

# AI Preceptor : Guide for Fitness

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***Abstract:** These days, virtual assistants play a crucial role in our daily activities and have become an inseparable part of our lives. The field of AI is emerging, and one project that aims to explore its potential is the development of an AI-based workout trainer called AI Preceptor. This desktop application detects the user's exercise pose, counts repetitions, and provides recommendations for improving form. The lack of physical activity is a significant contributor to the global obesity problem. Fitness is widely recognized as an essential goal for a healthy lifestyle and is used to measure health-related quality of life. While a fitness trainer can offer motivation and guidance, their services can be expensive and may not be accessible in certain settings. Additionally, exercising alone without supervision can lead to mistakes and incorrect form, which can be dangerous and ineffective. The AI Preceptor project seeks to address these challenges by utilizing artificial intelligence to detect the user's exercise pose and offer personalized recommendations for improving form. By analyzing key points coordinated with correct and incorrect form, the app's algorithm evaluates the user's pose and provides detailed feedback. This personalized guidance can help users avoid injuries and optimize their workouts. By combining the convenience and accessibility of virtual assistants with the expertise and guidance of a personal trainer, AI Preceptor aims to provide users with a valuable tool for safe and effective exercise. It aims to bridge the gap between the potential risks of exercising incorrectly and the benefits of having a personal trainer. Through the use of AI, users can receive real-time feedback and make adjustments to maximize their workout routines. In summary, AI Preceptor is an innovative project that leverages AI technology to offer personalized workout guidance and form correction. Its goal is to provide users with a virtual workout trainer that can enhance their exercise routines, promote safety, and help achieve their fitness goals without the need for a physical trainer.*

**Keywords:** Fitness

## I. INTRODUCTION

Many individuals who engage in exercise often lack access to professional guidance, resulting in missed opportunities for progress and poor form during their workouts. In some cases, these individuals may even risk injury or hinder their progress due to incorrect exercise techniques. To address these challenges, our project aims to leverage the potential of artificial intelligence (AI) techniques specifically in the context of weight training and exercise. The motivation behind this project is to illustrate the effectiveness of AI in sports by developing a solution that provides real-time guidance and evaluation for exercises performed with or without gym equipment. With the recent global pandemic, people have been confined to their homes with limited physical activity. Therefore, we have developed a personal Gym Trainer utilizing AI technology to help individuals exercise efficiently in their own homes. Our web application, AI Preceptor, plays a central role in this project. It utilizes pose detection to accurately identify the user's exercise pose, counts the specified exercise repetitions, and provides personalized, detailed analysis to improve the user's body posture and form. Our aim is to assist users in achieving optimal results and avoiding injury by offering real-time feedback and corrective recommendations. We understand that not everyone has access to gym equipment or personal trainers, which can be significant barriers to exercising effectively at home. Thus, our AI-based trainer focuses on building an exercise repetition counter and form corrector using the latest advancements in deep learning for pose estimation. By doing so, we enable users to receive accurate evaluations of their exercise performance and facilitate their growth and progress. In addition to exercise guidance, our AI system also incorporates an AI dietitian that calculates maintenance calories, providing a holistic approach to fitness and overall well-being.

In summary, our project utilizes AI technology to develop a personalized Gym Trainer that offers real-time exercise guidance and form correction. By leveraging pose detection and deep learning algorithms, we aim to optimize users' exercise routines and help them achieve their fitness goals in the absence of gym equipment or personal trainers.

### 1.2 Ease of use

Our project focuses on developing an AI-based Workout Assistant and Fitness Guide to cater to individuals who want to maintain their physique and fitness by working out at home, especially in situations where access to gyms is limited. The primary goal is to provide guidance for performing exercises correctly, reducing the risk of both immediate and chronic injuries. To offer a comprehensive fitness solution, our project includes personalized health guidance and a customized diet plan. Additionally, we provide a feature that calculates the user's daily workout calorie count, tailoring the experience to their specific needs and goals. Furthermore, our project extends to displaying relevant health insurances and government policies offered by the Indian government to the general public. To achieve this, we utilize APIs and web services to check eligibility criteria and provide users with essential information. This feature empowers users to make informed decisions regarding their healthcare options. Given the current scenario of pandemics and lockdowns, spending extended periods at home can become tedious, particularly with limited access to outdoor activities. However, this should not be a reason for being unproductive, as it presents an excellent opportunity to prioritize personal health. While gyms typically provide exercise equipment and trainers to guide individuals on correct exercise posture, an AI-powered fitness trainer has the potential to act as a substitute when physical access to a human trainer is not feasible. Our project aims to enable diverse individuals to engage in daily exercises from the comfort of their homes, ensuring effective workouts without the need to visit a physical gym.

