Published by :
http://www.ijert.org

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 01, January-2016

DWT based Target Detection and Tracking

Hemangi. R. Patil
Department of Electronics & Telecommunication
J. T. Mahajan. College of Engineering
Faizpur, Maharashtra, India

Prof. K. S. Bhagat
Department of Electronics & Telecommunication
J.T. Mahajan College of Engineering
Faizpur, Maharashtra, India

***Abstract*— Now a days video surveillance system have an increasing demand in various fields. Detection of target in initial stage and then performing various functions like object detection, object classification, feature extraction and object tracking are performed by surveillance system. However, many problems are associated with detection and tracking such as illumination changes, ghost image, noise, *etc.* To overcome such problems a dwt based approach is proposed in this paper for detection and tracking of an object. An attempt has been made to develop effective object detection and tracking system.**

***Keywords*— Object Detection, Feature Extraction, DWT, Object Tracking.**

I. INTRODUCTION

Video surveillance systems have two important aspects detection and tracking. Locating moving object in sequence of frame is called as object tracking. The tracking function can be performed by extracting features and detecting the object in sequence of frames. However, there are many problems associated with detection of an object and hence making it a challenging task.

Security plays a vital role in today's society. Almost every field requires the need for security system for which detection and tracking of an moving object is important. The use of object tracking is pertinent in the field of motion based recognition, video indexing, human computer interaction, traffic monitoring *etc.* However, there are many problems associated with detection and tracking of an object and hence making it a challenging task. Disturbances may arise in tracking object due to noise in image, complex object motion, non rigid or articulated nature of object, complex object shape, scene illumination changes *etc.* Back ground subtraction, optical flow and temporal differencing are some of the old methods for detection of an object. All the above three methods are sensitive to illumination changes.

To overcome the above problems method for detecting and tracking moving objects based on discrete wavelet transform and identifying objects by extracting their wavelet features is proposed in this paper. Since discrete wavelet transform has a nice property that it can divide a frame into four different frequency bands without loss of information.

In this paper target detection is done by extracting the discrete wavelet transform features and tracking is done by calculating the centroid of the detected object. Then target is highlighted by bounded rectangle.

II. LITERATURE SURVEY

The success of most computer vision problem depends on how effectively the detection and tracking of object is done. Algorithms based on discrete wavelet transform have been used by many researchers for detection and tracking of an moving object. S. Rajput et al. [9] proposed a method for detecting and tracking multiple moving objects based on discrete wavelet transform and identifying the moving objects by their color and spatial information. B. Toreyin et al. [6] proposed an algorithm for moving object and region detection in video which is compressed using a wavelet transform (WT). The algorithm estimates the WT of background scene from the WTs of the past image frames of the video. The WT of the current image is compared with the WT of the background and the moving objects are determined from the difference. R. Arunkumar et al. [8] proposed a algorithm in which Discrete wavelet transform (DWT), Discrete cosine Cosine Transform (DCT) are combined DWT-DCT are implemented and evaluated for extracting features from the segmented object.

V. Landge et al. [11] propose a method to detect object based on background subtraction. S. Gogulamudi et al. [12] proposed an algorithm by taking relationship between object and environment factors and model it as environment state using distance transform technique, and integrate it into particle filtering for better tracking accuracy. N. Singla et al. [13] proposed a algorithm for detecting moving objects from a static background scene based on frame difference. S. Aslani et al. [14] developed a moving object detection system base on optical flow estimation. From the above discussion it is clear that there is an ever growing need for new and robust techniques for detection and tracking of moving object. The performance of the proposed method is compared with other standard methods available in literature such as frame difference and background subtraction.

A. Frame Difference

To determine the presence of moving objects frame difference method uses difference between the two consecutive frames. The simplest form of background subtraction is frame difference method. This method is sensitive to noise and variations in illumination. As it uses only a single previous frame it is unable to detect the interior pixels of large, uniformly colored moving object.

