship. Hence considering angle (α), program can identified the deceleration/acceleration of the present situation. The way of extracting acceleration and deceleration information for the vehicles from the gradient of the plots can be illustrated by portions AB and EF in the Figure 5.1.

The difference in X coordinates in EF (80-100) is relatively less in the number of frames (0-25) in AB region. Hence, the moving object in AB region is seen being accelerated whilst constant velocity is indicated at EF.

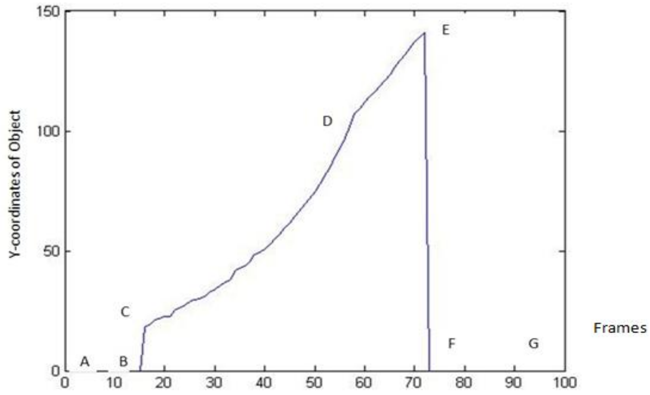

Figure 5.3-Random object moving path (ii)

The Figure 5.3 illustrates how the vehicle approximately maintains constant velocity in the DE region. As shown in the figure, the vehicle enters the ROI at point B (no vehicle is tracked between points A & B), while increasing speed gradually (CD). The constant slope line segment DE indicates that the vehicle approximately maintains a constant speed during that time. Between EF the vehicle leaves the ROI and subsequently no vehicle is tracked between E & G. In relation with figure 5.0, object 1 and 2 path plots are as Figure 5.4 and Figure 5.5.

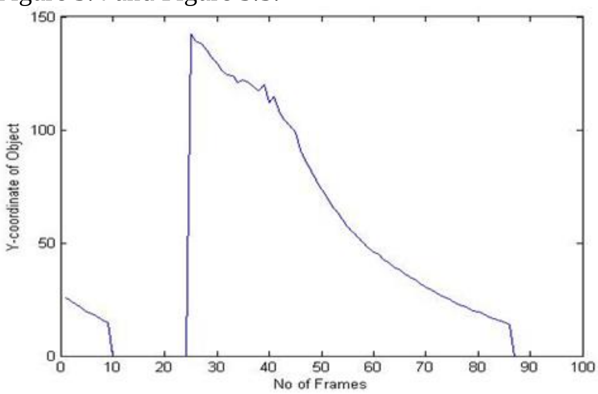

Figure 5.4-object 1 path

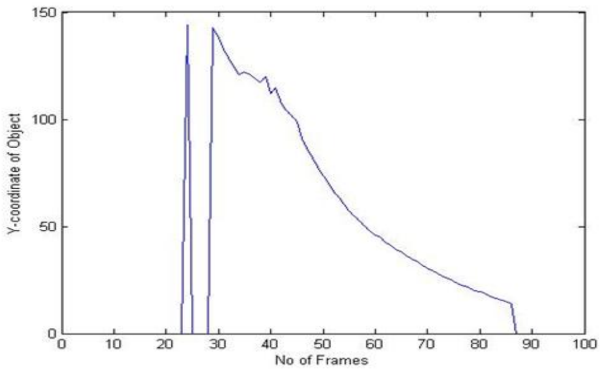

Figure 5.5-object 2 path

Figure 5.4 and 5.5 graphs show movement of two objects. But in the real image we can see one object only. Due to factors such as lighting variation and the color of different vehicles, (e.g.: white van) the same object is separated as two components. That will adversely affect the object count method. In relation with figure 5.0, object 5 and 9 path plots as below