In summary, our project utilizes AI technology, personalized fitness guidance, health insurance information, and government policies to provide a holistic fitness solution for individuals working out at home.

## II. PROPOSED WORK

### 2.1 Problem Definition

Research has consistently shown that maintaining fitness is crucial for a healthy lifestyle and serves as a measure of overall well-being. While fitness trainers can provide valuable guidance and motivation, accessing their services can be expensive and impractical in certain situations. Moreover, performing exercises incorrectly can lead to ineffective results and even pose risks to individuals. It is essential to ensure correct posture and form during exercises to maximize their benefits and prevent injuries.

### 2.2 Proposed System

The objective of our project is to develop an AI-based fitness preceptor that can assist individuals in achieving efficient workouts at home. Our focus is on creating an AI algorithm that utilizes pose estimation techniques to determine the quality and quantity of exercise repetitions. By employing pose estimation algorithms running on the CPU, our system can detect various body postures such as bicep curls, squats, and sit-ups. We use these pose estimation results to calculate the desired angles and provide real-time feedback to the user. Additionally, our preceptor will track different fitness activities, display results on the screen, and provide personalized workout recommendations. To implement the system, we will utilize libraries such as NumPy, MediaPipe, and OpenCV. Through this AI-powered solution, we aim to promote efficient and safe home workouts.

## III. PROPOSED METHODOLOGY

Our application employs the OpenCV library in Python to capture real-time video feed from the user's webcam. We extract individual frames from the video feed and utilize the "BlazePose" tool from "MediaPipe" for human pose detection. The "BlazePose" tool utilizes a machine learning approach to estimate human poses by detecting 33 key points across the body. This allows us to track and analyze the user's posture in real time. Our system leverages this pose estimation data to provide accurate feedback and guidance on correct form and posture during exercises. By expanding upon the existing COCO, BlazeFace, and BlazePalm topologies, we have developed a more comprehensive topology of 33

keypoints, enabling precise and consistent body semantics prediction. Our AI-based preceptor also incorporates diet management features, tracking fitness activities, maintaining records, and providing customized diet plans. Additionally, it includes a workout schedule notification system to help users stay consistent with their exercise routines.

### A. ALGORITHM

To perform pose estimation and calculate angles, follow these steps:

Install the necessary dependencies if they haven't been installed already. Ensure mediapipe and opencv-python are installed.

Import the required libraries and modules: mediapipe, cv2 (OpenCV), numpy, and matplotlib.pyplot.

Load the pose estimation model from the mediapipe library.

Initialize the mediapipe drawing utility and pose estimation objects.

Create a function named "calc\_angle" to calculate angles using three points (x, y, z). Convert the points to numpy arrays.

Detect landmarks using the pose estimation model's "pose\_landmarks" attribute.

For bicep curls exercise, identify the following landmarks:

Left arm: left\_wrist, left\_shoulder, left\_elbow

Right arm: right\_wrist, right\_shoulder, right\_elbow

Open the webcam to capture video input.

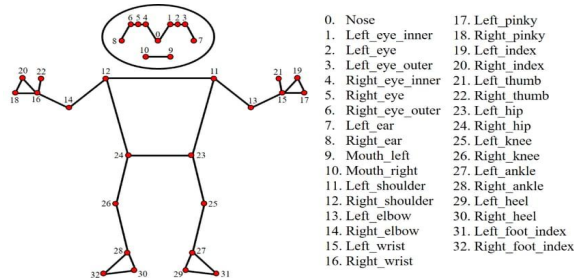
Render the detected landmarks and connections on the screen.