B. Background subtraction

The background subtraction method uses the difference between the background frame and current frame to detect moving objects. After background image B(X,Y) is obtained subtract the background image B(X,Y) from the current frame $F_k(X,Y)$. If the pixel difference is greater than the set threshold T, then determines that the pixels appear in the moving object, otherwise, as the background pixels [17]. This method is very sensitive to changes in external environment.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 01, January-2016

III. DISCRET WAVELET TRANSFORM

Wavelet theory is the mathematics associated with building a model for a signal or system or process with a set of special symbols. The special signals are just little waves or wavelets. The discrete wavelet transform is based on sub-band coding and is found to yield a fast computation of wavelet transform. DWT is simple to implement and reduces time.

The discrete wavelet transform uses filter banks for the construction of the multiresolution time frequency plane. A filter bank consists of filters which separates a signal into frequency bands as shown in figure1. A discrete time signal x(n) is given as an input which is filtered by filters g(n) and h(n). They separate frequency content of input signal into frequency bands of equal width. The filters g(n) and h(n) are low pass and high pass filters respectively. At each level detail information is produced by high pass filter whereas the low pass filter produces coarse approximation associated with the scaling function. In the process of filtering ↓2 represents down sampling by 2.

An image is decomposed into different levels using different frequency bands namely LL, LH, HL, and HH respectively. Detail images are represented by sub-bands labelled LH1, HL1 and HH1 where as approximation image by LL1.

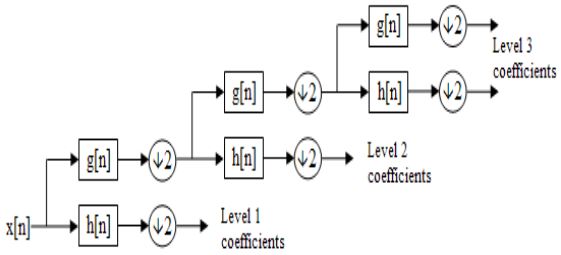


Figure1. DWT decomposition

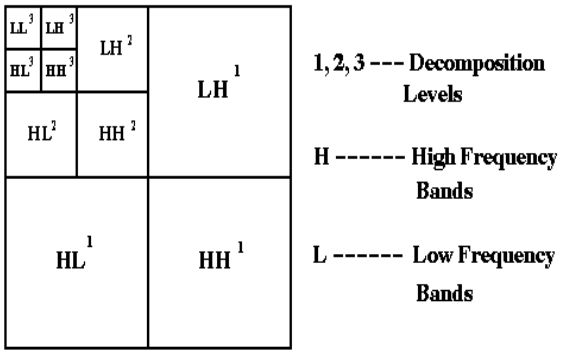
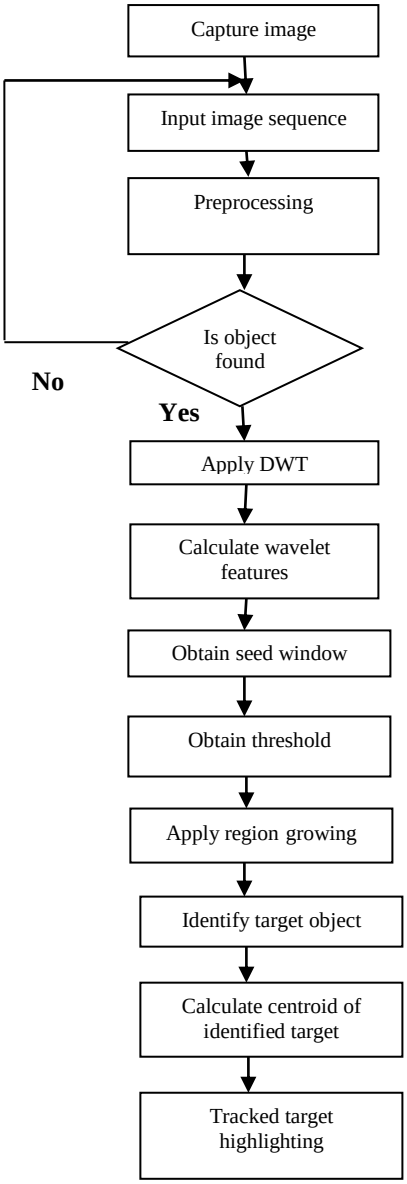


Figure2. Three level decomposition

IV. TARGET DETECTION AND TRACKING SYSTEM

The steps involved in detection and tracking are shown in figure3.



