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USING SELF ORGANIZING MAP FOR ABNORMAL BEHAVIOR DETECTION IN VISUAL SURVEILLANCE

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ABSTRAT

Visual surveillance is an active research topic in the field of computer vision. The task of visual surveillance system is to automatically track object in video image sequences and monitor their activity. Neurobiological studies have concluded that the human brain can perceive actions by observing only the human body poses (postures) during action execution. Thus, actions can be described as sequences of consecutive human body poses, in terms of human body silhouettes. In this work Self organizing map (SOM) is used to find basic posture prototype of action in the video frame. SOM is a type of artificial neural network that is trained using unsupervised learning to produce a low – dimensional, discretized representation of the input space of training samples, called a map. Behavior classifier then detects abnormal behavior by monitoring continuous frames and helps to detect suspicious activity in visual surveillance method.

Keywords- Video Surveillance Systems, Anomaly, SOM, Classifier.

I. INTRODUCTION

Video surveillance systems are to be seen to monitor busy environment like shopping malls, financial institute etc. The videos from these systems are later analyzed to find out any crime, or in some cases human operator continuously keep watch on these video so that he can detect if something abnormal happens. But because of human limitation and huge amount of data it is possible that person get bored which affect on accuracy of system. We proposed a system that can automatically detect abnormal behavior.

Neurobiological studies have concluded that the human brain can perceive actions by observing only the human body poses (postures) during action execution. Thus, actions can be described as sequences of consecutive human body poses, in terms of human body silhouettes [1]. In this work Self organizing map (SOM) is used to find basic posture prototype of action in the video frame. Posture of a person provide clue for the understanding his activity. The Self-Organizing Map (SOM) developed by prof. Kohonen is used here. The SOM belong to category of competitive network; where no human intervention is needed during learning [6]. One of the important characteristic of SOM is 'topology preserving' property i.e. points that are near each other in the input space are mapped to nearby map units in the SOM. This research focus on detection of anomalous behavior in an environment through the use of a prototype based video surveillance system. The system developed can only handle a subset of possible events in an environment and by no means is it a fully fledged surveillance system, but instead it is a tool that is used as concept demonstrator. The system designed considering only one person in current context with static background. The position of camera, picture quality, shadow may limit accuracy of the anomaly detection system.

II. PROPOSED METHOD

Patterns in the scene that do not conform to expected behavior are referred to as abnormal behavior. We propose an intelligent system with the aim to automatically analyze incoming data and detect anomalous events and only notify the operator when appropriate. Video frames grabbed from camera are preprocessed as shown in Fig. 3 and given to the self organizing neural network. Input vector and weight vector associated with each neuron are of same dimension. During training weights of neuron updated for each input while each try to become like input vector. After training, the maps that we get such that postures that are spatially related in video are closer in map.

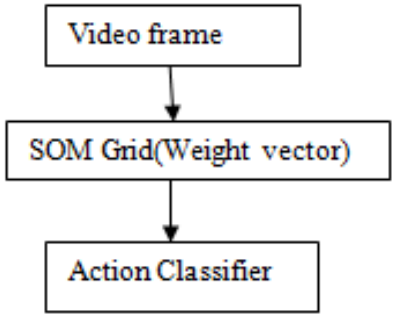

Fig.1 SOM Based Behavior Detection System

2.1 Preprocessing

Moving object detection is the basic step for analysis of video. Approach used here is to use information in a single frame to create binary images depicting person's body in white and the background in black. These images are centered at the person's center of mass.

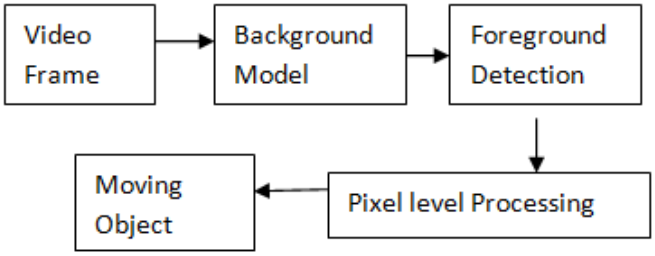

Fig.2.Moving Object Detection Process

First, we need to distinguish foreground objects from stationary background. Background modeling is used to model the background and then detect the moving objects in the scene. The basic method of background subtraction is to compare |frame – background| with a predefined threshold Th. If the difference of a pixel is larger than Th, then classify it as foreground; otherwise, claim that it is background. Running Gaussian average method is better in terms of Speed and Memory requirement [2].

