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Human Action Classification And Analysis

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Abstract: ***Monitoring suspicious activities in various places is important and has become a major research area. Suspicious activities if monitored properly then we can mitigate or avoid many unwanted incidents. In this paper we have proposed a system to detect human suspicious activity while operating an automated teller machine. Computer vision techniques are used to detect suspicious behavior and generate an alarm when required this in turn will help the security personnel which will help in improving the response time required to stop any unwanted incident.***

Keywords: Computer vision, Image processing, Human motion analysis.

1. Introduction

Computer vision has a number of applications. The use of computer vision techniques helps humans and machines work together seamlessly. Applying computer vision techniques makes many tasks easy for humans where machines can participate in decision making process too. Due to which humans can focus on more complicated tasks. Computer vision has applications in many areas like surveillance, medical, image processing and analysis.

In this paper we propose a system for smart surveillance for detecting human suspicious activity while operating an automated teller machine (ATM). Whenever a human is found doing something suspicious the system must detect it and generate an alarm or a notification. Ronald Peppe [7] discusses vision based human action recognition focusing on classification and temporal state space models, even hidden Markov Model is discussed. J. K. Aggarwal et. al. [5] have discussed many techniques for human motion analysis. Robert Bodor et al. [3] described a system to detect pedestrians and prevent collisions with them, a method which uses vision based gesture recognition to develop character animation by En-Wei Huang and Li-Chen Fu [6] also in [10] Khai Tran et al, a method for continuous recognition of human actions online is described.

2. Related Work

Volumetric models and stick figures can be used to represent human structure [13]. It becomes simple to detect the motion of human body in stick format. L. Wangetal et al. [12] described a method to for silhouette analysis while walking.

Rowley et al.[14] . explains a method that uses a kinematic model for motion detection. O'Rourke and Badler [15] have developed a model-based system to detect human motion. Sato et al. [17] and Pentland et al. [16] used the blob feature to detect the human motion. The use of temporal templates is done by Bobick and Davis [18]. Some methods make use of more than one camera to cover more area to capture the motion in detail. Using multiple cameras helps in capturing the motion. Goddard [19] used composition of events linked by time intervals along with hidden Markov Model.

3. Proposed System

The system is designed to detect a human suspicious activity. Whenever the system detects a suspicious activity it will generate an alarm or a notification. The camera will be in a fixed position to capture the motion. The basic block diagram is shown in Fig. 1.

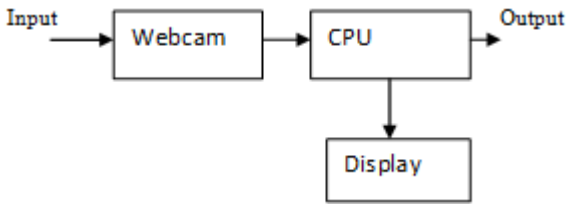

Figure 1: Architectural diagram

The system uses the haarlike features technique to detect the suspicious activity. The system is trained with the positive and negative samples. We have used 825 positive samples and 1159 negative samples. We have considered bending and sitting human action to be detected as suspicious in the scenario of operating an automated teller machine. While operating an ATM standing is considered as a normal human action, but a bending or a sitting human action for a particular duration will be considered as suspicious human activity which is to be detected.

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4. Mathematical Model

Let S be a system such that,
S= {I, O, ROI, B, M, R, Su, Fa, C}

Where,
I: Set of input.
O: Set of output.
ROI: Region of interest.
B: Blobs tracked.
M: Frames in which motion is tracked.
Su is the success of the system.
Fa is the failure of the system.
C is constraints of the system.

- INPUT
  - I is the input set such that

I = { F_1, F_2, ……..F_n}

Where,
$F_1 \ldots F_n$ are the frames

- OUTPUT
  - O=Notification or alert on detection of suspicious activity.

- FUNCTIONS

  - Function to select input.
    f_{Ic} : I_c -> Live video from camera
  - Function to select Region of interest
    f_{ROI}: I_c -> ROI
  - Function to detect blobs and track them
    f_b: f_{ROI} -> B
  - Function to detect motion for a particular duration
    f_m: f_b -> M
  - Function to detect suspicious activity and to display result
    f_{sa}: f_m + {constraints} -> O

- SUCCESS
  - Su= {Detection of suspicious activity}.
- FAILURE
  - Fa= {fac,fr}

1. fac =False Acceptance.
2. fr = False Rejection.

- CONSTRAINTS
  - Object should be in the webcam range.(1.9 meters)
  - Lighting conditions should be kept stable.

5. Results and Experimental Setup

Windows 7 32-bit operating system is installed on a dual core machine with a processor speed of 2.00GHz with 2GB RAM. Microsoft HD camera with video capture resolution of 1280 X 720 and frame rate 30 fps is used to capture the live video and as input source. The camera is mounted at a height of 1.85m and the persons have performed actions at a distance of 2m from the camera. Stable lighting conditions were achieved. The system is trained to detect the bending and sitting action of a human. We have performed the testing on 3 persons 8 times each and have shown the results in Table 1. The Fig. 2 and Fig. 3 show how the suspicious activity is detected by the system.

Table 1

Sr. No.	*Action performed*	*Success rate*
1	Bending	87.5%
2	Sitting	95.83%

The system obtained an average success rate of 91.66% which will be useful in many applications.

Figure 2: Detection of human bending action

Figure 3: Detection of human sitting action.

6. Conclusion

In this paper we have presented a system to detect the suspicious activity in scenario of ATM operations. The system was able to detect the actions with a success rate of 91.66% which is a good rate and can be used for many applications as well. Further, more complex actions can be considered for the suspicious activity detection. The system can be developed for more robust performance for varying lighting conditions.

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