Pushup Posture Analysis and Counter using Computer Vision and Pose Simulation

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1. Methodology

This section details the methodology used in the development of the pushup analysis system.

1.1. System Architecture

1.1.1 Components

The pushup analysis system consists of the following main components:

- MediaPipe: Used for pose estimation.
- OpenCV: Used for video processing.

1.1.2 Data Flow

The system captures video input, processes the frames to detect pose landmarks, analyzes the pushup posture, and provides real-time feedback and pushup count.

- Video Capture: Frames are captured from a video file or camera feed.
- Pose Estimation: MediaPipe detects pose landmarks in each frame.
- Pushup Analysis: The detected landmarks are analyzed to evaluate the pushup posture and count correct pushups.
- Feedback Generation: Feedback on pushup posture and the count of correct pushups are displayed on the video frames.

1.2. Pose Estimation

1.2.1 MediaPipe

MediaPipe's pose estimation model is employed to detect and track the pose landmarks in each video frame. This model is capable of

identifying 33 different landmarks on the human body, including shoulders, elbows, wrists, hips, knees, and ankles.

1.2.2 Landmark Detection

Pose landmarks are detected using MediaPipe's Pose solution. These landmarks are then utilized for further analysis to calculate joint angles and assess pushup posture.

1.3. Push-Up Analysis

1.3.1 Posture Evaluation

The pushup posture is evaluated based on the calculated angles:

- Elbow angle between 70 and 160 degrees.
- Straight back, indicated by the vertical alignment of shoulder and hip landmarks.

This function is essential for determining joint angles, such as the elbow and hip angles, which are critical for pushup posture evaluation.

2. Results