Gabor Feature based Abnormal Event Detection

Jayandrath R. Mangrolia
Assistant Professor, A.D.Patel Institute of Technology, Anand, Gujarat

***Abstract*- In today's world security in public places, such as airport, railway stations, shopping malls etc is highly essential, that's why abnormal event detection in video has attracted more attention in the computer vision research community. This paper presents a novel approach for detection of abnormal events and upon detection of such events notification is sent to concerned authority. The proposed algorithm specifies Gabor filter based features used for motion analysis. Extracted features are given to Artificial Neural Network which is used to recognize whether the input event is normal or abnormal. Proposed algorithm is very much efficient and provides high level of accuracy.**

***Index Terms*- Abnormal Event Detection, Gabor Filter, Artificial Neural Network**

I. INTRODUCTION

Abnormal Event Detection gains huge attention in recent years due to the increased focus on automated surveillance systems. Any event which stands out from the normal behavior within a particular context is considered as abnormal. In this work, the videos near secure area are considered, and the videos in which abnormality presents are classified through Neural Network. Frames are extracted from the given input video and preprocessing is done on every alternate frames. Gabor filter is applied on all selected frames. Gabor filter is a modulation of a Gaussian function used to extract features with different frequency and orientation. Extracted features are classified by artificial feed forward Neural Network. With different orientation and frequency of Gabor filter high level of correctness can be achieved.

II. LITERATURE REVIEW

One well known approach based on local nearest neighbor distance (LNND) descriptor requires less intermediate processing steps also achieves better performance [1]. LNND descriptor efficiently incorporates spatial and temporal contextual information around the video event, as well as it is a compact representation and its dimensionality is typically much lower than the low level feature descriptor [1]. LNND descriptor is used to account contextual information for both anomalous event and interaction can be efficiently detected with less intermediate process. Both memory requirement and computation time can be saved accordingly, due to the fact that dimensionality of LNND descriptor is much lower than typically used low level features [1]. Another approach presents a novel block based approach to detect abnormal situations by analyzing the pixel wise motion context, as an alternative for the conventional object based approach [2]. Event characterization at a pixel level based on motion estimation technique is done and density and velocity of the motion is extracted by optical flow. Simple block based approach is used to identifies abnormal motion variations [2].

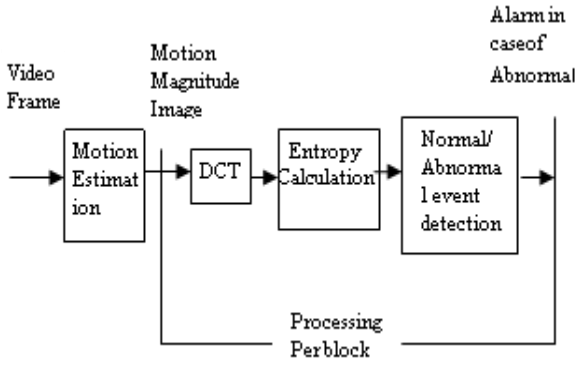

Figure1. Block based processing framework [2].

One another well-known approach is exploited for the detection and localization of abnormal events in pedestrian areas [3]. A model is designed to detect abnormal events in video sequences using motion and appearance information [3]. Motion information is represented through the use of velocity and acceleration of optical flow and the appearance

information is presented by texture and optical flow gradient [3]. This algorithm provides a general solution to detect both local and global abnormal events.

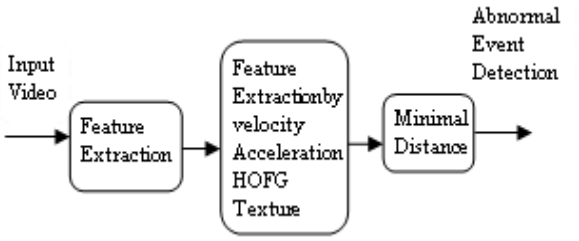

Figure2: Workflow of the approach [3].

III. PROPOSED WORK

The proposed approach is based on features extracted from Gabor filter used for Motion Analysis. From the input video frames are extracted and preprocessing is applied on sampled frames. Background subtraction is applied to remove unwanted regions as a part of preprocessing. Gabor filter is applied on those preprocessed sampled frames and features are extracted from each one of the sampled frames. Extracted features are given to Artificial Neural Network which is used to recognize whether the input event is normal or abnormal.

