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Human Fall Detection using CNN Algorithm

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Abstract: *Globally, the problem of falling is a major health problem resulting in serious injuries and sometimes lead to death especially for elderly people. This project is based on Human Fall Detection using visual surveillance which could be used to detect such incidents at faster pace so help could be provided to elderly people. The system is designed using CNN Algorithm which is considered to be one of the best image classifiers and is being widely used in image and video processing. Firstly, It uses background subtraction using Improved GMM to find the foreground objects then contour based human template matching to categorize the human or nonhuman object. Through computing distance between top and mid center of rectangle covering human, if it is less than a certain threshold, then human fall is confirmed. Finally it checks if inactive pose of human is continued till 100 consecutive frames, then an alarm is generated to alert the people at home to provide treatment on time. According to prediction and analysis it shows that proposed system works efficiently and effectively in real-time and gives good fall detection accuracy.*

Keywords: CNN Algorithm

I. INTRODUCTION

Over the past decade, more and more elderly people had to live alone due to the development of seriously aging society. The old-age dependency ratio will sharply increase from 22 percent in 2010 to 37 percent by 2050. The attendant problem is that falls have been one of the major health hazards among the population ofage over 60 living alone, among whom accidental falls have become a widespread accident. Nowadays, falls are threatening the health and lifestyle of victims. Furthermore, falls are considered as the eighth leading cause of death in the U.S. A lot of falls occur in our daily activities. Besides falls during walking, many falls occurin the process of sitting or lying. Compared to healthy people, patients most likely have difficulties to control the balance of the body and hence fall, therefore human falls often happen in medical places. If a person falls unconsciously without getting emergency treatments, irreversible consequences such as fracture, stroke, disability and even death may occur. Unfortunately, the existing methods cannot effectively detect falls in complicated environments, especially for the falls on furniture which have different features from falls on floor because of involving furniture.

II. MOTIVATION

Nowadays since people are busy due to their schedule, it's not always possible to keep someone at home to take care of elder person. Tissue injuries, joint dislocations, bone fractures, and head trauma are some of thehealth conditions caused by falling. The absence of movement of a person after a fall may cause severe complications regarding health and may even lead to death if immediate assistance is not provided to them In order to overcome these challenges, automatic fall detection and alert system can be used at the home forquicker assistance.

III. PROBLEM DEFINITION

An overview of fall detection systems using Machine Learning is provided. These systems aim to notify otherswhen a fall is detected such that immediate care can be given to the fallen person without any delay.

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IV. LITERATURE SURVEY

2.1 Study of Research Paper

Paper Name: Fall Detection Based on RetinaNet and MobileNet Convolutional Neural Networks
Authors: Ahmad.M Ahmad, Hadir Abdo, IEEE 2020
Abstract: The problem of falling is a major health problem resulting in serious injuries and sometimes lead to death especially for elderly. This paper presented a method for fall detection which based on combining convolutional neural networks Retina Net and Mobile net in addition to handcrafted features. Traditional human detection methods may result in human shape deformation which affect the performance of fall detection frameworks. Therefore, the proposed framework depends on RetinaNet for detecting humans withshorter computing time and higher accuracy compared with the traditional human detection methods. The proposed framework extracts aspect ratio and head position as shape features and motion history image as amotion feature of the detected human to create the feature map. This feature map is used in training MobileNet network to classify the human motion into fall or not-fall.

Paper Name: An Approach to Enhance Fall Detection Using Machine Learning Classifiers
Author: Mukesh Soni, Bhavna Bajpai,Tanvi Puri, Sonali Chauhan, IEEE 2021
Abstract: Human fall detection is an effective environmental support sub-area. One of the critical issues in elderly people is the fall detection. In this paper, they have proposed the fall detection algorithms using machine learning which later uses a fog computing approach to send information to the caregiver in real- time.One class method based on a support vector machine is used to build fall detection and a Smartphone Accelerometer is used for the data collection. According to the study of this paper during the detection of human fall, the model has achieved 100 percent sensitivity and 98.8 percent specificity.

