Effective Moving Object Detection using Background Subtraction in Complex Wavelet Domain

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***Abstract*— For the last few years, Visual surveillance is a very active research topic in many countries because of its various practical applications such as in defense, airports etc. This paper presents effective moving object detection in complex wavelet domain using background subtraction for surveillance system. In frequency domain, the object detection is approached by segmenting objects from foreground without background noise. The initial frames are chosen by approximate median method for background initialization. Then for current and initialized background, wavelet transformation is applied for generation of low and high frequency sub bands. The next step in this process is Frame differencing and then edge map creation and reconstruction of image. To remove some useless pixels, morphological erosion and dilation operation is performed for edge smoothness of the object. This process has advantages like insensitive to background noise and no change in changing light or brightness. After detecting object, performance of method will be measured (between frame ground truth and obtained result) by using parameters such as sensitivity, accuracy, correlation and peak signal to noise ratio (SNR).Through this we can also track the detected object by using connected component analysis. This proposed method for object detection has better accuracy and less processing time consumption comparing with the other existing methods.**

KEYWORDS: VISUAL SURVEILLANCE, MOVING OBJECT DETECTION, BACKGROUND INITIALIZATION

I. INTRODUCTION:

In general, monitoring of any behavior is called surveillance. The process of monitoring the behavior of people, objects or processes to check what is happening or how the things are going on is called system surveillance. CCTV (Closed-circuit television) ,are some group of cameras arranged for purpose of video surveillance. They are arranged in places like banks, airports, railway stations, traffic junctions etc., where ever security is needed. The main tasks in visual surveillance systems are motion detection, object classification and object tracking. The usual approach for moving object detection is maintaining an updated model of the background and detecting moving objects through background subtraction. We know that the background image is not fixed all time but it should resist: variations in light changes, environmental changes, changes in moment, oscillations of camera etc.

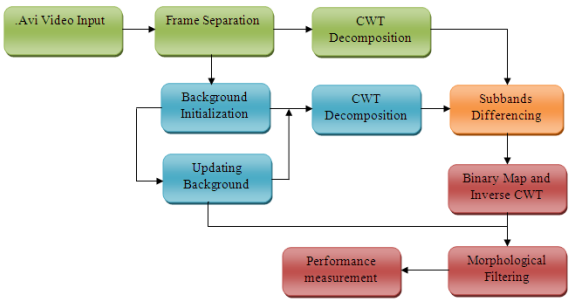
Existing methods for the moving object detection are:-

1) Threshold based segmentation
2) Gaussian mixture model
3) Color histogram and gradient based segmentation

The drawbacks of those existing methods are:-

- They are sensitive to illumination changes leads to more background noises
- Time consuming process
- It is not provides better results due to varying light conditions, shadows and other occlusions

II. PROPOSED METHOD BLOCK DIAGRAM



- Background subtraction based Effective moving object detection using,
- Complex wavelet transform, frame differencing and approximate median based background update

The present method proposed is based on an approximate median filter in Discrete wavelet domain. For obtaining video object planes which gives changed pixel value from consecutive frames , it uses differencing of frame . Using Discrete wavelet transform first we decompose two consecutive frames (In-1 and In) and to detect frame difference approximate median filter based method is applied. The co-ordinate of frame is FDn(i, j)=WIn(i,j)-WIn-1(i,j) for every pixel location.

For frames In(i,j) and In-1(i,j) , WIn(i,j) and WIn-1(i,j) are wavelet coefficients respectively. The result obtained contains some noise . To remove noise softthresholding method is to be applied.

The equation is expressed as: FDn'(i, j)= FDn(i, j)- λ , in presence of noise.

And without noise FDn'(i,j) is frame difference , noise components are represented by λ.

For de-noising, soft thresholding technique in the wavelet domain is used for estimation of frame difference FDn'(i,j). Inverse wavelet transform is applied to get moving object segmentation in the spatial domain i.e.. En. The obtained segmented

object may include a number of disconnected edges due to the non-ideal segmentation of moving object edges.Therefore , some morphological operation is needed for post the processing of object edge map to generate connected edges.So here, a binary closing morphological operation is used. After applying morphological operator M(En) is obtained which is segmented moving object, finally temporal updating of the background model is needed in order to adapt the changes in background and in lighting conditions.

IV. METHODOLOGIES USED IN THE PROPOSED METHOD:

- Complex wavelet transform
- Frame Differencing
- Morphological filtering
- Updating Background
- Performance measures (Sensitivity/Accuracy/PSNR/Correlation)

Software Requirement: MATLAB 7.5 and above

V. ADVANTAGES OF THIS METHOD:

- Better accuracy in segmentation under various illuminations
- Less time consuming process
- Flexibility in background updating model
- Very low sensitive to background noise

VI. APPLICATIONS:

- Video surveillance
- Machine Vision systems
- Object Recognition

VII.CONCLUSION

There are many interference factors such as target changes, complex scenes, and target deformation in the moving object tracking in video surveillance.in this paper we have proposed moving objects detection using discrete wavelet transform domain .By considering other standard methods of various performance metrics, The performance of the proposed method have been evaluated and compared. By the results of their qualitative and quantitative analysis, the proposed method is performing better in comparison to other methods as well as it also capable of alleviating the problems associated with other spatial domain methods such as ghosts, clutters, noises etc. used . . Future work will address on techniques to get better results to improve the human detection methods and occlusion handling in surveillance applications.

REFERENCES

[1] R. T. Collins, A. J. Lipton, T. Kanade, H. Fujiyoshi, D. Duggins, Y. Tsin, D. Tolliver, N. Enomoto, O. Hasegawa, P. Burt, and L. Wixson, “A system for video surveillance and monitoring,” Tech.Rep. CMU-RI-TR00-12, The Robotics Inst., Carnegie Mellon Univ.,Pittsburgh, PA, 2000.

[2] L W. Hu, T. Tan, “A Survey on Visual Surveillance of Object Motion and Behaviors”, IEEE Trans. Systems, Man, and Cybernetics, Vol. 34, No. 3, pp. 334-352, 2006

[3] Tao Jianguo, Yu Changhong, " Real-Time Detection and Tracking of Moving Object,"Intelligent InformationTechnology Application, 2008. UTA '08. Second International Symposium on Volume 2, 20-22 Dec. 2008 Page(s):860 – 863

[4] Y. Zhang “An Overview of Image and Video Segmentation in the Last 40 Years,” Book Vol. 1, pp. 1-16, 2006, IGI Global, USA.

[5] M. Piccardi, “Background subtraction techniques: a review,” in Proc. IEEE Int. Conf. Systems, Man, Cybernetics, 2004, pp. 3099–3104.

[6] S.C. Cheung and C. Kamath, "Robust techniques for background subtraction in urban traffic video," Video Communications and Image Processing, SPIE Electronic Imaging, UCRL Conf. San Jose, vol.200706, Jan 2004.

[7] L. Maddalena and A. Petrosino, “A self-organizing approach to detection of moving patterns for real-time applications,” in Proc. 2nd Int. Symp. Brain, Vision, and Artificial Intelligence, 2007, pp. 181–190, Lecture Notes Comput. Sci. 4729