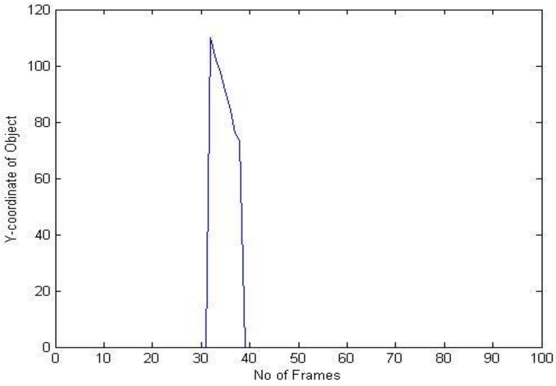

Figure 5.6- object 5 path

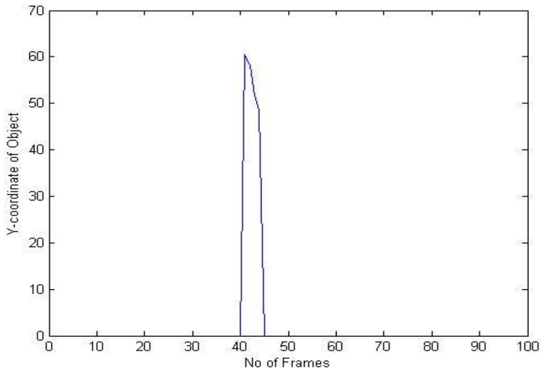

Figure 5.7- object 9 path

Above figure 5.6 and 5.7 shows that noisy object appears on the ROI. It also counts as the object.

V.CONCLUSION

In this approach, we have discussed several characteristics related to moving objects in public roads. Illumination, light reflection and several real time disturbances add more noise to the accrued video. Basically movement can be identified and analyzed by characteristic such as velocity, direction and acceleration. We have addressed several problems that arise related to the analysis of this video stream. The proposed framework was based on the graph representation of moving regions (Center of gravity) which was extracted from the video.

It is possible to reduce noise and improve trajectory detection by further processing of video with kalman filtering approach and color based object segmentation method.

ACKNOWLEDGMENT

I should gratefully remember my first digital image processing teacher Dr. P.M.K.Alahakoon and other supportive members of the department who assisted me to improve and develop the basic theory on this approach.

REFERENCES

1. Cohem,I. and Medioni,G. "Detection and Tracking moving object for video Survillance". Proceeding of IEEE Conference on Computer Vision and Pattern Recognition, Fort Collins, CO.1999.
2. M.Yokoyama, T. Poggio," A Contour-Based Moving Object Detection and Tracking", In: Proceedings of Second Joint IEEE International Workshop on Visual Surveillance and Performance Evaluation of Tracking and Surveillance (in conjunction with ICCV 2005), Beijing, China,2005.
3. Thompson, W.B. and Pong ,T.."Moving Objects", International Journal of Computer Vision,4, Netherland, Kluwer Academic Publisher, pp 39-57,1990.
4. Fragkiaduki,K., and Shi , J."Detection free Tracking : Exploiting motion and topology for segmenting and tracking under entanglement".In IEEE Conference on Computer Vision and pattern recognition(CVPR),2011.
5. Hibo ,H., and Hong ,Z."Real-time tracking in image sequences based-on parameters updating with temporal and spatial neighborhoods mixture Gaussian Model".World Academiy of Science,Engineering and Technology.Vol : 43, pp 551-556 ,2010.
6. Prabhakar ,N et al.," Object Tracking Using Frame Differencing and Template Matching", Research Journal of Applied Sciences, Engineering and Technology 4(24): pp. 5497-5501, 2012.
7. R.C. Gonzalez, R.E. Woods,"Digital image processing (2nd Edition)", New Delhi: Prentice-hall of India private limited, 2005.
8. R.C. Gonzalez, R.E. Woods, S.L. Eddings ,"Digital image processing using MATLAB", New Delhi: Pearson Education Inc, 2004.

AUTHOR PROFILE

Mr. E.M.C.L Ekanayake, received his B.Sc degree from Faculty of Applied Sciences, Wayamba University of Sri Lanka in 2005 and received M.Sc degree in Communication & Information Engineering in Faculty of Engineering, University of Peradeniya, Sri Lanka.

Dr. J.V Wijayakulasooriya received his B.Sc.Eng. degree with first class honours from University of Peradeniya, Sri Lanka in 1994 and he was awarded the Prof. E.O.E. Perera Gold Medal (1994) for the most outstanding graduate of the Faculty of Engineering. He received his PhD degree from University of Northumbria at Newcastle Upon Tyne, UK in 2000.