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Human Pose Estimation For Fitness Feedback

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ABSTRACT

This project is about creating a human pose detection system using artificial intelligence. It can recognize and show the name of a person's body pose in real time. Many people doing exercises or yoga at home find it hard to keep the correct posture without a trainer. When the camera is turned on, the system captures live video and tracks body parts like shoulders, elbows, and knees. Using these points, it identifies which pose the person is doing and shows its name on the screen. If the pose doesn't match any known pose, it shows "None." The project uses Python, OpenCV, and Media Pipe to detect poses accurately. It can be helpful for fitness tracking, yoga pose detection, and movement analysis.

Key Words:

OpenCV, Media Pipe, Posture Recognition, Machine Learning. Human Tracking, Deep Learning

INTRODUCTION

A computer vision technique called Human Pose Estimation (HPE) is used to identify and monitor the locations of human joints in pictures or movies. It assists with real-time exercise form monitoring in fitness, providing users with prompt feedback to guarantee proper posture. This increases the effectiveness of workouts, lowers the chance of injury, and supports uses like sports coaching, personal training, and recovery. HPE can precisely map important body landmarks and compute joint angles by utilizing machine learning models such as Media Pipe Pose or Open Pose. With the help of these insights, the system can rapidly identify errors and recommend fixes by comparing a user's movements with reference exercise forms. Because of its affordability and scalability, HPE provides a useful substitute for conventional trainer supervision, opening up guided exercise to a larger audience.

LITERATURE SURVEY

I looked into some related articles to pose estimation in recent years, but I found some limits.I looked at a recent paper to check it. Ce Zheng and Wenhan Wu developed Deep Learning-Based Human Pose Estimation in 2006; in this article, they utilize multi-view cameras, while I use single cameras to make it user-friendly.Additionally, according to a different research by Yang Liu, Changzhen Qiu, and Zhiyong Zhang (2024), powerful hardware is needed.And Haoming Chen and Runyang Feng's final paper.(2022) In my research publications, I get over such issues. While the study offers a thorough analysis, my project gets around expensive gear, complicated models that need powerful hardware, or multi-camera setups.

RELATED WORK

In this project, OpenCV is used for handling video input and image processing tasks, while Media Pipe, developed by Google, provides powerful pose estimation models that detect and track human body landmarks. TensorFlow is used to train and run the deep learning model that classifies the detected poses. Pandas and Scikit-learn are utilized for data handling, preprocessing, and analysis. The project focuses on developing an AI-based Human Pose Detection System that can accurately recognize and label human body poses in real time using computer vision techniques. This project aims to provide a low-cost, user-friendly solution for fitness tracking and yoga posture correction

EXISTING SYSTEM

In contrast to the suggested low-cost project, the majority of the 2D and 3D human pose estimation systems now in use, as covered in the study by Ce Zheng and Wenhan Wu (2023, ACM Computing Surveys), have drawbacks. These systems are costly and inappropriate for regular users since they frequently call for several cameras, depth sensors, or motion capture devices. They also require technical know- how and are challenging to maintain due to their intricate installation and calibration procedures. Furthermore, a lot of these techniques are difficult to implement and are more suited for professional or research settings than for home or individual fitness applications.

PROPOSED SYSTEM

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This project introduces a lightweight and affordable human pose detection system built with Python, OpenCV, MediaPipe, and TensorFlow. Unlike traditional complex setups that depend on multiple cameras or sensors, this system performs effectively using just a single webcam, making it convenient for everyday users. It avoids heavy installations and expensive hardware by applying Media Pipe's pre- trained models to detect and track human body joints in real time. With TensorFlow, the system classifies poses accurately while maintaining low

