MACHINE LEARNING IN VIDEO SURVEILLANCE FOR FALL DETECTION

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Abstract : Falls are the leading cause of injury and death in elderly individuals. Unfortunately, fall detectors are typically based on wearable devices, and the elderly often forget to wear them.. We can reduce the impact of fall consequences, if human fall has been detected instantly and proper medical facility is provided. Our detector combines algorithms (background subtraction) as input to a machine learning algorithm with high detection accuracy. Tests conducted on the different fall videos .We present here a unique video data set which will be very useful for the community to test the fall detection.This video data set contains different falls and normal daily activities acquired in realistic conditions.The use of computer vision systems offers a solution to analyze people behavior and detect events and different falls.It is also based on the combination of motion history image and the shape of human in variation in the dataset.It provides the results on video sequences of daily activities and falls.

Keywords **– Fall detection,Video Sequence for fall detection,Machine Learning ,Artificial Intelligent ,Deep Learning.**

1 INTRODUCTION

One of the greatest danger for old people living alone are the falls. Almost 62% of injury-related hospitalizations for seniors are the result of falls [1]. And the gravity of the situation can increase if the person can not call for help. Usually, wearable fall detectors like accelerometers [2, 3], gyroscopes [4] or help the buttons [5] are used to detect falls. But seniors often forget to wear them, and a help button is useless if the person is unconscious after the fall for long period of time. Moreover, these sensors need a battery regularly replaced or recharged for adequate functioning. Therefore, a new and promising solution for fall detection is the use of computer vision, as no sensors need to be worn along with this technology.To overcome these limitations, we use a computer vision system which doesn't require that the person wears anything.

1.1 RELATED WORK

One of the greatest danger for old people living alone are the falls. Almost 62% of injury-related hospitalizations for seniors are the result of falls [1]. And the gravity of the situation can increase if the person can not call for help. Usually, wearable fall detectors like accelerometers [2, 3], gyroscopes [4] or help the buttons [5] are used to detect falls. But seniors often forget to wear them, and a help button is useless if the person is unconscious after the fall for long period of time. Moreover, these sensors need a battery regularly replaced or recharged for adequate functioning. Therefore, a new and promising solution for fall detection is the use of computer vision, as no sensors need to be worn along with this technology.To overcome these limitations, we use a computer vision system which doesn't require that the person wears anything.

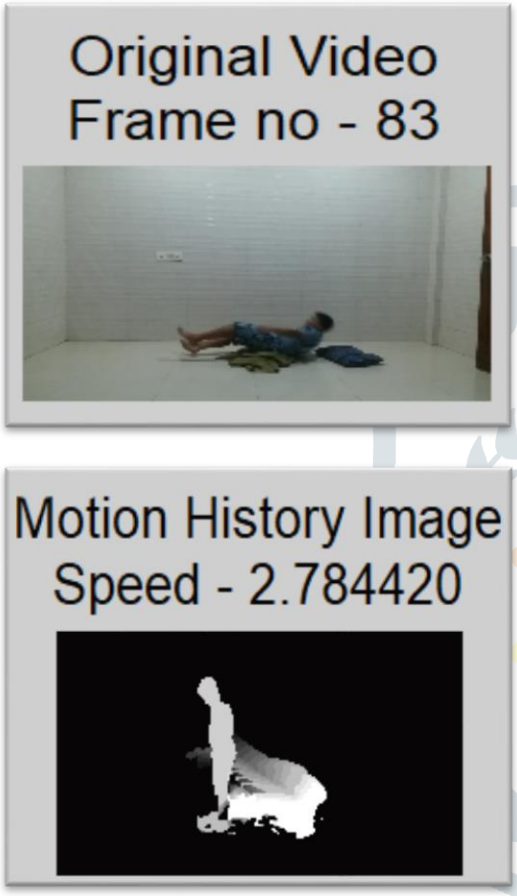
1.2 SYSTEM OVERVIEW

1. Motion History Image (MHI): Our method is based on the fact that the motion is large when a fall occurs. So, the first step of the system is to detect large motion of the person on the video dataset using the Motion History Image of the person.

2.Change in the Human Shape: When a motion is detected, we analyze the shape of the person in the video sequence(dataset). During a fall, the human shape changes and, at the end of the fall, the person is generally on the ground with few and or small body movements. A change in the human shape can discriminate if the large motion detected is normal (e.g.: the person walks or sits) or abnormal (e.g.: the person falls,forward or backward).

2 MOTION HISTORY IMAGE(MHI)

Motion gives a crucial information about fall, because no serious fall occurs without a large movement. Based on this observation, we decided to extract some motion information from the video sequence. Optical flow is commonly used to detect motion in a video sequence. But, optical flow is not well-suited for real time application, and can generate errors in case of large movement as it happens during a fall. Another attempt to extract motion is the ”Motion History Image” (MHI), first introduced by Bobick and Davis [12]. The MHI is an image where the pixel intensity represents the recency of motion in an image sequence, and therefore gives the most recent movement of a person during an action. The MHI is commonly used for activity recognition [12]. MHI is useful in our case, because it is not necessary for us to detect the direction of the movement, we want above to quantify the motion of the blob of a person. The motion will be high in the case of a fall.



3 HUMAN SHAPE

To analyze the human shape, the person is segmented in the video sequence using a background subtraction method, and then, the blob is approximated by an ellipse. The steps of the human shape extraction are explained.

3.1 BACKGROUND SUBSTRACTION

First, we need to extract the moving person in the image. For this purpose, we use a background subtraction method described in the article[13],which gives good results on image sequences with shadows, highlights and high image compression.

