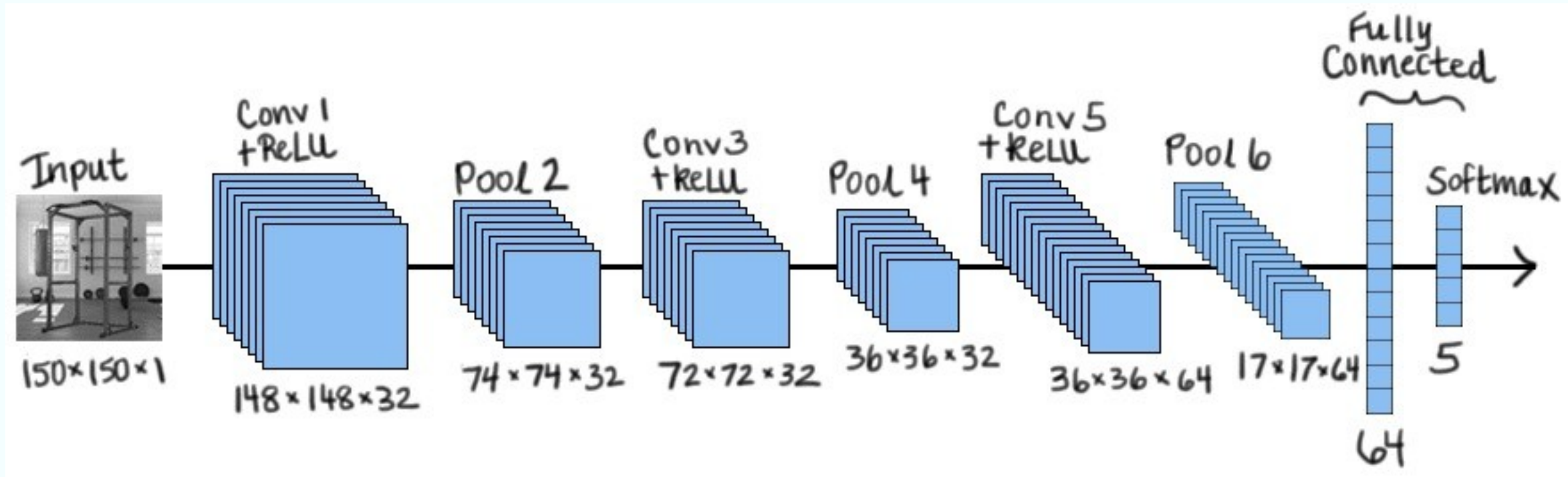


Goals and Contributions

Goals & Contributions for Exercise Pose Tracker:

1. Accurate pose estimation in real-time using image processing and deep learning techniques.
2. Develop an intelligent system to monitor and analyze exercise form, providing personalized feedback.
3. Enhance user experience by offering tailored workout plans and injury prevention recommendations.