Paper Name: Fall Detection and Personnel Tracking System Using Infrared Array Sensors
Author: Zhixin Liu, IEEE Sensors Journal 2020
Abstract: This paper proposes a non-contact scheme for detecting human body state using infrared array sensors, which has the advantages of low cost, easy implementation and high detection accuracy. For achieving real-time monitoring, rather than simple motion analysis, the system identifies suspicious points ofbody falling by simple positioning, which attempts to achieve the real-time implementation and reduces the
analysis of irrelevant data. In addition, considering the influence of the radiation temperature result of the
human body, the falling characteristics are included, and the clustering algorithm is proposed to tackle the problem of inaccurate determination of the area

V. ALGORITHM USE

Artificial Intelligence has been witnessing monumental growth in bridging the gap between the capabilities of humans and machines. Researchers and enthusiasts alike, work on numerous aspects of the field to make amazing things happen. One of many such areas is the domain of Computer Vision.
The agenda for this field is to enable machines to view the world as humans do, perceive it in a similar manner, and even use the knowledge for a multitude of tasks such as Image & Video recognition, Image Analysis & Classification, Media Recreation, Recommendation Systems, Natural Language Processing, etc. The advancements in Computer Vision with Deep Learning have been constructed and perfected with time, primarilyover one particular algorithm — a **Convolutional Neural Network** A **Convolutional Neural Network (ConvNet/CNN)** is a Deep Learning algorithm that can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image, and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets have the ability to learn thesefilters/characteristics.
The architecture of a ConvNet is analogous to that of the connectivity pattern of Neurons in the Human Brain and was inspired by the organization of the Visual Cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the Receptive Field. A collection of such fields overlap to cover the entire visual area.

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A ConvNet is able to **successfully capture the Spatial and Temporal dependencies** in an image through the application of relevant filters. The architecture performs a better fitting to the image dataset due to the reduction in the number of parameters involved and the reusability of weights. In other words, the network can be trained to understand the sophistication of the image better.

VI. SYSTEM DESIGN

6.1 System Architecture

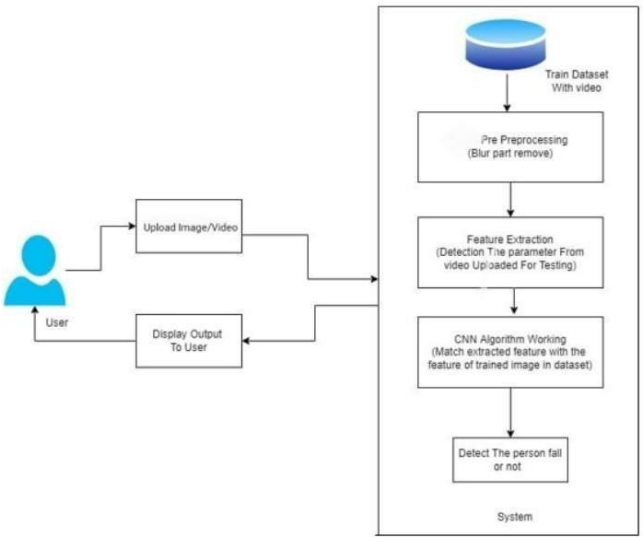
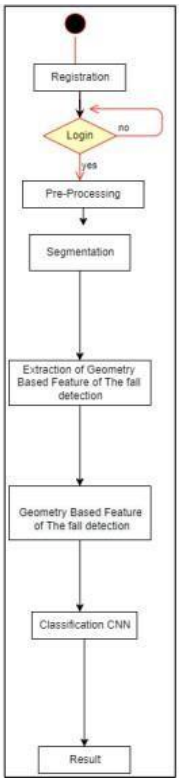


Figure: System Architecture



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6.2 Other Specification

A. Advantages

- A fall detection system is proposed which monitors elderly people in real-time.
- To improve quality of life of old aged people and to provide living assistance to them, automatic fall detection systems are in place.

B. Disadvantages

- The system designed is such that it is limited to a specific area.
- It does not guarantee privacy and is expensive.

VII. CONCLUSION AND FUTURE WORK

7.1 Conclusion

The fall detection design based on the Inception model; CNN helps to improve the accuracy of the fall detection. In this way the designed system could get rid of the false alarms or reduce the number of false positives and could be used to make a more reliable fall detection system in the real-world environment. Deep learning architecture for automated detection of human fall from frames taken by a single camera with the body joint locations and information on segmentation, our framework produces human propositions. Such ideas are refined and converted into multimodal visual representations for input, a model CNN that uses modality-specific and multi-modal layers and utilizes highly discriminative embedding features for fall recognition. Study predicted that falls are appropriately detected using decision tree algorithm with an accuracy of 96 percent. So, CNN has proven to be one of the best image classifiers and is being widely used in image and video processing. The decision of choosing the concept of deep learning and CNN has been very crucial for the system design.

7.2 Future Work

As currently we are working for desktop application in future, we can deploy our model to android application which will be easier to use. Further improvement in accuracy can be obtained by training the models with large dataset and by identifying optimal features.

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