A Project Report on

APT - Your Personal Trainer

Submitted in partial fulfillment of the requirements for the award of the degree of

Bachelor of Engineering

in

Computer Engineering

by

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Approval Sheet

This Project Report entitled ***APT - Your Personal Trainer*** Submitted by ***Aryan Singh (18102033), Chinmay Marathe (18192005),Dhruvin Kamani (18102023), Yash Sampat (18102020)*** is approved for the partial fulfillment of the requirement for the award of the degree of ***Bachelor of Engineering*** in ***Computer Engineering*** from ***University of Mumbai***.

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CERTIFICATE

This is to certify that the project entitled ***APT-Your Personal Trainer*** submitted by ***Aryan Singh (18102033), Chinmay Marathe (18192005), Dhruvin Kamani (18102023), Yash Sampat (18102020)*** for the partial fulfillment of the requirement for award of a degree ***Bachelor of Engineering*** in ***Computer Engineering***,to the University of Mumbai, is a bonafide work carried out during academic year 2021-2022.

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Acknowledgement

We have great pleasure in presenting the report on **APT-Your Personal Trainer** We take this opportunity to express our sincere thanks towards our guide **Prof. S.S.Aloni** Department of Computer Engineering, APSIT Thane for providing the technical guidelines and suggestions regarding line of work. We would like to express our gratitude towards her constant encouragement, support and guidance through the development of project.

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Declaration

We declare that this written submission represents our ideas in our own words and where others' ideas or words have been included, We have adequately cited and referenced the original sources. We also declare that We have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in our submission. We understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

The project focuses mainly on how effectively the user performs his/her exercise which helps them minimize the casualties that are associated with an improper form of their exercise. Human pose estimation is one of the important researches in the field of Computer Vision for the last few years. In this project, pose estimation and deep machine learning techniques are combined to analyze the performance and report a feedback on the repetitions of exercises performed in real time. Involving machine learning technology in the fitness industry could help the judges to count repetitions of any exercise. The proposed method divides respectively into three phases; pose tracker to identify and track user, exercise recognition to detect the name of the appeared exercises, and counter to count and indicate the correct and incorrect repetitions.

Contents

List of Abbreviations

AQA: Action Quality Assessment

Chapter 1

Introduction

Create an Android application which will use your phone's camera to count the number of repetitions you do for a single exercise and check how correctly you do them.

1.1 Problem Definition

Due to the lockdown in the pandemic , everyone had to stay at home and weren't able to access the gym. This caused people to seek the help of various apps available in the app store to help them out. Like everyone else, we too wandered through the App store to find an app that would fulfill our needs. After researching a lot we found out that there were plenty of apps that would suggest the user a new workout plan and these workout plans would instruct the user on how to perform the suggested workout using images or a video.However no attempts are made to recognise and correct the form of the user while performing these exercises. There are also no systems available that accurately count the no of reps that the user has performed.

Without any proper assistance and guidance from a personal trainer, people are at a risk of injuring themselves even while performing basic exercises like a push up or a bicep curl. With this information in mind we scoped various research papers that could perform either of these task and we finally deduced two main ideas to tackle this problem.

1.2 Scope

The main idea of our project is pose estimation, pose correction and counting the number of times a particular action is repeated. Although we will be working with a limited number of exercises, our project, when modified correctly, can be used by Judges in Olympics, trained athletes, bodybuilders and many more.

This also has wide application in accordance with the upcoming VR technologies. The basis of the project can be implemented in such a way that the action quality assessment can be used to create virtual simulation of surgeries or some simulation where the user needs to perform a specific task in quite accurate manner.

1.3 Technology stack

Android (Flutter and Dart): It will be used to create the android application that will detect video.
Python : Language which will be used to write the project.

- PyOpenpose library (python)
- Posenet library (from google teachable machine)

Computer Vision: A technology that allows computers to deduce meaningful information from digital images, videos and other visual inputs.
Video Database: The input data that we are going to use to train our model on.

