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REAL-TIME HUMAN FALL DETECTION

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ABSTRACT: Based on skeleton traits and variations in human shape, a novel video-based human fall detection system effectively separates fall-down actions from fall-like ones, attaining high detection rates and low false alarm rates. Falls can result in serious injury, necessitate medical attention, impair functioning, and even result in death. Effective fall detection is essential for lowering mortality risks and raising survival rates. The AlphaPose optimization model and ST-GCN are the foundation of the proposed lightweight method, which includes a GSM module for message alerts upon fall detection. Wearable sensors and smart technology are used in a real-time human fall detection system to identify falls and dispatch help right away. Advanced algorithms recognize fall-related trends, decreasing injuries and improving wellbeing in places like homes and assisted care institutions. For individuals who are at danger, this technology provides piece of mind by enhancing safety and lowering risks.

KEYWORDS: ST-GSN, GSM, AlphaPose, Yolo

I. INTRODUCTION

Based on skeleton traits and variations in human shape, a novel video-based human fall detection system effectively separates fall-down actions from fall-like ones, attaining high detection rates and low false alarm rates. Recent developments in AI and machine learning have intensified study on human fall detection, with an emphasis on the security and safety of the elderly. Falls can cause fatalities as well as serious, minor, and fractured injuries, with fatalities being a prominent issue. Using built-in technology on the neck, wrist, or waist, a fall detection medical alert system enables users to summon assistance without touching a button. Accidental falls are a big problem, particularly for the elderly and those who are unwell. Real-time fall detection systems are made possible by advances in sensor technology and machine learning.

Quick detection and action are essential to reducing risks. By analyzing sensor data and finding patterns, machine learning systems reliably recognize fall events. In order to minimize false positive detections, they train on a sizable dataset of labeled falls and everyday activities. They extract variables including peak acceleration, jerk, angular velocity, and spatial orientation. With the use of automated calls that are customized to each user's needs and preferences, alarms that are set off by fall detection systems alert caregivers and enable fast response and aid. Real-time fall detection systems can improve people's safety and wellbeing, especially for those who are more vulnerable. They can be utilized in homes, hospitals, and senior living facilities to give carers extra support and guarantee quick help in case of falls. Wearable sensors, machine learning algorithms, and reaction mechanisms are used in real-time fall detection systems to reliably detect falls and enhance safety and quality of life. Their efficiency and dependability continue to improve fall prevention and intervention as technology develops. Wearable sensors and clever algorithms are used in real-time human fall detection systems to automatically identify falls and dispatch aid. These systems use sensors like accelerometers and gyroscopes to track body movements and evaluate data. In order to increase safety and wellbeing in nursing homes and assisted living institutions, machine learning analyzes fall tendencies and starts reactions, like alarms or notifications

II. RELATED WORK

[1] Li et al., 2011, Systems use several microphones scattered around the surroundings to detect falls by comparing sound intensity and direction to a predetermined threshold value.

[2] To detect falls, Zhang et al placed a tri-axial accelerometer around a person's waist and supplied data to an SVM classifier.

- [3] Using an SVM classifier Doukas et al classified foot movement into three categories using accelerometer data: walk, run, and fall.
- [4] A bi-axial gyroscope was used by Bourke and Lyons 2008 to monitor a person's pitch and roll angular velocity and sound an alarm if it exceeds predetermined limits.
- [5] Kim and Ling 2009 used Doppler Radar and Doppler Spectrogram to extract characteristics from seven activities. They used STFT to analyze the retrieved features, four-fold class validation to improve them, and SVM and Decision Tree to classify the data.
- [6] Principal component analysis was utilized to extract foreground characteristics from two perpendicular cameras, which Hazelhoff and Han 2008 then fed into a multi-frame Gaussian classifier for fall event identification.
- [7] The 3-Dimensional CNN fall detection system was created by Lu et al, employing kinect data, LSTM for feature extraction, and concentrate on particular areas.
- [8] Nizam et al., 2016, Wearable fall detection technologies include accelerometers, tilt meters, gyroscopes, and oscilloscopes as sensors to detect falls, necessitating constant carrying and observation.
- [9] Alwan et al. 2006, Utilizing floor vibrations to distinguish between fall and regular activity vibration patterns, Alwan et al. created a fall detector

