Realtime Gym Ai

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ABSTRACT :

The adoption of a healthy lifestyle is a challenge for many people, and joining a gym is often one of the first steps. However, many individuals struggle with the cost, accessibility, and lack of guidance on proper technique. This problem is addressed through an automated posture detection model, which uses machine learning to recognize different human postures in real-time and help correct them.The posture detection model involves a computer vision system that utilizes machine learning algorithms to analyze live video feeds of individuals exercising in the gym. The model can detect and track body postures in real-time, providing immediate feedback on any mistakes in form or technique. This feedback can be in the form of visual cues or audio prompts, allowing users to adjust their posture and prevent injuries.By providing immediate and personalized feedback, the posture detection model addresses the main barriers that people face when joining a gym. It eliminates the need for costly personal trainers, reduces the risk of injury, and saves time by providing on-the-spot corrections. Overall, this model has the potential to revolutionize the fitness industry, making healthy living more accessible and attainable for everyone.

Keywords: Posture detection, Machine Learning, Deep Learning

INTRODUCTION :

The benefits of regular exercise are well-known, but for many people, joining a gym can be challenging due to various reasons like lack of time, financial constraints, or limited access to a personal trainer. However, with the advancements in technology, innovative solutions are being developed to address these challenges and make exercise more accessible and convenient. One such solution is an automated posture detection model using machine learning. This technology can recognize different human postures in real-time and provide corrective guidance to users. This means that individuals can exercise more effectively and efficiently without the need for a personal trainer. The automated posture detection model works by using sensors and cameras to capture the user's movements and analyze their posture. It then provides real-time feedback, pointing out areas for improvement and offering corrective measures. With this technology, users can have the assurance that they are performing exercises correctly and safely, thus avoiding injury.

PROBLEM DEFINITION :

Many individuals struggle to perform exercises correctly due to lack of knowledge, experience, or access to a personal trainer. Incorrect posture and form during exercise can lead to injury and reduce the effectiveness of workouts. This can discourage individuals from exercising regularly and achieving their fitness goals. Therefore, there is a need for an automated system that can detect and correct incorrect postures in real-time during gym sessions. The system should be able to analyze various exercises and movements, identify incorrect postures, and provide personalized feedback to the user. It should also be able to adapt to different body types, fitness levels, and exercise preferences. The system should be user-friendly and accessible, so that individuals of all skill levels can benefit from it. By addressing these challenges, the real-time gym AI posture detection system can help individuals achieve their fitness goals safely and effectively, and ultimately improve their overall health and wellbeing.

LITERATURE SURVEY :

Wu Wen ,Yong Yang ,Jingyi Du ,Lixiang Liu,Jiahao [1] et al. have explored that Attitude detection can help the gymnast's posture movements correct. The general method is to extract the contour of the moving target in a video frame, but this method has poor real-time performance and low accuracy. To this end, this paper proposes a deep learning real-time attitude detection method to detect the posture of gymnasts. Input an image, extract features through the convolutional network, correctly link skeleton to detect the posture of the gymnast. The method has good real-time performance and accuracy high.

MATERIALS AND METHODS :

The system we are building includes a camera and a speaker. The camera will capture the user video which will be given as input to the Convolutional Neural Network which will predict the main keypoints of human body such as shoulders, elbow and knee joints, eyes, ears, etc and will output the coordinates and confidence level of these keypoints. Using these keypoints we will get a body posture of the user, this posture will then be given as an input into the classification model which will be trained to classify posture into specific gym activities like pushups, squats, crunches, etc and once the user posture is classified, then using the posture keypoints, model will determine if posture is correct or not

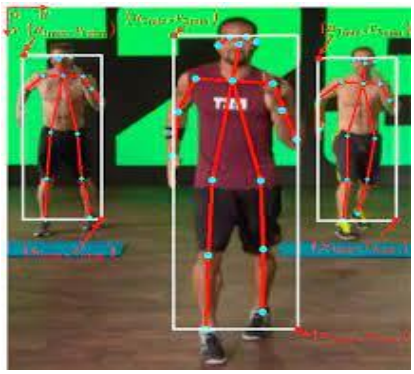


Fig 2 : Posture Detection

Posture detection is used to extract essential features from static images and live feed where useful information will be gathered. An image is a two-dimensional figure where x and y spatial coordinates of function f(x,y) are represented through a matrix with rows and columns in the form of pixels.