Chapter 2

Literature Review

- Action Quality Assessment Across Multiple Actions : In this paper, they carried out experiments to see if knowledge transfer is possible in the action quality assessment (AQA) setting. Action quality assessment (AQA) is the process of quantifying how "well" an action was performed or computing a "score" representing the execution quality of an action.
- Live Repetition Counting : This paper talks about how when given an input video capturing a scene in which the same action is repeated multiple times in consecutive cycles, how we can count the number of repetitions.
- Recognizing Exercises and Counting Repetitions in Real Time : This research paper provides a solution to count repetitions of a physical exercise in real time. The method used in this paper is pose estimation to track athletes, recognize their performed exercises, count the repetitions, and analyze the performance of the repetitions.

Chapter 3

Project Design

3.1 Proposed Design

- To create the android application - flutter (framework), dart (language)
- Machine Learning Models:
  1) Action Quality Assessment
  2) Repetition Counter

Chapter 4

Project Implementation

4.1 Android Application

The android application will act as an interface for the user to select the type of exercise that he/she wants to perform.
On selection of exercise user would be redirected to exercise instance where repetition would be counted and exercise quality would assessed.
Once the user successfully completes one repetition the exercise counter will get incremented automatically.
If the user performs a wrong exercise a pop would notify the user to correct the posture.

4.2 Action Quality Assessment

Action Quality Assessment would be performed with help of a machine learning model.
Machine learning model implemented using PyOpenpose library along with database consisting of videos of exercise and their corresponding label, to allow the model to learn the right and wrong postures of a given exercise.
If the model detects that the user is performing wrong exercise then it will generate a pop to notify the user of the same.

4.3 Repetition Counter

Similarly, the exercise repetition counter would be a machine learning model.
The model would be based on the Posenet library, which can be used to estimate the pose that the user is performing while also detecting the presence of the user.
The model will detect when a user completes a specific exercise by detecting its pose and simultaneously increment the counter which would be displayed on application for the user to see.