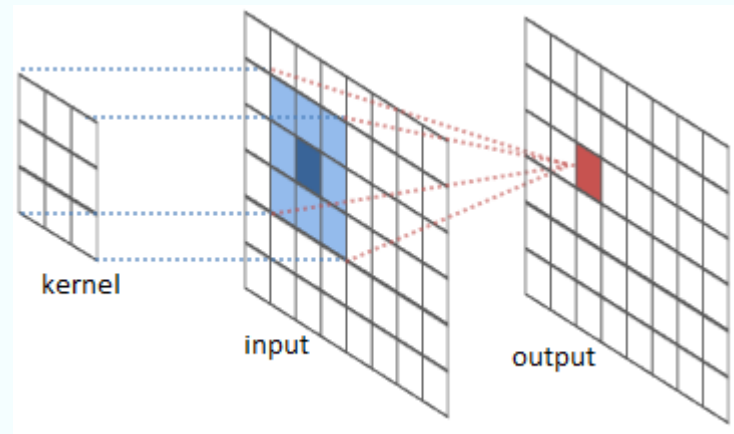
CNN Architecture



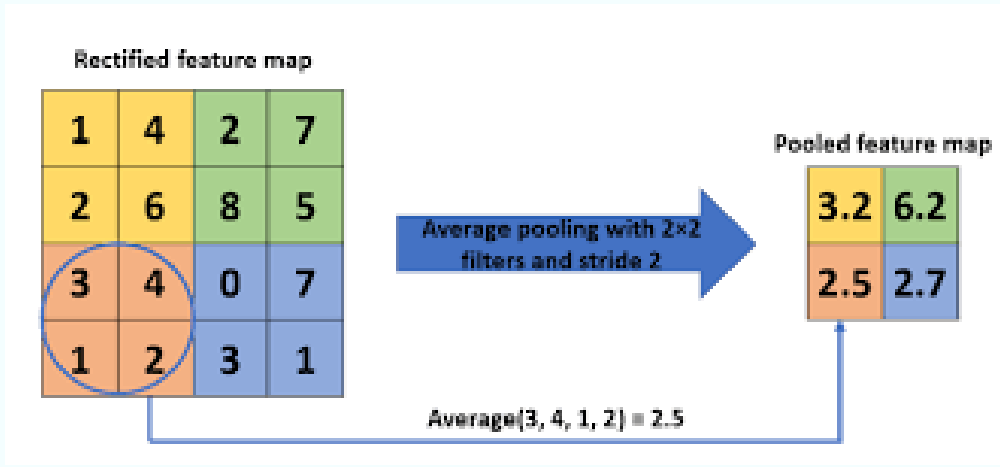
A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other.

Convolution:

Pooling:

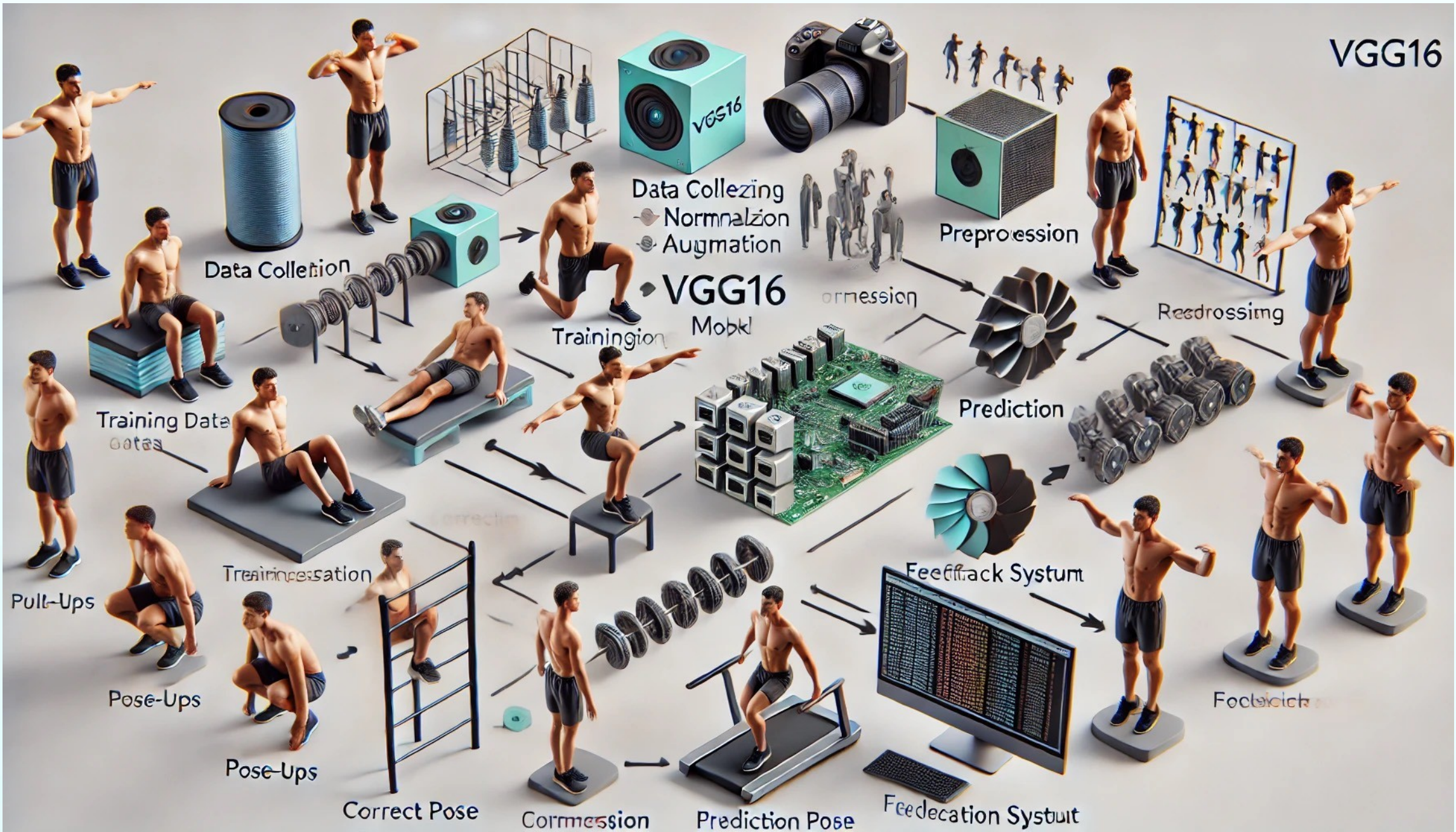


Convolution is a mathematical operation on two functions (f and g) that produces a third function (h) that expresses how the shape of one is modified by the other.