The steps for images processing are
1.Reading the image as input
2.Pre-process (Noisy removal and shaping) of the image
3.Extracting features on the input image (segmentation, description)
4.The result is an image classification after manipulation We have two types of image processing:
5.Analog image processing 6.Digital image processing (computer vision)

Some of the important techniques for image processing are preprocessing, enhancement and, information extraction. An image is converted into grayscale to perform a specific task whereas to display by converting into RGB (color) for user view.

EXISTING METHOD :

The general method is to extract the contour of the moving target in a video frame, but this method has poor real-time performance and low accuracy. To this end, this paper proposes a deep learning real-time attitude detection method to detect the posture of user. Input an image, extract features through the convolutional network, correctly link skeleton to detect the posture of the user. The method has good real-time performance and accuracy high.

Convolutional Neural Network (CNN)

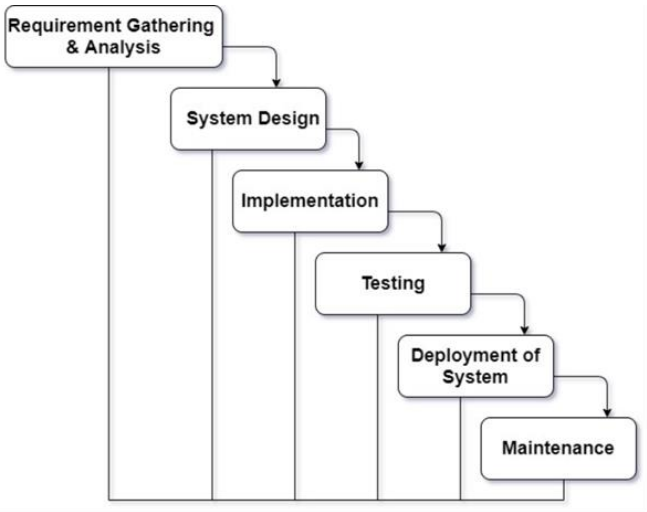
The Convolution Neural Network (CNN) based approach provides a better way that is less sensitive to translation and hand poses. However, the CNN approach is complex and can increase computational time, which at the end reduce its effectiveness on a system where the speed is essential. In this study we propose a shallow CNN network which is fast, and insensitive to translation and hand poses. It is tested on two different domains of hand datasets, and performs in relatively comparable performance and faster than the other state-of-the art hand CNN-based hand detection method. Our evaluation shows that the proposed shallow CNN network performs at 93.9% accuracy and reaches much faster speed than its competitors .

PROPOSED METHODOLOGY :

Analysis Models :SDLC Model to be applied

1.Planning :

It is performed by the senior members of the team with inputs from the customer, the sales department, market surveys and domain experts. This information is then used to plan the basic project approach and to conduct product feasibility study in the economical, operational and technical areas. Planning for the quality assurance requirements and identification of the risks associated with the project is also done in the planning stage



2.Defining :

Next step is to clearly define and document the product requirements and get them approved from the customer or the market analysts

3.Designing :

Based on the requirements specified in SRS, usually more than one design approach for the product architecture is proposed and documented. This is reviewed by all the important stakeholders and based on various parameters as risk assessment, product robustness, design modularity, budget and time constraints, the best design approach is selected for the product.A design approach clearly defines all the architectural modules of the product.

4.Building :

The actual development starts and the product is built. The programming code is generated. If the design is performed in a detailed and organized manner, code generation can be accomplished without much hassle. The programming language is chosen with respect to the type of software being developed.

5. Testing :

This stage is usually a subset of all the stages as in the modern SDLC models, the testing activities are mostly involved in all the stages of SDLC. However, this stage refers to the testing only stage of the product where product defects are reported, tracked, fixed and retested, until the product reaches the quality standards defined in the SRS.

6.Deployment :

Once the product is tested and ready to be deployed it is released formally.

APPLICATIONS :

- Solving fitness-related problems
- Enhancing the gyming experience
- Helping to be safe from the injuries
- Improving the quality and accuracy of the users workout sessions using the web app

RESULTS AND COMPARATIVE STUDY :

Implementing a real-time gym AI system requires a combination of hardware and software components. In this section, we will outline the steps involved in creating a working gym AI system, including data collection, model training, and real-time inference.