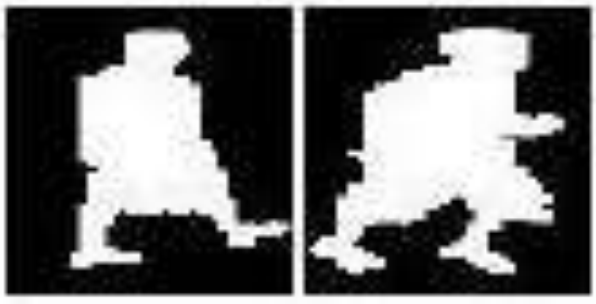

Fig. 3.Body Poses After Preprocessing

2.2. SOM Algorithm

The self-organizing neural network [Kohonen (1989)], are networks which incorporate a topology scheme, i.e., take into account a topological structure among units. Each input is fully connected to all units, which respond differently to the input pattern. At each step in the training phase, the cluster unit with weights that best match the input pattern is elected the winner (minimum Euclidean distance criteria). This winning unit and a neighborhood around it are then updated in such a way that their internal weights be closer to the presented input [10]. The adopted updating factor is not equal for all neurons, but stronger near the winning unit, decreasing for more distant units. The SOM algorithm distinguishes two stages: the competitive stage and the cooperative stage. In the first stage, the best matching neuron is selected, i.e., the "winner", and in the second stage, the weights of the winner are adapted as well as those of its immediate lattice neighbors. We consider the minimum Euclidean distance version of the SOM.

SOM Algorithm:

1. Randomly initialize weight vectors w_i
2. Randomly sample input vector x
3. Find Best Matching Unit (BMU):

   $i(x) = \text{argmin}_j \|x - w_j\|$
4. Update weight vectors:

   $w_j = w_j + \eta h(j, i(x))(x - w_j)$

   η ->learning rate

   $h(j, i(x))$: neighborhood function of BMU.
5. Repeat steps 2 – 4.

The goal of learning in the self-organizing map is to cause different parts of the network to respond similarly to certain input patterns.

1. Competition: For each of the training posture vectors p_i, its Euclidean distance from every SOM weight is calculated. The winning neuron is the one that gives the smallest distance.

2. Co-operation: The winning neuron j indicates the center of a topological neighborhood h . Neurons are excited depending on their lateral distance from this neuron.

3. Adaptation: At this step, each neuron is adapted with respect to its lateral distance from the wining neuron. Similar posture prototypes lie in adjacent lattice positions. This results to a better posture prototype organization

III. RESULT AND FUTURE WORK

3.1Background Modeling Using Mixture of Gaussian (MOG) For Foreground

Mixture of Gaussian is widely used approach for background modeling to detect moving objects from static cameras. Each pixel is characterized by a mixture of Gaussian. For the foreground detection, each pixel is compared with Gaussian and classified correspondingly.

Fig. 4.Output of Mog Method

3.2. Expected Output of Trained SOM

Proposed system use self organizing map to represent video in spatially distributed manner such that the postures those are consecutive in video will be at closer distance in SOM feature map. Then classifier will classify behavior as normal or abnormal by observing consecutive frames. Given few frames determine whether next frame belongs to abnormal action using conditional probability.

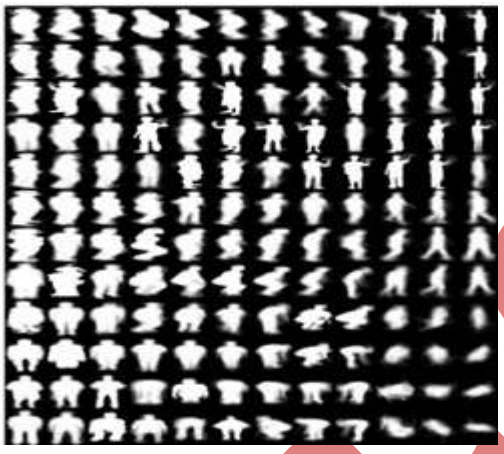

Fig.5. SOM Of Action

The video captured from static single view camera. The system will give better result in case of efficient preprocessing system and multi-view camera setup with system trained for different actions.

IV. CONCLUSION

Sequences of image frame captured from video in video surveillance system are used to identify actions. SOM learned Actions are classified considering continuous frames of video. The common activities in any area under surveillance are trained as normal action. Thus, the behavior of a person can be identified as normal or abnormal behavior using neural networks.

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