Pooling layers are used to reduce the dimensions of the feature maps.

Architecture Diagram



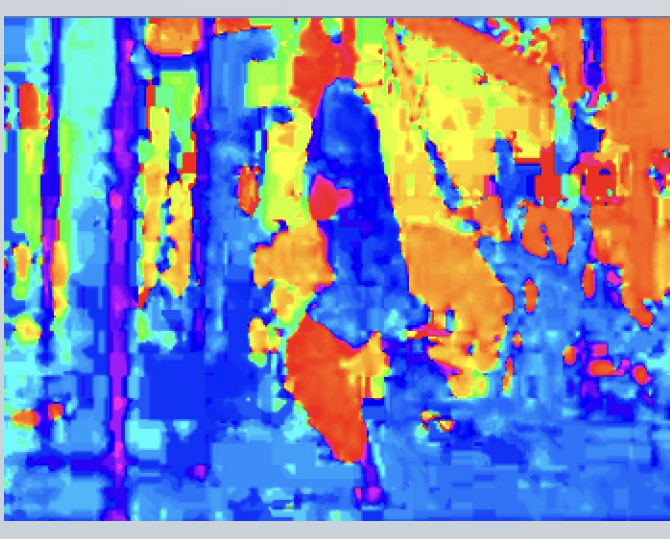
Main Processes:
Pose Detection
Movement Analysis
Feedback System

The input data from cameras or wearable sensors is fed into the system, which is connected to the cloud. The program identifies specific body landmarks, posture misalignments, and joint angles. Tracking and analysis of the user's movements are performed in real-time. Using deep learning models, the system calculates the accuracy of each exercise pose, allowing for feedback and alerts to be sent to users with suggestions for improvement and correction.