III. METHODOLOGY

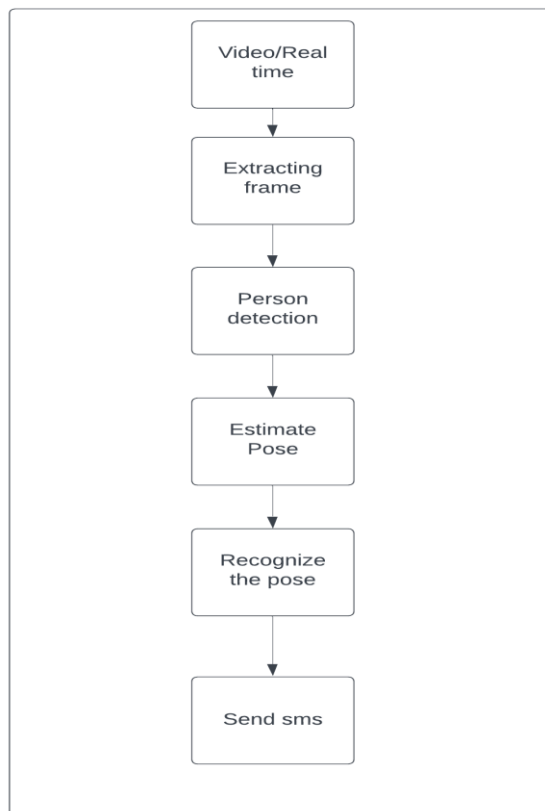


Figure1. Block diagram of fall detection

The methodology for human fall detection uses web cameras for video streaming, extracting frames, and detecting a person using the Yolo algorithm. The skeleton pose is estimated using Apose, an opensource multi-person pose



estimator. The skeleton pose is then used for Skeleton-Based Action Recognition using ST-GCN, which detects actions like Standing, Sitting, and Fall Down.

video/real time: In this step, it counts the frame to extract the

Extracting the frame: It extracts the frame.

Person detection: Detects the person using yolo algorithm.

Estimate pose: It determines the posture of a person.

Recognize the pose: It identifies the posture of a person.

Send sms: Send a notification to the given contact number.

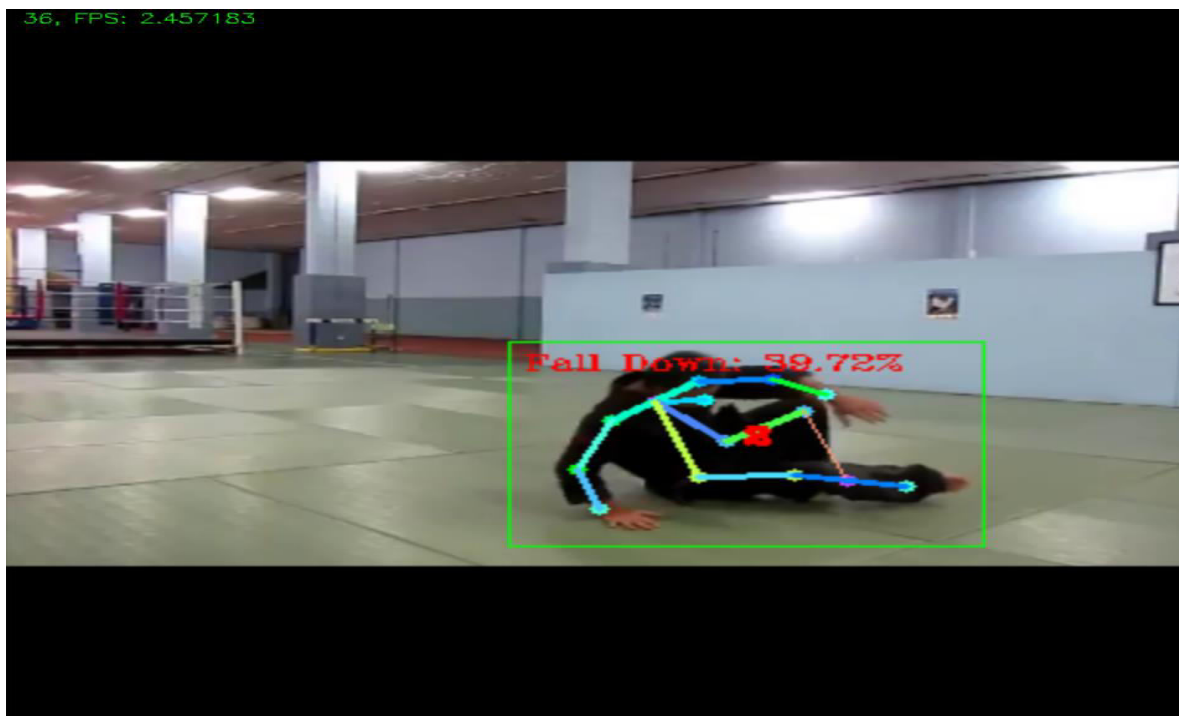
YOLO is a method that uses convolutional neural networks (CNN) to detect and identify objects in real-time. It ensures precise image recognition by using a single forward propagation to anticipate class probabilities and bounding boxes in a single run. The center, width, and image location are the four numbers that the YOLO algorithm uses to determine object class and bounding box. Popular real-time object detection technology called the YOLO algorithm blends deep neural networks with computer vision methods. It creates a grid from the input image and uses each grid cell to forecast bounding boxes and class probabilities. YOLO uses a deep convolutional neural network architecture to complete object detection in a single neural network pass. For each grid cell, it forecasts various bounding boxes and class probabilities while utilizing non-maximum suppression to weed out redundant forecasts. The result is a set of bounding boxes that show the position and type of objects that were detected in the image and are accompanied by class names and confidence scores.