Figur3. Flow chart of target detection and tracking

MXM sized images are considered as input. The input image is converted to gyray scale for further processing to reduce the processing time as it has only one color channel while RGB image has three color channels. The input image is divided into non-overlapping image blocks. Block size is important as it will affect tracking performance. Detection of target is carried out by considering these non-overlapping blocks of different sizes. Each block is taken from top left corner and decomposed by using either one level or two level DWT. The input image is decomposed into four non-overlapping sub-bands LL1, LH1, HL1 and HH1. Cooccurrence matrix for sub-bands of DWT is derived. [1] Then from cooccurrence matrix wavelet features such as contrast, cluster shade and cluster prominence are derived. Then the seed window is selected by calculating the wavelet features. The sub-block having the maximum combined feature value is selected as seed window. Region growing is then applied. Region growing is simple region-based image segmentation method. It is also classified as pixel-based

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 01, January-2016

image segmentation method since it involves the selection of initial seed points. The first step in region growing is selection of seed point. The initial region begins at the exact location of these seeds. The regions are then grown from these seed points to adjacent points depending upon predefined criteria. Depending upon the target image threshold is determined by finding mean (M) of first m% sub-image blocks. The window whose value is close to the maximum feature values will be merged with seed window. The process is repeated for all the blocks. The algorithm terminates if no window is merged from adjacent blocks. The target detection is then completed. Now by calculating the centroid of the detected object tracking is done. Finally tracked target is highlighted by bounded rectangle.

V. EXPERIMENTS AND RESULTS

In this paper the proposed algorithm has been implemented using MATLAB software and the objects are tracked through webcam. A series of experiments have been conducted to detect the accuracy of the proposed method. The performance of the the algorithm is evaluated by capturing images through webcam.

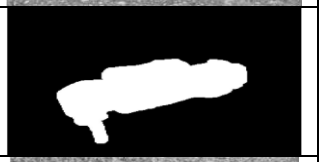
Sr.no	Steps
Input image	
Gray scale image	
Seed block image	
Region growed image	
Tracked object	

Figure. 1 Steps in target detection and tracking

VI. PERFORMANCE EVALUATION

The proposed system is experimented with different of parameters which are used for performance evaluation. The parameters used to check the performance of system are MSE, PSNR, Correlation coefficient, similarity and processing time.

A. Mean Square Error (MSE)

It represents the cumulative squared error between the compressed and the original image. The lower the value of MSE lower is the error. MSE is represented by following equation.2

$$MSE = \frac{\sum_{M,N}[I1(m,n) - I2(m,n)]}{M * N}$$

Where, M and N are number of rows and columns in input image

B. Peak Signal to Noise Ratio (PSNR):

PSNR represents measure of peak error. The PSNR between two images having 8 bits per pixel or sample in terms of decibels (dBs) is generally when PSNR is 40 dB or greater. PSNR is calculated using following equation:

$$PSNR = 10\log_{10}\frac{R2}{MSE}$$

Where, R is the maximum fluctuation in the input data type.

C. Correlation coefficient:

This computes correlation coefficient between A and B, where A and B are matrices or vectors of the same size.

D. Similarity:

Pixel based similarity measure is given as follows

$$Similarity = \frac{tp}{tp + fn + fp}$$

Greatest value of similarity shows accurate detection of moving object.

E. Processing time:

Processing time of a single image is calculated by using tic toc functions of MATLAB. Based on time we would determine which system is fastest

Table 1. Values of Processing time, MSE, PSNR, correlation coefficient and similarity for image no. 1

Sr. no	Parameters	Methods		
		Background subtraction	Frame difference	Proposed method (DWT)
1	Processing time	0.325s	0.562s	0.225s
2	MSE	0.7498	0.07083	0.05632
3	PSNR (dB)	+59.415 dB	+59.662 dB	+60.658 dB
4	Correlation coefficient	0.1757	0.26524	0.30550
5	Similarity	0.6106	0.5931	0.6704

VII. CONCLUSION

In this paper DWT has been used for detection of moving objects whereas tracking is achieved by calculating the centroid of the detected object. To improve the tracking performances, DWT is used to pre-process the image for reducing computations required and achieving real-time tracking. From the experimental results it is clear that an efficient tracking algorithm have been developed using DWT. The performance of the proposed method have been evaluated and compared with other standard methods considering various performance metrics. From the obtained results it can be concluded that dwt has better accuracy as compared to others also it is fast.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 5 Issue 01, January-2016

REFERENCES

[1] S. Arivazhagan, L. Ganesan, " Automatic Target Detection Using Wavelet Transform," EURASIP Journal on Apllied Signal Processing 2004:17, 2663-2674.