SYSTEM ARCHITECTURE

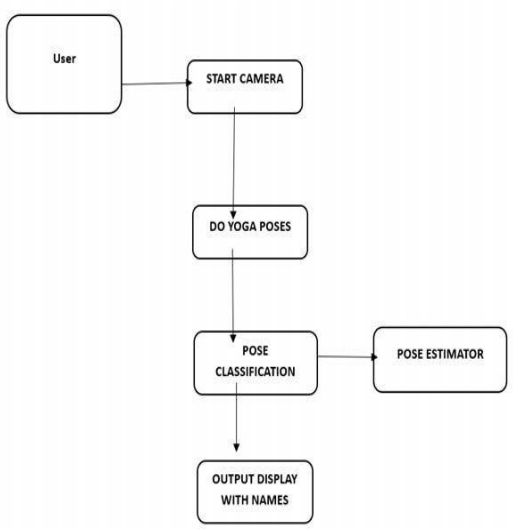

Fig:1 Human Pose Estimation for fitness feedback

METHODOLOGY DESCRIPTION

User: The individual performing yoga postures in front of the system, initiates the camera and interacts by posing for reorganization.

Start Camera: Turn on the web cam to capture real time video, streams continuous frames for further processing passes each frame to the pose estimation module for analysis.

Do Yoga Poses: The User performs different yoga positions such as Mountain Pose, Boat Pose, Cobra Pose, the camera records every frame of the motion these frames become inputs for pose detection and key point extraction.

Pose Estimator: The Main AI component (like Media pipe, Open Pose or TensorFlow model), detects human joint points such as elbow, shoulders, hips, and knees, converts the person's image into a set of coordinate points forming a skeleton.

Pose Classification: Takes the joint coordinates from the pose estimator, matches them against stored yoga pose models, applies machine learning to identify the posture.

Output Display with Name: Shows the detected pose label in real time on the screen

RESULTS AND DISCUSSION

The system successfully detected Tadasana by recognizing an upright spine, aligned Sholder, and straight legs, providing to maintain balance and posture.

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Fig :2 Tadasana(Mountain Pose)

Fig :4 Utkatasana(Chair pose)

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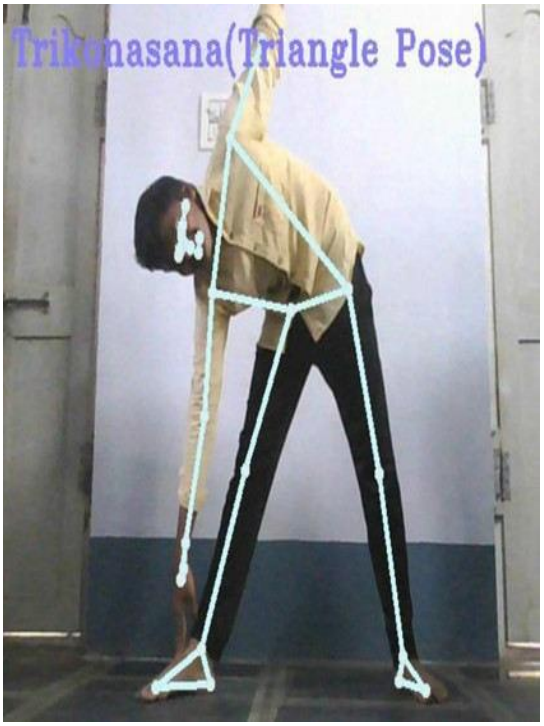

Fig :3 Trikonasana (Triangle Pose)

The system accurately detected Trikonasana by identifying the sideways bend of torso and alignment of both arms.

The system correctly identifies Utkatasana by detecying bent knees and a straight spine posture.

CONCLUSION

In conclusion, this project presents a lightweight and affordable AI-driven human pose detection system that functions in real time using a single webcam. It effectively resolves the limitations of existing costly and complex systems by being simple, efficient, and easy to operate. This innovation enables accurate pose recognition for home exercises, yoga, and fitness tracking without requiring advanced or expensive hardware.

FUTURE SCOPE

In the future, this project can be enhanced by adding real-time feedback to help users correct their yoga postures and improve accuracy. It can be extended to mobile platforms for on-the-go training and include personalized performance tracking. Integration with AI analytics and cloud storage can further enable progress monitoring and intelligent health recommendations.

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