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KILO - Fitness application with posture estimation

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Abstract

The lockdown measures taken by countries across the globe in light of the COVID-19 pandemic has made people realize the importance of a healthy lifestyle. As more people try to change their habits to adopt fitness routines, they tend to perform exercises without knowing which ones are for beginners and how long they should be working out for. In proposed work, we focus on implementing a fully functional workout app built using flutter, a cross-platform development framework to develop applications for iOS and android, supported by a backend service provided by firebase. This paper surveys different technologies used in pose estimation /classification as well as the different architectures used for the app development in Flutter. It also focuses on the importance of yoga and a technology aided approach for performing yoga poses. The grave nature of challenges faced while doing yoga such as performing it with incorrect form or postures as well as the cost of classes. With novel computer vision techniques, human pose estimation sees a great future. The work delves into the means of deploying yoga pose estimation on an android application, the modeling of the app and the working of each component.

Subject Classification: *90B50.*

Keywords: *Contact tracing, E-wallet, Fitness tracking, Pose estimation, Social media.*

Introduction

FITNESS tracking is a method that goes way back. In the past, stopwatches, analogue scales and thermometers were used to record data, and then it was sent to the medical center for analysis.

Electronic fitness tracking systems have overcome the limitations of traditional systems. These days the use of stopwatches and analogue scales as methods for analyzing performance has become a thing of the past [1]. With this, individuals who seek a better physique must turn to more indoor solutions such as fitness applications [2]. This helps in improving their physical health using this valuable feedback from such social media sites and applications [3].

Keeping all these factors in mind we designed and implemented the fitness app that we named KILO. This app acts as your friend and assistant in tracking and analyzing your performance and data, so you can set a target and improve. In the app we also ask the user to give access to retrieve their Google Fit data, so that the KILO app can become a one-stop-shop for all their fitness needs. The app also asks the user to give access to their Camera as it is an integral part of the Yoga Pose Detection Model.

I. Literature Review

By analyzing multiple research papers related to the different modules implemented, we understand the significance of each of these features.

In [4], global positioning system: a new opportunity in physical activity measurement, we can infer that with recent advancements in GPS (Global Positioning System) technology, the accuracy of physical locations has improved drastically. Identifying Walking Trips Using GPS Data[5], by complementing GPS devices with accelerometry, it is possible to measure physical activity in the majority of populations. Furthermore, GPS provides features such as speed and elevation, which further enhance the detection of activities, as examined by accelerometer and GPS Data for Real-Life Physical Activity Type Detection [6].

The Study on Impact on Customer Satisfaction for E-Wallet Using Path Analysis Model [9], analyzes different factors in which customers are affected by and concludes that convenience, efficiency and security are the main contributors to customer satisfaction.

Differences between acting and non-acting users [12], gamification improves user interaction through goals. Investigation of the perceived persuasive features of fitness app: a case study of Nigeria [13].

In contact tracing in healthcare digital ecosystems for infectious disease control and quarantine management, noted that users' privacy must also be protected [15].

II. Methodology

A. *Components*

The application developed has a set of new and exciting features such as E-Wallets, contact tracing as well as feed.

On the home screen, the user is welcomed to the dashboard where they can view the number of steps taken and calories burnt.

The user can choose to record his/her activity or workout through the app. After concluding a workout, a summary with necessary details is presented to them.

Furthermore, they can opt to write and create a post in the feed section and can also look at other people's posts in feed as well as like and comment on them. The user can receive daily updates/ notifications of any COVID-19 cases in and around the gym. The user has to fill in a questionnaire before entering the gym as well as a temperature reading will be taken before the user gets to enter the gym.

Figure 1

Pose Estimation implementation for Triangle Pose.

B. *Yoga Pose Estimation*

Pose estimation can be done in a 2-D as well as a 3-D plane [17].

The images were then passed through a PoseNet model to generate a series of values for each body part containing the name, score and the 2-D coordinates as shown in Figure 1. The model was trained with an accuracy of 86%. The classification model gives a prediction from 0.0 to 1.0 for each pose. We filtered out the prediction for a particular pose (the pose chosen by the user) and displayed the results on screen in the form of words that read "Wrong Pose", for values less than 0.5, "Almost There", for values

more than 0.5 but less than 0.7 and "Good" for values above 0.7. This margin was chosen to compensate for the accuracy of the PoseNet model running in real-time on the mobile device.

From the confusion matrix generated by AutoML, shown in Figure 2, it is clear that the model was trained with a good score. Running the pose classification model generated by AutoML vision on each frame after converting the frame from YUV420 to RGB can lead to throttling, and in some cases, can cause the application to hang and/or crash, depending on the processor of the device. This approach leads to high throttling issues and is reserved for further implementation.

III. Conclusion

In difficult times like COVID, the contact tracing feature is implemented whereby a user can stay cautious during the workouts. This feature can be tweaked and extended for other issues if required. Badges can be earned by the user upon successfully reaching a milestone on the application. We believe that yoga is an important discipline which is very necessary for staying healthy and maintaining a good balance in life and thus felt the need to provide users a pose detection model where the accuracy of their yoga postures can be monitored dynamically. It is believed that this application would prove to be a catalyst for motivated fitness enthusiasts.

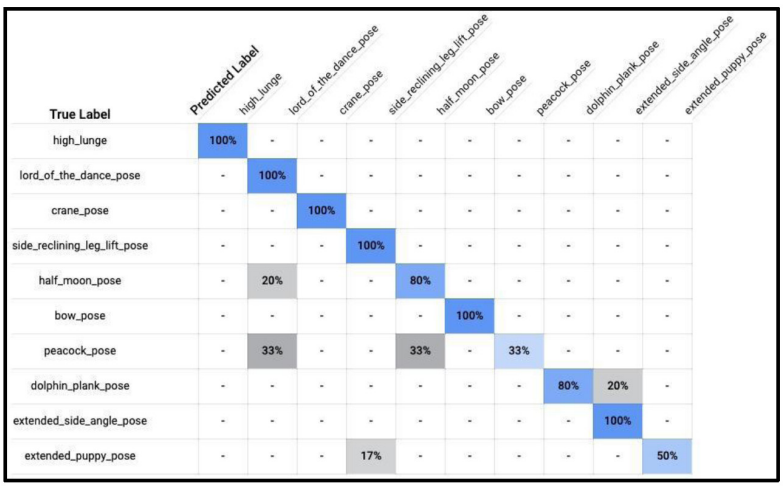

Figure 2

Confusion matrix generated by AutoML vision on GCP

IV. Future Scope

The pose detection model used in the app currently tracks only three yoga poses. However, by improving the accuracy of the model as well as increasing the number of poses that can be estimated with it would help users in improving their health by doing exercises with correct posture.

Apart from all this, conduction of feedback forms and surveys can be looked into for future improvements of the app.

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