Exercise Pose Detection



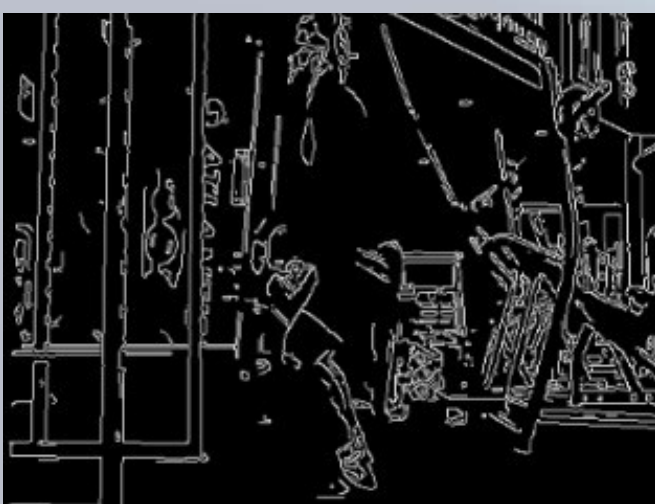
Input image



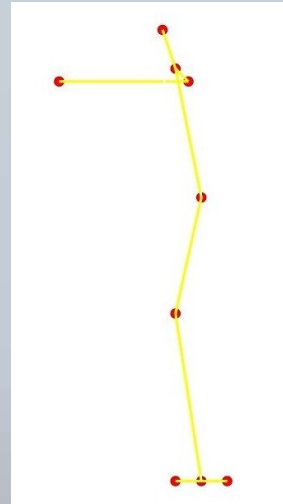
HSV Colour Selection



Fire Mask



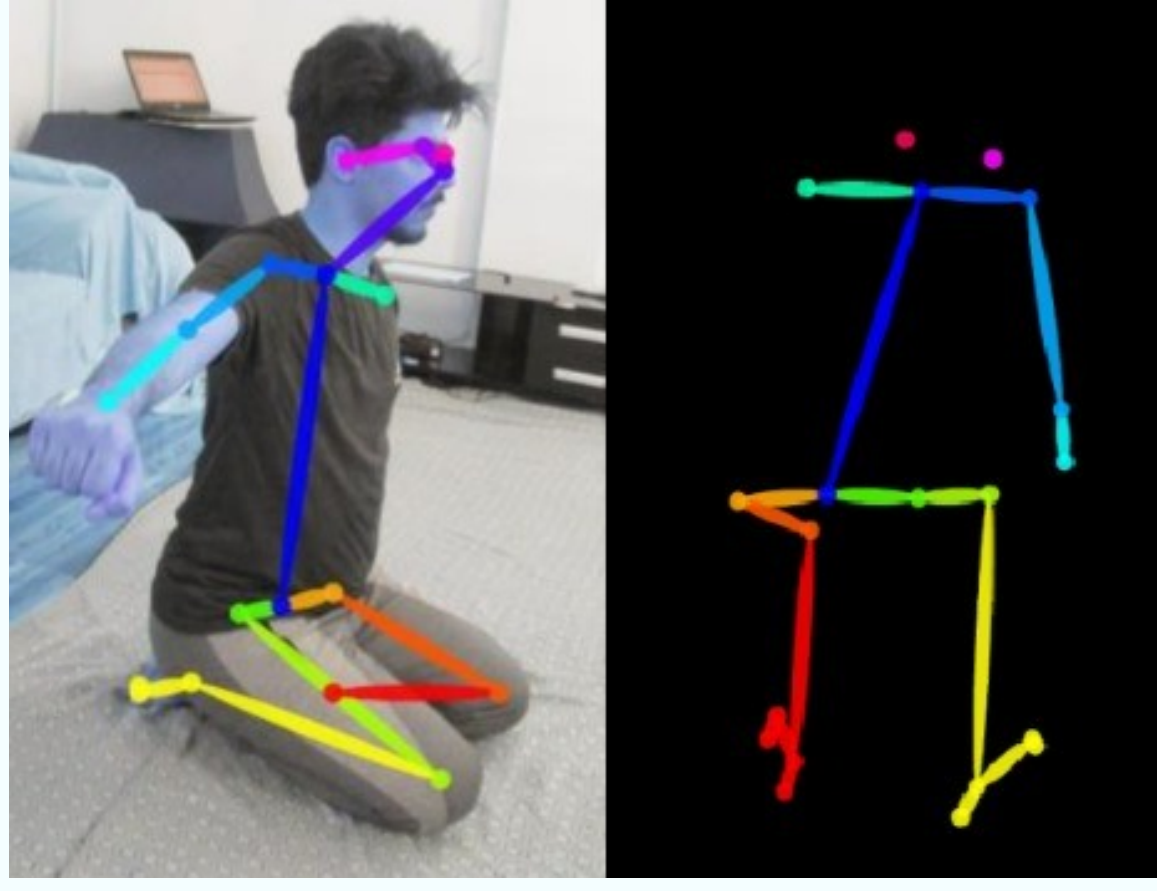
Canny Edge Detection



Output Image

To implement exercise pose tracking, first load the input image or video feed and analyze it using a pose estimation model to identify key anatomical landmarks. Apply joint detection algorithms to locate critical points such as shoulders, elbows, wrists, hips, knees, and ankles. Next, calculate the angles between these joints to assess proper form and alignment. Implement real-time angle measurement, particularly focusing on key metrics like shoulder angles, knee bend, and hip position. Finally, overlay a visual representation onto the original image showing red dots at joint positions connected by yellow lines to create a skeletal structure. Display text feedback about angle adjustments needed (like "Decrease right shoulder angle" or "Increase left shoulder angle") to guide the user in maintaining proper form during exercise execution. This visualization helps users understand their body positioning and make necessary corrections to achieve optimal exercise form.