[2] Wesam A. Sakla, Adel A. Sakla, M.S. Alam, " Wavelet- based Hyperspectral Target Detection using Spectral Fringe-adjusted Joint Transform Correlation," Proceedings of SPIE vol. 7335 , 73350B 2009.

[3] Patil Gaurav Jaywantrao, Shabahat Hasan, " Application of Image Fusion Using Wavelet Transform in Target Tracking," International Journal of Engineering Research & technology, ISSN: 2278-0181, Vol. 1, Issue 8, October 2012.

[4] Sunil Tiwari N, Ravikumar A.V, " Multiple Moving Object Detection and Tracking using Harr Features with Smart Video Surveillance System," International Journal of Engineering Research & Technology (IJERT), ISSN: 2278-0181, Vol. 3, Issue 6, June-2014.

[5] Sukanyathara J, Alphonsa Kuriakose, " Robust Detection and tracking of Multiple Objects under Complex Backgrounds and Occulsion," International Journal of Engineering Research & Technology, Vol.3, Issue 8, August 2014

[6] B. Ugur. Toreyin, A. Enis Cetin, Anil Aksay, M. Bilgay Akhan, "Moving Object Detection in Wavelet Compressed Video," Signal Processing: Image Communication 20 (2005) 255-264.

[7] Hari Hara Santosh, P. Venkatesh, P. Poornesh, L. Narayana Rao, N. Arun Kumar, " Tracking Multiple Moving Objects Using Gaussian Mixture Model," International Journal Of Soft Computing and Engineering (IJSCE), ISSN: 2231-2307, Volume-3, Issue-2, May 2013.

[8] R. Arunkumar, M. Balasubramanian, S. Palanivel," Indoor Object Recognition System using Combined DCT-DWT under Supervised Classifier," International Journal of Computer Applications (0975-8887), Volume 82- No.3, November 2013.

[9] Seema Rajput, S.D. Oza," Detection and Tracking of Multiple Moving Objects Based on DWT," International Journal of Engineering Research & Technology, ISSN: 2278-0181, Vol.2 Issue1, January-2013.

[10] B.S.M. Madhavi, M.V. Ganeswara Rao, " A Fast and Reliable Motion Human Detection and Tracking Based on Background Subtraction, Journal of Electronics and Communication Engineering, ISSN: 2278-2834 Volume 1, Issue 1 (May-June 2012), PP 29-35.

[11] Vishwadeep Uttamrao Landge, "Object Detection and Object Tracking using Background Subtraction for Surveillance Application," International Journal of Advanced Research in Electrical, Electronics and Intrumentation Engineering, Vol.3, Issue 7, July 2014.

[12] Sri Lakshmi Gogulamudi and B.M. Kusuma Kumari, " Efficient Multiple Objects Detection and Tracking Using Particle Filter," International Journal of Information Technology, Control and Automation (IJITCA) Vl. 2, No.4, October 2012.

[13] Nishu Singla, " Motion Detection Based on Frame Difference Method," International Journal of Information & Computation Technology, ISSN 0974-2239, Volume 4, Number 15(2014), pp. 1559-1565.

[14] Sepehr Aslani, Homayoun Mahdavi-Nasab," Optical Flow Based Moving Object Detection and Tracking for Traffic Surveillance." International Journal of Electrical, Computer, Electronics and Communication Engineering Vol:7, No.:9, 2013

[15] Sherin Cherian, C. Senthil Singh, " Real Time Implementation of Object Tracking Through webcam," International Journal of Research in Engineering and Technology, ISSN: 2319-1163.

[16] Josan Athanesious J, Suresh P, " Implementation and Comparision of Kernel and Silhouette Based Object Tracking," International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), Volume 2, Issue 3, March 2013.

[17] Mahesh C. Pawaskar, N.S. Narkhede, Saurabh S. Athalye, "Detection of Moving Object Based on Background Subtraction", International Journal of Emerging trends & Technology in Computer Science, Volume 3, Issue 3, May-June 2014.