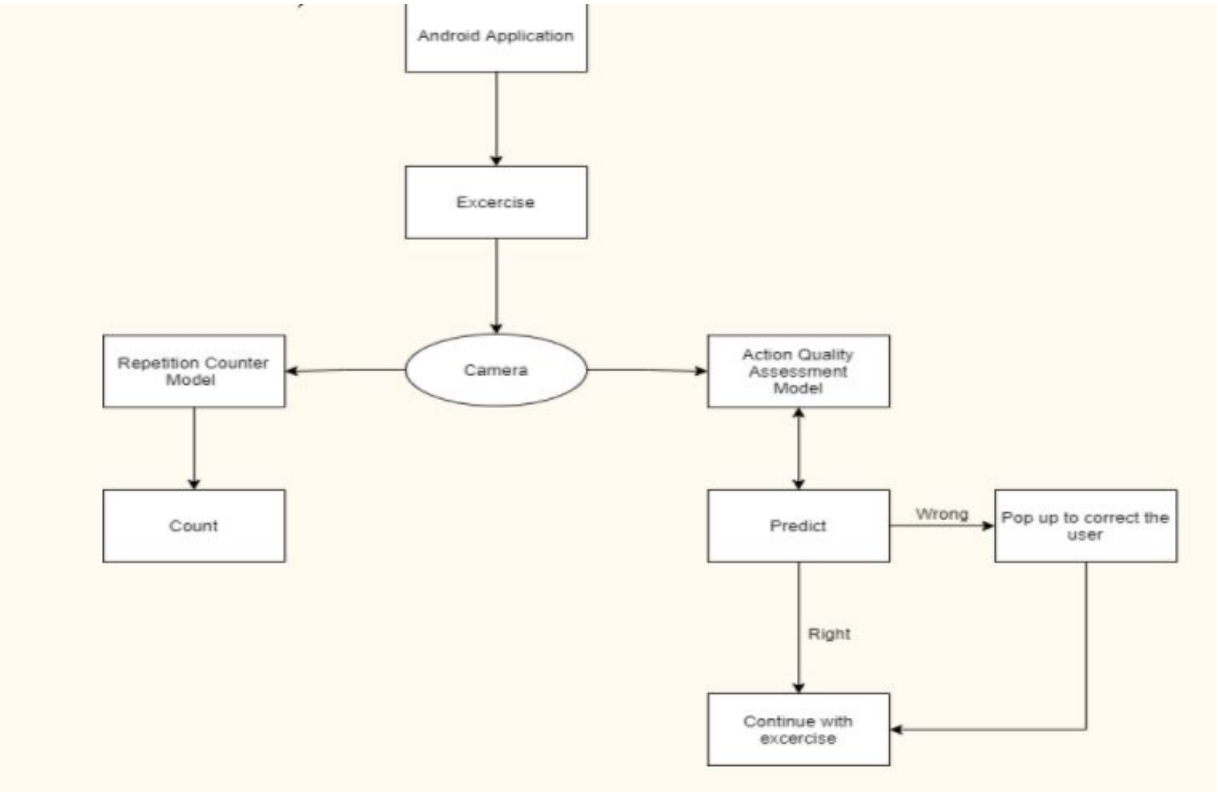

Figure 4.1: Flow of Modules

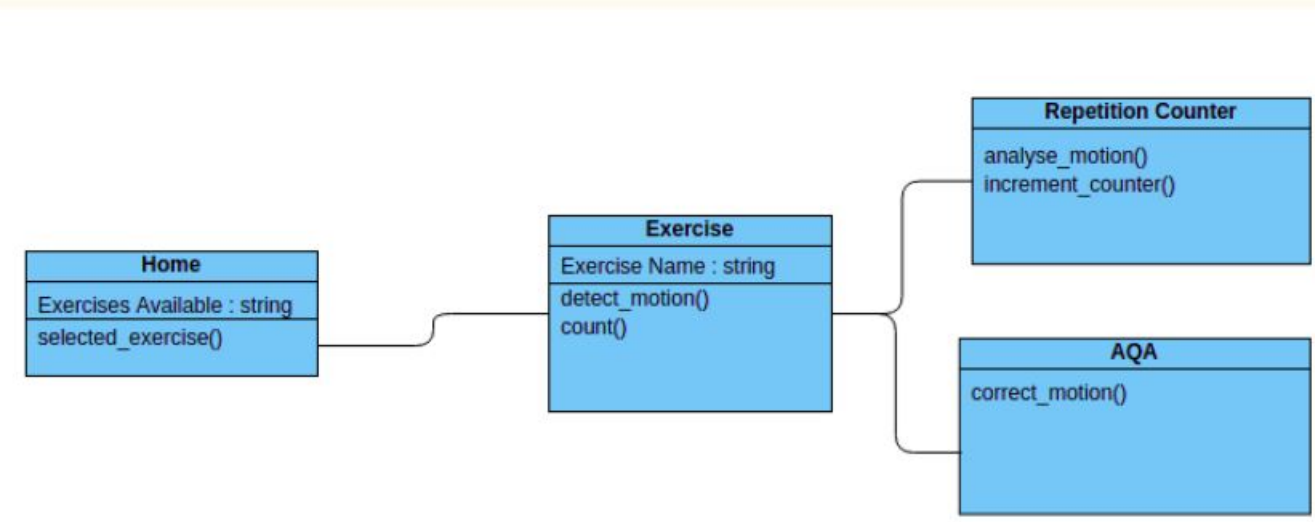

Figure 4.2: Class Diagram

Chapter 5

Conclusions

- Created an Android Application which uses camera instance of users device to detect emotion of the user in real time.
- The motive behind the current implementation is to integrate the camera instance in an Android Application and also combine it with a Machine Learning Model.

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