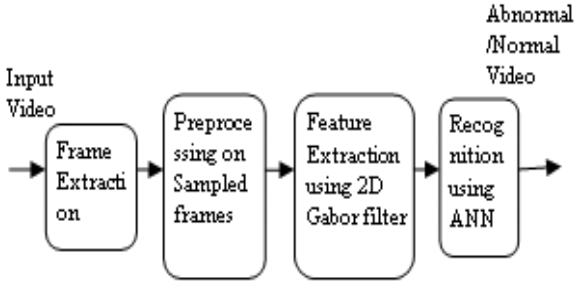

Figure3. Proposed Approach

Gabor filter have received the considerable attention in image processing during the last decade. It is extensively used in image processing for the purpose of feature extraction. Gabor filters are well suited for motion analysis in abnormal event detection because these filters have been shown to possess optimal localization properties in both spatial and frequency domain [4]. Multiresolution analysis is possible with Gabor filter by giving a coefficient matrices and Gabor filter are also found to be unaffected by illumination changes and noise. Here 2D Gabor filter is used for the purpose of feature extraction. Gabor filter is a modulation of a Gaussian function means whose impulse response is defined as a harmonic function multiplied by the Gaussian function [4].

$$G(x,y) = \left(\frac{k^2}{\sigma^2}\right)\left[\exp\left(-\frac{k^2}{2\sigma^2}(x^2+y^2)\right)\right] * \exp\left(i2\pi f(x\cos\theta + y\sin\theta)\right)$$

Where k is a parameter which determines the orientation and scale (frequency) of the Gabor filter.

$$(k_x, k_y) = (k_v \cos\theta_w, k_v \sin\theta_w) \quad (2)$$

Where $k_v = \frac{k_{max}}{f^v}$ v=(0,1,2,3,4) is the different set of frequencies and w=(0,1,2,3,4,5,6,7) is for the different orientation. The values consider for this typical application are f=$\sqrt{2}$,$k_{max} = \frac{\pi}{2}$, $\theta_w = \frac{\pi w}{8}$ and $\sigma = \pi$. The Gabor window of a size 7 x 7 is used for feature extraction. Features are extracted by simple convolution of the window with the image.

IV. CLASSIFICATION USING NEURAL NETWORK

Neural networks are composed of simple elements operating in parallel. These elements are inspired by biological nervous systems. As in nature, the network function is determined largely by the connections between elements. Neural networks are adjusted, or trained, so that a particular input leads to a specific target output. The network is adjusted, based on a comparison of the output and the target, until the network output matches the target [4].

In supervised learning, many such input/target pairs are used to train a network. An Artificial Neural Network consists of a number of interconnected artificial processing neurons called nodes, connected together in layers forming a network. A typical ANN is schematically demonstrated in figure 4.

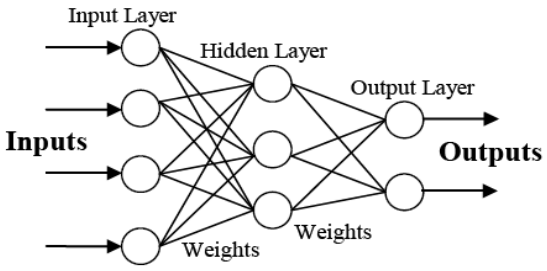

Figure4. Artificial Neural Network [4].

V. IMPLEMENTATION AND RESULT

Gabor filter is well suited for the purpose of motion analysis whose response is defined by the harmonic

function multiplied by the Gaussian function [3]. After frame extraction every alternate frame is selected, preprocessed and then Gabor filter is applied. The size of the Gabor mask which is used here for the purpose of feature extraction is 7 x 7. The equation of the Gabor filter is shown in section III. The parameter v and w determines the size and orientation of the Gabor filter. The value of parameter v varies from 0 to 4 while value of the parameter w varies from 0 to 7. Then the real part of the Gabor mask is convolved with the input frame. So five different Gabor faces are obtained. Those faces are shown in the Figure 5.