Calculate and display the desired results, such as the number of repetitions and the correctness of the pose.

Optionally, calculate the Body Mass Index (BMI) using the appropriate formula based on the metric or imperial system:

Metric BMI Formula:  $BMI = \text{weight (kg)} / [\text{height (m)}]^2$

Imperial BMI Formula:  $BMI = 703 \times \text{weight (lbs)} / [\text{height (in)}]^2$



### B) ARCHITECTURE

The architecture of the proposed system consists of the following components and functionalities:

**User Registration and Authentication:** Users can register themselves by providing their mobile number, email ID, name, and password. This information is used for user authentication during the sign-in process.

**Fitness Guide and Diet Plan:** After signing in, the fitness guide prepares a personalized diet plan for each user based on their input data such as gender, age, height, and weight. This diet plan aims to cater to the specific nutritional needs of the user.

**Exercise List and Pose Estimation:** The system provides a dashboard that displays a list of exercises for the user to perform. When the user selects an exercise, the AI preceptor utilizes pose estimation techniques to detect the user's body posture. If the pose is incorrect, the preceptor provides feedback and prompts the user to correct it.

**Repetition Tracking and Progress Monitoring:** The preceptor keeps track of the repetitions performed by the user for each exercise. This information is stored in a database, allowing the user to monitor their progress and track their health improvements over time.

## IV. RESULTS

The final system is capable of accurately detecting various body postures during exercises, including bicep curls, pushups, squats, and more. It provides real-time feedback on correct form and posture, helping users perform exercises accurately.

and reduce the risk of injuries. Additionally, the system offers personalized diet plans based on individual user profiles, enhancing the overall fitness experience.

### V. CONCLUSION

As our lives become busier, finding time for regular exercise becomes challenging, leading to increased health issues such as diabetes and cancer. AI in fitness aims to address this problem by introducing innovative gadgets and applications that help individuals become more conscious of their fitness journey. The integration of artificial intelligence in fitness applications and devices simplifies and enhances our lives, making it easier to maintain an active and healthy lifestyle. This AI-powered fitness preceptor has the potential to transform fitness habits and improve overall well-being.

### VI. FUTURE SCOPE

The demand for health and fitness solutions is expected to grow globally. With the aid of artificial intelligence and intelligent algorithms, businesses can better meet consumer needs while providing excellent service. The proposed project has a bright future as more individuals will find it convenient to train at home with features similar to those provided by gyms and personal trainers, including personalized nutrition plans. To enhance the application, it can be converted into a mobile app and integrated with fitness apps for smartwatches to monitor additional parameters such as calories burned, stress levels, blood oxygen levels, and heart rate. Multiple person detection can be added to make the application more useful for friends and family members. The diet recommendation system can be further improved by incorporating specific diet plans for conditions like PCOD/PCOS and other diseases based on available datasets. Furthermore, the application can introduce interactive features to provide users with a friendly and inspirational environment for their fitness journey.

### VII. ACKNOWLEDGEMENT

We would like to take this opportunity to express my sincere gratitude to the individuals who have been instrumental in the successful completion of this project. Writing this project has posed various challenges, and it is with the unwavering support, patience, and guidance of these individuals that we have been able to overcome them and accomplish our goals.

We extend our heartfelt appreciation to our respected and knowledgeable guide for their valuable help and guidance throughout this project. Their expertise and insights have played a crucial role in shaping the direction and execution of our work. We would also like to express my gratitude to our guide and the head of the department, Prof. Dr. Ninad More, as well as our respected principal, Prof. Dr. Shriramshastri Chavali, for their invaluable support and guidance, which have been pivotal in the successful completion of this project.

The contributions and dedication of all those involved have made a significant impact on the outcome of this project. We are truly grateful to have had the opportunity to collaborate with such a supportive team, and we highly appreciate their contributions.

We want to emphasize that this project's success is a collective effort, and we are deeply grateful to everyone who has contributed, regardless of the size of their role. Your support and assistance have been invaluable throughout this journey. Once again, We express my heartfelt thanks to all those who have played a part in making this project a reality. Your contributions have been genuinely appreciated.

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