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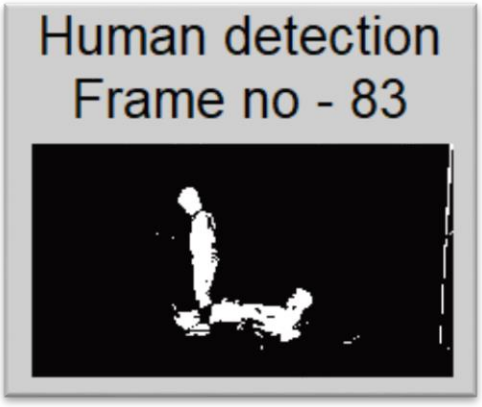
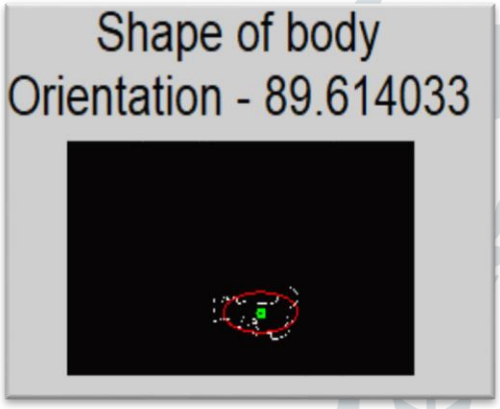


3.2 Approximation Of Ellipse

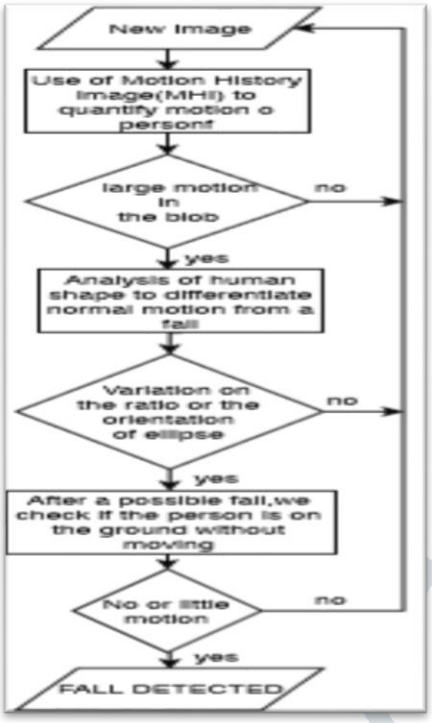
The person is then approximated by an ellipse using moments [14]. An ellipse is defined by its center ($\bar{x}$,$\bar{y}$), its orientation θ and the length a and b of its major and minor semi-axes.



4 FALL RECOGNITION SYSTEM

Our fall detection system is based on the Motion History Image and some changes in the shape of the person. An overview of our fall recognition algorithm is shown. The three main steps of the algorithm are:

Motion Quantification: The quantification of the motion of the person allows to detect large motion like falls. But a large motion can also be a characteristic of a walking person, so we need to analyze further to discriminate a fall from a normal movement.
Analysis of Human Shape: An analysis on the moving object is performed to detect a change in the human shape, more precisely in orientation and proportion.
Lack of motion after a fall:The second analysis of the moving object is to check if there is a lack of motion just a few seconds after the fall.
Fall Recognization system approach:

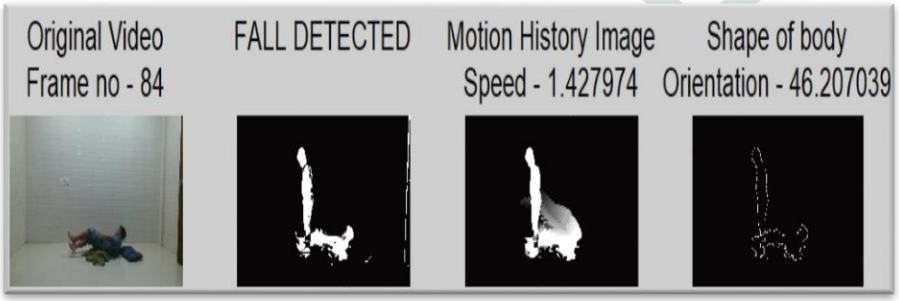


5 DATASET

The dataset comprises of several normal daily activities and falls viewed from the camera. It consist of normal activities like walking in different directions, housekeeping work etc. and falls like forward falls, backward falls, falls when inappropriately sitting down, loss of balance.

6 RESULTS

Our system is designed to work with a single uncalibrated camera. As we want a low-cost system, our video sequences were acquired using a USB webcam with a wide angle of more than 70 degrees to see all the room (model Live! Ultra from Creative Technology Ltd). As you will see further down, our method gives good results in spite of the low-quality images (high compression artifacts, noise) of our acquisition system. Our fall detection system is implemented in MATLAB. Our dataset for our experiments is composed of video sequences representing daily normal activities (walking, sitting down, standing up, crouching down) and simulated falls (forward falls, backward falls).



7 CONCLUSION

In this method to detect elderly person falls is proposed. The combination of motion of humans and change in the human shape gives crucial information on human activities. Our fall detection system has proven its robustness on realistic video dataset of simulated falls and daily activities. In this , we make the assumption that the person is on the ground with no or little motion after a fall. This can be argued in some circumstances, for example in the case of injury, where the person could move rapidly because

of the pain.Falls are a major issue in elder people, which needs some promising solution to mitigate the effect of falls. We designed and implemented a real time fall detection and posture recognition system using camera.

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