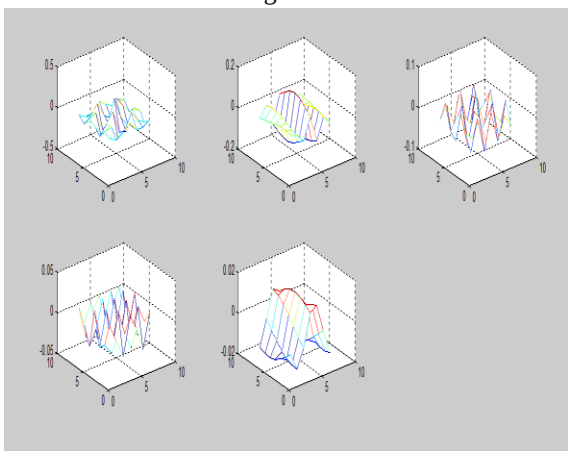

Figure6. Gabor masks for different values of v and w

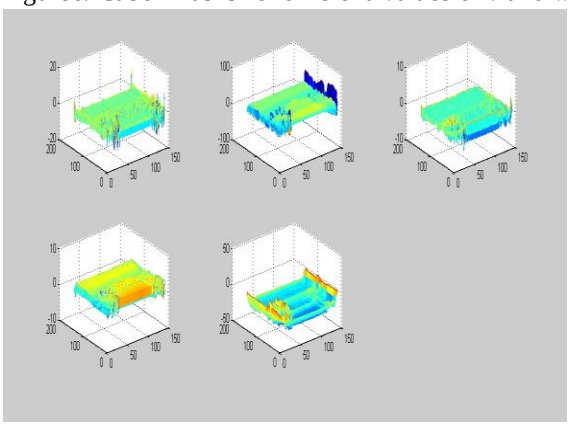

Figure7: Result of Convolution with different Gabor Masks

VI. CONCLUSION

Abnormal event detection has been a key component in ensuring security at private or public areas like airports, banks or some commercial institutions. Gabor filter is extensively used in image processing for the purpose of feature extraction and motion analysis. Extracted features are found to be unaffected by illumination changes and noise. Neural network is a supervised learning method and provides high level of accuracy. Proposed method is more appropriate for the local events like theft near secure areas, abnormal behavior in ATM. Extensive preprocessing is required for the Global events. Proposed method achieves better results and it also overcome the state of art results.

REFERENCES

[1] Xing Hu, Shiqiang Hu, Xiaoyu Zhang, Huanlong Zhang, Lingkun Luo, " Anomaly Detection Based on Local Nearest Neighbor Distance Descriptor in Crowed Scenes", The Scientific World Journal, Volume 2014.

[2] S. Javanbakhti, S.Zinger, P.H.N. de, "Fast abnormal event detection from video surveillance", Electrical engineering Department, The Netherlands.

[3] Neptali Menejes Palomino, Guillermo Camara Chavez, "Abnormal Event Detection in Video using Motion and Appearance Information", Ouro Preto, MG, Brazil.

[4] Jayandrath R.Mangrolia, Jatin B. Patel, "Automatic Facial Expression Recognition using Support Vector Machines and Neural Network" , IJCTA, Volume 5, Issue 2, March-April 2014.

[5] Yuxun Zhou, Reza Arghandeh, Ioannis Konstantakopoulos, Shayaan Abdullah, Alexandra von Meier, Costas J. Spanos, "Abnormal Event Detection with High Resolution micro-PMU Data", Department of Electrical Engineering, Florida State University.

[6] Cewu Lu, Jianping Shi, Jiaya Jia, "Abnormal Event Detection at 150 FPS in MATLAB ", The Chinese University of Hong Kong.

[7] Prof. J.R.Mangrolia, Dr. N.C. Chauhan, "Intelligent Video Surveillance: Concepts, Review

[8] M. Chitra, M.KalaiseviGeeta, L.Menaka, "Occlusion and Abandoned Object Detection for Surveillance Application", International Journal of Computer Applications Technology and Research, Volume-2, Issue-6.and Open Issues", AES e-journal, Volume-2 Issue-1, March-April 2014.