Fitness Trainer

**Abstract:**

Exercising is the most important thing to live a healthy life. To be free from injuries and getting the most from our workout proper form of exercise is important. Doing too much repetition and over training can cause muscle soreness. Unendingly doing exercise incorrectly could eventually cause severe future injuries. The rest between the sets should be optimum depending on the repetition of the exercise, what muscle group is being trained and the load that is being put in the muscle. Maximum Muscle hypertrophy is achieved with the correct form of exercise

In our work, we introduce an application that detects the user’s exercise pose counts the specified exercise repetitions and provides personalized, detailed analysis about improving the user’s body posture. This is an AI-based Workout Assistant and Fitness guide to guide people who don’t have access to the gym but are still willing to work out at home to maintain their physique and fitness and keep their body in good shape. To help them perform the exercises correctly and prevent them from chronicle and immediate injuries. This also provides a personalised health guide and diet plan along with a personalised daily workout calorie count. Most gyms have a wide variety of exercise equipment and also have trainers who guide us about the exercise and its correct posture. But the unavailability of the above equipment and trainers can be an important reason that can stop us from doing exercise at home. We aim to build an AI-based trainer that would help you exercise more efficiently in your own homes. The project focuses on creating an AI algorithm to help you exercise, by determining the quality and quantity of repetitions which is done by using pose estimation running on the CPU. With real-time data captured from camera, a person can get feedback in the application on the accuracy of their pose and keep track of their fitness goal.

Sometimes we forget to keep a track on the number of reps. Doing a lot of exercise can lead to muscle tear or serious body injuries and can even decrease muscle hypertrophy. Nowadays people prefer working out at home. It is very convenient and time saving as well. We can workout anytime we want at home. But we also know that a trainer is very important to keep a track of our exercise. We have designed a virtual trainer. A system which will take care of all the parameters of workout like counting sets, repetitions and further giving suggestions to maximize muscle hypertrophy using AI and it will also check the form of exercise. The person will be doing his exercise live and live results will be given as outputs. There is a counter which will count the number of reps a person is doing while performing the workout. The status of the workout will also be displayed on the screen; the system will detect the motion of the exercise by calculating the angles between different points. If a person is doing exercises with the help of this system, the user's form is checked (corrections in form also will be given if any) repetition’s status and count is displayed. Along with this the AI dietitian calculates the maintenance calories, BMR, etc. This will increase muscle hypertrophy and reduce the risk of injury.

Another useful feature the application will offer is the ability to find a gym or activity center nearby. If a user of the app is new to working out and has never been a member of a gym this is especially useful. This feature will show the user in their current location on a map and within a certain proximity will pin point a gym. A future feature could expand on this to also display things like membership prices and opening hours as this information could potentially be available through Google Maps.

The applications also contain multiple programs for weight gain, weight loss and body building. Users can browse and try out programs as provided in the app, or they can save a program to their own personal list and make tweaks to them in order to better suit their needs. A user could have an injury or other health related reason not to do a certain exercise so they can then switch out certain ones as they wish from the program they are using.

**Background & Justification:**

While health and fitness are growing rapidly, obesity also growing with same pace. People are becoming more obese nowadays. The idea of fitness applications was chosen to encourage people to be more active and providing people a tool to help them by their best and turn the tide on obesity.

As a background research for validation of application a survey was also conducted with some friends at local gym. The main purpose of survey is to determine whether main ideas and functionality of application is beneficial for users or not. The survey consist of three questions as follows:

1. Would you like to use virtual trainer to assist your workouts without any fee.
2. Would you like an application that can manage, schedule and provide complete track of your workout.
3. Do you often use internet or other sources to best workouts or fitness advice to assist your training.

**Feedback:**

Q1: 77.8% of people responded positively to question 1.

Q2: 72.2% of people responded positively to question 2.

Q3: 83.3% of people responded positively to question 3.

Feedback to above questions was positive and encourages us to develop a fitness application. Many people want a assistant to helping them out in their workouts while other want an application to manage their daily training.

There are numerous applications available in the market which guide the user about the exercises to be performed. But through our application, we not only guide the user regarding which exercise to perform but also about the correct posture and counting the repetitions using computer vision. This application can be considered as the workout assistant which provides real-time posture detection and diet recommendations. The application can not only be used by individuals at homes but by increasing the scope can be used in gyms as smart trainers thus reducing the human intervention.

Their objective was to provide a bottom-up approach for the activity of estimation of the pose of the user and real-time segmentation of the user while using images of the multiperson solution and by implementing an effective single-shot approach.

**Project Scope:**

* There are numerous applications available in the market which guide the user about the exercises to be performed. But through this application, we not only guide the user regarding which exercise to perform but also about the correct posture and counting the repetitions using computer vision.
* Monitor the user in real-time keeping track of the quality repetitions of a particular exercise, thus keeping his form intact and correct throughout their workout. This will educate newbies about different exercise routines and their correct postures to prevent injuries.
* The application also offers personalised health advice and nutrition ideas while keeping the daily calorie log in the database.
* The application can not only be used by individuals at homes but by increasing the scope can be used in gyms as smart trainers thus reducing the human intervention.
* Our main motive is to spread awareness about the importance of good health and fitness among common people.

**Methodology:**

Using OpenCV and Python, we will create an AI Trainer in this project. We'll utilise the CPU's posture estimate to get the proper points, and we'll use these points to achieve the necessary angles. Then we identify a variety of movements depending on these angles, including the amount of biceps curls. We'll design the code in such a manner that you can determine angles between any three points with just one line of code.

From real time and recorded videos, the user’s postures are automatically detected. The steps used in the system are as follows: In the first step, the data is collected from a real time camera or recorded video. Next, joint location is recognized. The detected points are sent to the model where KNN classification is applied. Thirdly, the pre-trained model is used in the application.

Web Cam Video/Recorded Video

Feedback

Estimation of accuracy of pose

Classification of pose

Detection of key-points of pose

The steps involved are as follows:

1. Extraction of Pose/ Data Collection Real time data from web cameras or recorded videos is taken. The video is broken into several images. Extracted image is the data on which the model is trained.
2. Identification of Pose, model measures the keypoint in pose and gives the confidence score for those keypoints. It gives Heatmaps and offset vectors as output which is then fed to the KNN classifier model.
3. Classification of Pose and estimation of accuracy Using KNN classifier, the pose is recognized and classified. Feedback on accuracy of pose is provided and time counter records the duration of pose performed. The system triggers sound upon finishing the duration for the pose and gives a red trigger for wrong pose.

**CONCLUSION AND FUTURE WORK:**

Nowadays our life is becoming busier and we hardly find time in our schedules to be healthy and fit and exercise daily. This has caused many diseases and health issues. Implementation of Artificial Intelligence in the field of fitness can solve many problems. The health-related applications and devices are making our lives easier and eases our fitness journey. Individuals can use this application in their own workouts, hence making them more efficient are less error-prone. In this process, we learnt how to use the OpenCV library and package and how the application of machine learning can be beneficial to humans.

There is a lot of scope of development in this project. The project can be upgraded to support more exercises. A User interface can be added for easy navigation through the exercises. The data collected by the AI trainer can be saved and processed for the next sessions. Daily steps tracker can also be added. The trainer will suggest your workout plan and its intensity according to your body type and weight. This application can be developed into a complete android/ios application for ease of use.

Future work may include the movement of the camera vertically and horizontally to capture another wide variety of exercises or it may include the use of multiple cameras to capture the body pose from various angles in order to feed the template of other exercises

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