A frame in video — OpenPose → The processed image

Fall Detection Using Computer Vision

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Course : CS5031 - Applied Computer Vision (Sec-A)

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Project Idea

The goal of this project is to implement computer vision techniques to train a machine learning model that performs fall detection among humans using computer vision only. Usual approaches to fall detection combine sensor data with vision data; these sensors may take the form of wearable devices or environmental sensors. However, for this project, the model will detect falls solely by using images from a standard video camera, without the need for environmental sensors.
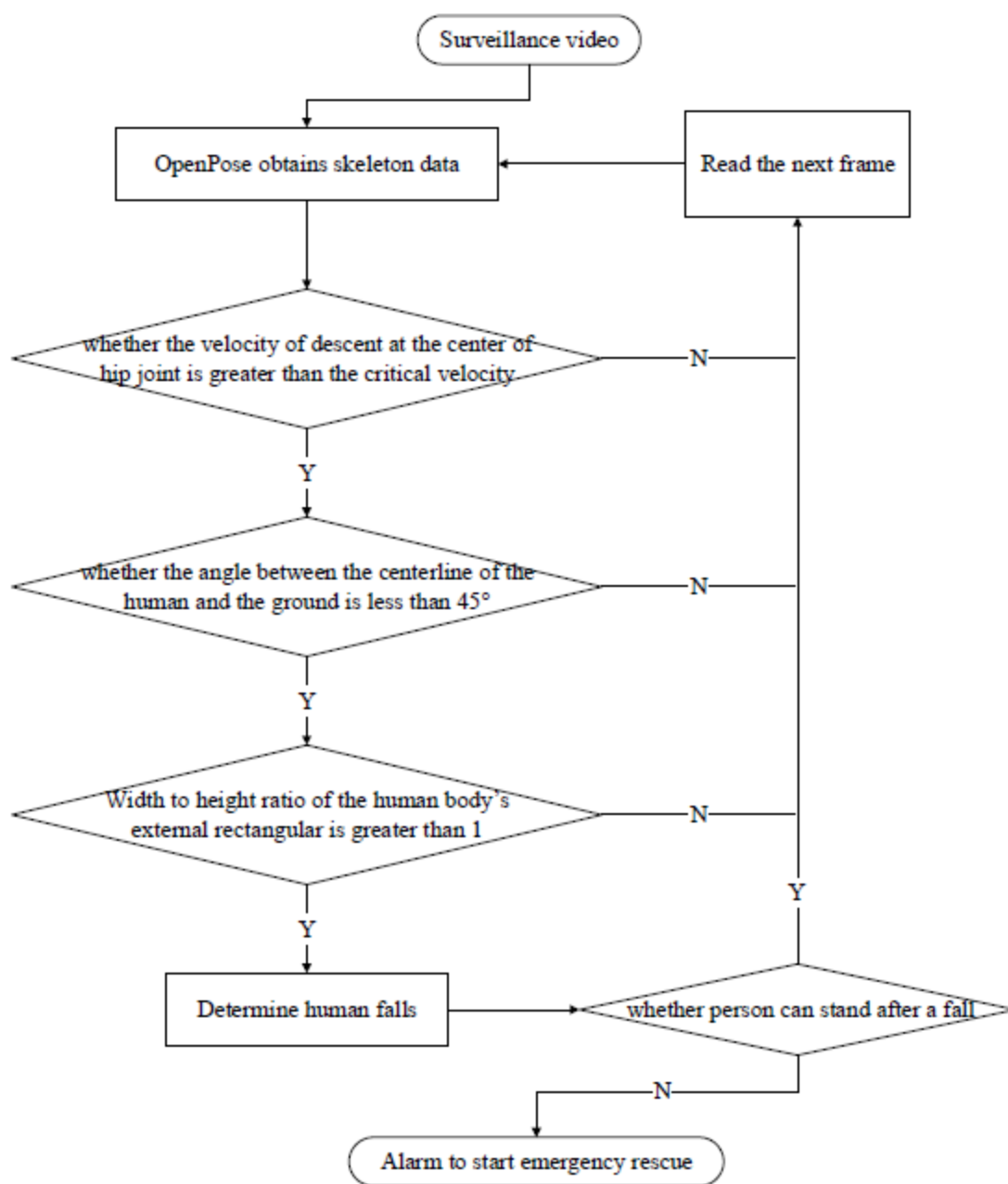
Implementation Details

- ## Associated Research

  I will be taking guidance from three different papers published between 2020 and 2022.

  1. [Fall detection based on key points of human-skeleton using OpenPose by Weiming Chen.](#)
  2. [Fall Detection and Activity Recognition Using Human Skeleton Features](#)
  3. [Fall detection based on OpenPose and MobileNetV2 network](#)

- ## Why these papers?

  1. The **first paper** presents an interesting approach that not only detects a fall but also predicts whether the person has stood up within a set time period. If the person does not stand up, an emergency call can be triggered automatically, without requiring manual action. The method identifies falls using three critical parameters: the speed of descent at the center of the hip joint, the angle of the human body's centerline relative to the ground, and the width-to-height ratio of the body's external bounding rectangle.

Surveillance video

OpenPose obtains skeleton data ← Read the next frame

whether the velocity of descent at the center of hip joint is greater than the critical velocity —N—

Y

whether the angle between the centerline of the human and the ground is less than 45° —N—

Y

Width to height ratio of the human body's external rectangular is greater than 1 —N—

Y

Determine human falls ← whether person can stand after a fall

Y

—N—

Alarm to start emergency rescue

2. The **second paper** uses the [UP-Fall Detection Dataset](#) and classifies the detected action into the following 12 categories using four different classification models (Random Forest, SVM, Multi-Layer Perceptron and KNN):

UP-FALL Activities and their corresponding IDs.

Activity ID	Description
1	Falling forward using hands
2	Falling forward using knees
3	Falling backwards
4	Falling sideways
5	Falling sitting in empty chair
6	Walking
7	Standing
8	Sitting
9	Picking up an object
10	Jumping
11	Laying
20	Unknown activity

3. The **third paper** uses a light neural network (modified version of MobileNetV2) and detects falls by integrating both human keypoint information and pose information in the original images to correct the deviation caused during the keypoint labeling process.

- How do I plan to Implement the Project?

I will primarily follow the approach proposed in the first paper. However, if necessary, I may incorporate elements from all three papers to achieve better results.

- Programming language and Framework

I will use **Python** as the programming language and **PyTorch** as the framework for this project.