A precise real-time method for estimating multiple-person poses called Alpha Pose is utilized in computer vision, healthcare, sports, and security. It has a number of characteristics and abilities, including pose and orientation analysis to forecast and monitor a person's whereabouts. Human-computer interaction, action recognition, motion capture, augmented reality, sports, fitness, and robots are a few examples of applications. A sizable labeled dataset containing bounding box annotations and images is used to train the YOLO algorithm. While it has become more well-known as a result of a computer vision and machine learning technique called AlphaPose detects and assesses human poses from pictures or videos. It analyzes photos and determines body positions using deep learning methods, more especially convolutional neural networks (CNNs). The algorithm detects human bodies using object detection models like YOLO, then utilizes a CNN-based network to estimate joint positions. Following that, it adjusts joint positions based on the environment and the body's structure, tracking approximated poses over multiple frames. Each detected individual receives a collection of joint positions as the output, which can be applied to a variety of tasks like action identification, gait analysis, fitness tracking, and human-computer interaction.

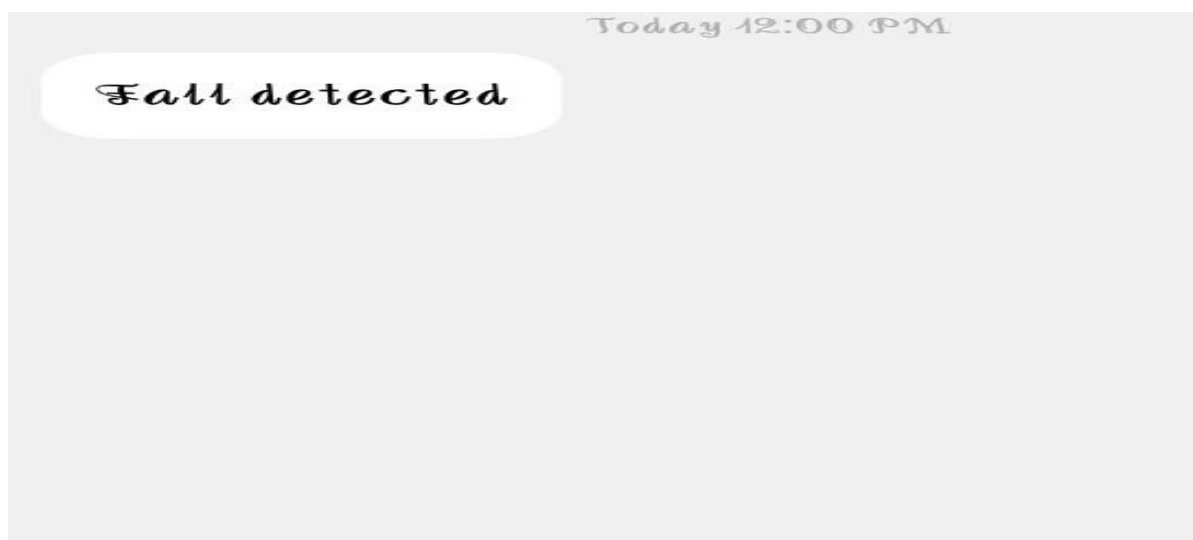
The ST-GSN model combines graph convolutional networks and temporal modeling to capture spatial and temporal correlations. It is a deep learning architecture for activity recognition in movies. Each video frame is represented as a node in a spatiotemporal graph, with connections made based on geographical relationships. In order to capture spatial dependencies and extract spatial information, the model uses graph convolutional procedures to the graph structure. Additionally, it uses temporal modeling, such as recurrent neural networks or temporal convolutional networks, to capture the dynamic aspect of movies. High-level representations of the video data are produced by the ST-GSN model and supplied into fully connected layers for classification. In a number of video analysis applications, including action identification, video surveillance, and human behavior understanding, this deep learning architecture has demonstrated promising results.

IV. EXPERIMENTAL RESULTS

The image below shows how a person is found after a fall. It estimates a person's stance first, and if they fall over, it detects that.



The notification that is sent when someone falls over is seen in the figure below.



V. CONCLUSION

A real-time human fall detection system is an innovative technology advancement that has the potential to increase people's safety and wellbeing, especially the elderly and people with mobility challenges. The technology can lessen the effects of falls and offer peace of mind by speeding up response times and notifying caregivers or emergency



personnel. More precise and trustworthy fall detection systems have been made possible by developments in sensor technologies, machine learning algorithms, and wearable technology. The accuracy of the system can be affected by issues including false positives and false negatives, ambient circumstances, sensor placement, and individual variability. User acceptance and privacy issues are also essential for a successful implementation.

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