

Report: AI-Powered Workout and Diet Planner with Exercise Counter Integration

1. Introduction

This report presents an AI-powered application designed to generate personalized workout and diet plans based on the user's goals. The system integrates two key functionalities:

- **Personalized workout and diet plan generation** using a pre-trained GPT-2 model.
- **Exercise counting and pose analysis** using OpenCV and Mediapipe, integrated within the GUI.

2. System Overview

The application consists of two main modules:

1. **Workout and Diet Planner:** Utilizes OpenAI's GPT-2 model to generate detailed workout and diet plans.
2. **Exercise Counter:** Uses Mediapipe for real-time pose estimation and counts specific exercises based on user input.

Both modules are integrated into a Tkinter-based GUI, enabling smooth user interaction.

3. Key Features

1. Personalized Workout and Diet Plan

- The user inputs their personal details such as name, age, weight, height, fitness goal, gender, and dietary preferences (vegetarian).
- Based on this input, the system generates a structured plan detailing:
 - **Workout Plan:** Exercise suggestions with sets and repetitions.
 - **Diet Plan:** Meal suggestions and portion sizes.
- The AI model generates the plan based on the goal (e.g., Muscle Gain, Weight Loss, or Maintenance).

2. Exercise Counter and Pose Estimation

- The system integrates **Mediapipe's Pose Detection** to analyze the user's body posture in real-time via webcam or video file.

- The application calculates the angles between key body parts (e.g., shoulders, elbows, knees) to determine the user's exercise technique and count repetitions of specific exercises.
- The user can select a video source: either a webcam or an uploaded video file.

3. User Progress Tracking

- User details, fitness goals, and progress (e.g., weight, height) are stored in a text file for future reference.

4. System Workflow

1. Workout and Diet Plan Generation

- The user enters details into the input fields: name, age, weight, height, gender, and goal.
- Based on the goal (Muscle Gain, Weight Loss, Maintain), the AI model generates a custom workout and diet plan.
- The system calculates the **BMI** and categorizes the user into one of four categories: Underweight, Normal weight, Overweight, or Obese.

2. Exercise Counter

- The user selects a video source (Webcam or Video File).
- The system opens a video feed (either from the webcam or an uploaded file) and uses **Mediapipe Pose Detection** to track the user's exercise movements.
- The system calculates angles between key body parts (shoulders, elbows, knees) to monitor exercise form and count repetitions.

5. Technological Details

1. GPT-2 for Workout and Diet Plan Generation

- **Library:** transformers from Hugging Face.
- **Model:** GPT-2 (small version).
- **Method:** The model generates text based on predefined goal-specific templates (e.g., Muscle Gain, Weight Loss).
- **Processing:** The prompt is tokenized and passed to the model for text generation using a greedy decoding method.

2. Mediapipe for Exercise Pose Estimation

- **Library:** mediapipe for pose estimation.
- **Method:** The user's pose is detected through a series of landmarks, and angles between joints are calculated to determine exercise form.
- **Video Source:** The user can select between a webcam or an uploaded video file to capture the exercise.

3. GUI with Tkinter

- **Library:** tkinter for building the graphical user interface.
- **Features:** Input fields, buttons, and labels for collecting user data and displaying results.
- **Buttons:** To trigger plan generation and open the exercise counter feature.

4. File Handling for Progress Tracking

- **Data Persistence:** The user's details and progress are saved in a text file (user_progress.txt).

5. Exercise Tracking Integration

- **Exercise Types:** The application can detect exercises based on arm and leg movements (e.g., squats, push-ups, curls).
- **Repetition Count:** The system counts repetitions for each exercise using real-time pose tracking.

6. Data Flow and User Interaction

1. User Input

- The user provides inputs such as personal details (e.g., age, weight), fitness goal, and dietary preferences.

2. AI Plan Generation

- The GPT-2 model processes this input and generates a structured workout and diet plan, which is displayed on the GUI.

3. Exercise Video Feed

- The user can start a webcam feed or upload a video.
- The system detects the pose and monitors the exercises, providing feedback based on the detected form and repetition count.

4. Result Display

- The generated workout and diet plan is displayed on the screen.

- If the user opts for the exercise counter, the system begins real-time video analysis and counts exercise repetitions.

5. Saving Progress

- After generating the plan, the user's details and progress are saved for future reference.

7. Potential Enhancements

1. More Advanced Exercise Detection

- The system could be enhanced by adding more advanced exercise tracking, such as detecting multiple exercise types simultaneously.

2. Diet Recommendations

- In future versions, more personalized diet plans could be integrated based on nutrient requirements and specific dietary preferences (e.g., vegan, keto).

3. Mobile Version

- The application could be adapted for mobile devices for on-the-go workout tracking.

8. Conclusion

The AI-powered workout and diet planner, integrated with an exercise counter, provides users with personalized fitness plans based on their goals. The combination of AI-driven text generation for workout plans and real-time pose estimation for exercise tracking offers a powerful tool for fitness enthusiasts. The system ensures that users receive comprehensive and actionable insights, while tracking their progress to achieve their fitness goals effectively.

9. Future Work

- Integration of advanced machine learning models for more accurate exercise tracking.
- Expansion of the diet planner to recommend personalized meals based on the user's metabolic rate.
- Development of a mobile application for easier access to the system.

10. References

1. **Hugging Face Transformers Library:** <https://huggingface.co/docs/transformers/index>
 - For generating workout and diet plans using the GPT-2 model.
2. **Mediapipe:** <https://google.github.io/mediapipe/>
 - For real-time pose estimation and exercise counting.
3. **Tkinter:** <https://wiki.python.org/moin/TkInter>
 - Used for building the graphical user interface (GUI).
4. **OpenCV:** <https://opencv.org/>
 - For handling video processing and integration with Mediapipe.
5. Singh, Amritanshu Kumar, Vedant Arvind Kumbhare, and K. Arthi. "Real-time human pose detection and recognition using mediapipe." *International conference on soft computing and signal processing*. Singapore: Springer Nature Singapore, 2021.
6. Li, Xiangying, et al. "Fitness action counting based on MediaPipe." *2022 15th International Congress on Image and Signal Processing, BioMedical Engineering and Informatics (CISP-BMEI)*. IEEE, 2022.