Data Collection

The first step in creating a gym AI system is to collect data on human postures during exercise. This can be done using a variety of sensors, such as cameras, motion sensors, or pressure sensors. The goal of data collection is to obtain a large and diverse set of training data that accurately represents the range of human postures during exercise

Model Training

Once we have collected a large and diverse set of training data, we can use this data to train a machine learning model. There are several types of models that can be used for posture detection, including convolutional neural networks (CNNs), recurrent neural networks (RNNs), and support vector machines (SVMs).

Real-time Inference

Once we have trained our model, we can use it for real-time posture detection during exercise. This requires integrating the model into a software application that can interface with the gym's hardware and provide feedback to the user. To implement real-time inference, we would need to use a computer vision library, such as OpenCV, to process the video footage captured by the gym's cameras. We would then use the trained model to classify each frame of video as a specific exercise and provide feedback to the user on their posture.

OUTCOMES :

The outcome of this project will be that any person will be able to do correct gym activities, which will lead to staying healthy, and prevent any injuries. While doing gym activities, the user's video will be continuously analyzed and his posture will be detected and compared using a classification model, which will also give voice feedback to the user.

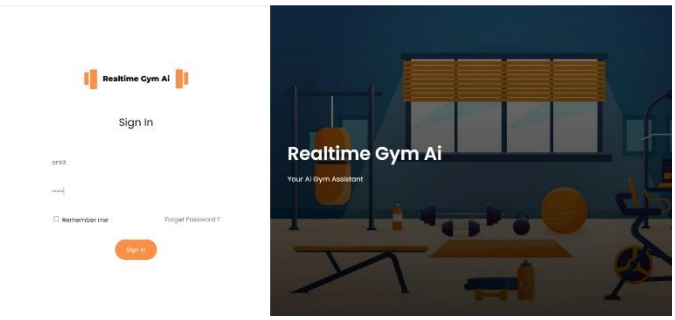


Fig . Login page of the system

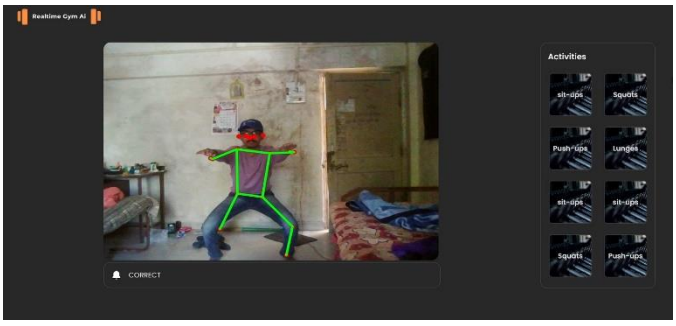


Fig. Model predicting Correct posture

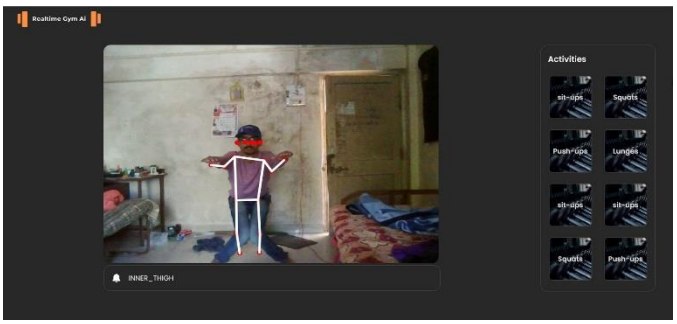


Fig. Model Predicting Incorrect Posture

CONCLUSION AND FUTURE WORK :

Conclusion : Aiming at the aesthetics of the limb movements of the existing gymnasts, only a method of visual observation is proposed, and a more scientific and rational real-time human posture detection method is proposed. Through the detection of the key points of the gymnastics athlete's posture in real time, their posture is made clearer and they play a good corrective role in the training process of the gymnasts. The experiment proves that the accuracy of prediction in each method is far higher than that of other methods.

Future work :

1)In the future, combining sports training such as gymnastics with deep learning is a new trend in the development of sports.
2). This application can be developed into a complete android/iOS application for easy use.

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