Pose Estimation



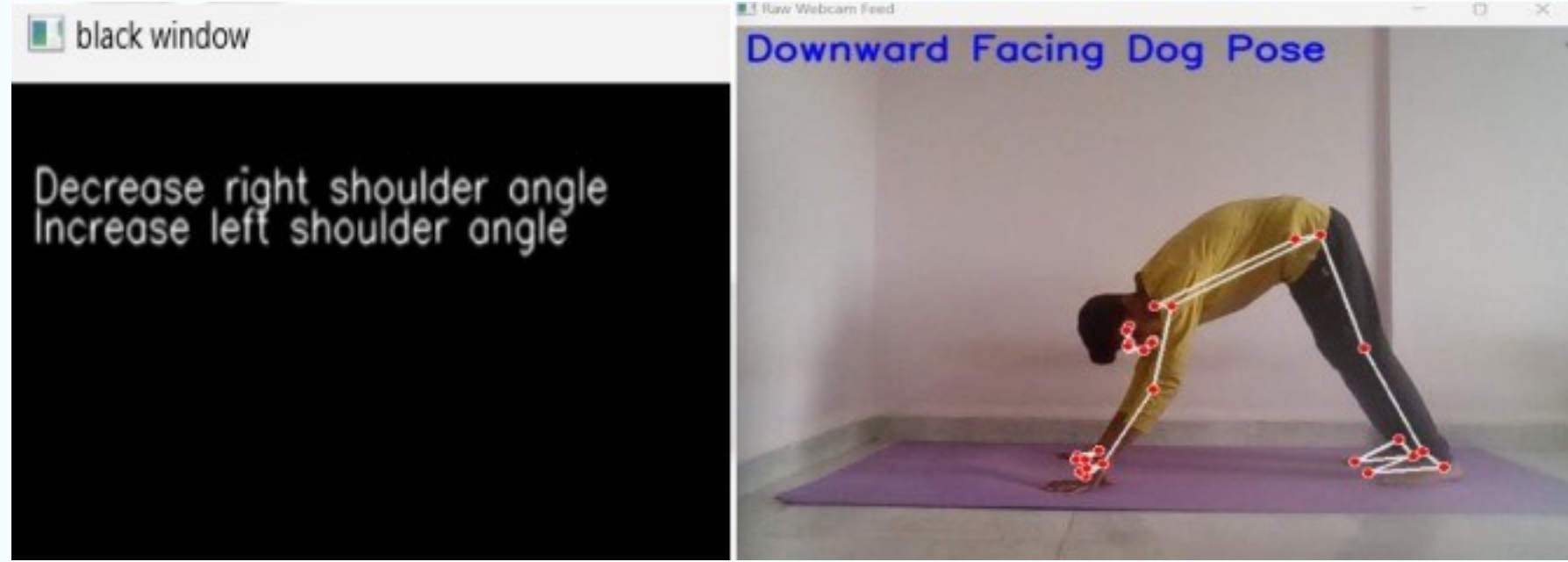
Pose estimation is a crucial technology in exercise tracking systems. It involves analyzing images or videos to identify and track the positions of key body points, such as joints and limbs. This data can then be used to assess the accuracy of exercise movements, measure performance metrics, and identify potential injury risks.

By comparing a user's movements to reference poses or ideal form, pose estimation can provide real-time feedback on technique, helping users correct errors and improve their performance. Additionally, it can be used to measure objective metrics like range of motion, speed, and power, allowing users to track their progress and set goals.

Furthermore, pose estimation can help identify biomechanical factors that may increase the risk of injuries, such as improper alignment or excessive stress on joints. This information can be used to recommend modifications to exercise techniques or targeted strengthening exercises to reduce the risk of injuries.

Overall, pose estimation is a valuable tool for exercise tracking systems, enabling users to improve their form, achieve their fitness goals, and stay healthy.

Real Time Feedback



Exercise pose trackers offer a comprehensive suite of features to enhance the user experience and optimize workout routines. They provide real-time feedback on exercise form, highlighting errors and suggesting corrections to ensure proper technique. This personalized guidance helps users avoid injuries and maximize the benefits of their workouts.

In addition to form analysis, these trackers offer detailed performance metrics such as reps counted, time under tension, range of motion, and speed. This data empowers users to track their progress, identify areas for improvement, and set realistic goals.

Furthermore, personalized workout recommendations are a key feature of exercise pose trackers. By analyzing a user's fitness level, goals, and performance data, the app can suggest tailored workout routines, ensuring that each session is challenging yet achievable.

To keep users motivated and engaged, exercise pose trackers often incorporate gamification elements like challenges, rewards, and social features. These elements can make workouts more enjoyable and help users stay committed to their fitness goals.

Overall, exercise pose trackers offer a valuable tool for anyone looking to improve their fitness and achieve their health goals. By providing real-time feedback, performance metrics, personalized recommendations, and motivation, these trackers can help users maximize the benefits of their workouts and stay on track.

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- [2] Fang, H., Zhang, J., Xie, S., Zhu, Z., Dai, D., & Luo, J. (2018). AlphaPose: Real-time multi-person 2D pose estimation with pose flow. Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition, 1-10.
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