Boston University

Electrical & Computer Engineering

EC463 Senior Design Project

First Prototype Testing Report

Team 20 SwingOn

Team Members:

Yoel Beyene

Tingru Lian

Hanlin Mai

Jessica Martinez Marquez

Equipment

The second prototype testing consisted of assessing the application's hardware and software elements. The hardware section included an iPhone 6S (or newer for smoother processing) running at least iOS 15 or iPadOS 15, as well as another device running at least macOS Catalina. Both devices were set up to run and simulate the SwingOn app.

The software part of the prototype testing consisted of XCode 13 as the development environment for setting up the testing, Swift as the programming language, and SwiftUI as the user interface toolkit for designing the app presented in prototype testing.

The SwingOn app estimates the spatial location of a person's 17 key body joints from live video using the PoseNet pose detection model running on the iOS CoreML framework. Additionally, a phone tripod was used for the stabilization of the iPhone for testing the prototype app. One team member also acted as the user to perform several movements in front of the camera of the iPhone to demonstrate the model results.

Setup

To demonstrate the full functionality of the SwingOn app and its compatibility with different devices, the team showed the full process of building the app on the computer and installing it on the iPhone.

The setup consisted in connecting the iPhone to the computer to install the app, building the SwingOn project on XCode13, and downloading it on the iPhone. The device was adjusted on a tripod to ensure a stable position and placed 2 meters away from the user so that their full-body could be captured. This was to maintain a consistent laboratory environment to achieve better result accuracy when performing the test of detecting the user from a busy background.

Measurements

The measurements taken are the following. The SwingOn app should be able to successfully run on any iOS device, specifically, on the iPhone that is being used to test. Each screen and all of its elements should be distinctly displayed. The main screen should have the "SwingOn" logo, a welcome message, a map showing the user's location, and two buttons–one for the camera screen and the other to upload videos. If the user presses the "Open Camera" button, the camera screen should appear along with a "Back" button that returns to the main screen. The camera screen should ask the user for permission to access and open the camera. When permission is granted, the camera screen should display a person's body pose in real-time (>30fps) as well as allow users to make adjustments to the model. There should be a total of 17 key points detected on a person's body, including nose, left and right eye, left and right ear, left and right shoulder, left and right elbow, left and right wrist, left and right hip, left and right knee and left and right ankle. The centroid should also be calculated and displayed. The coordinates should be shown on the camera screen and indicate the location that a keypoint exists in the video. The goal is to have a real-time analysis of a golfer's motion using a camera as well as enable users to upload a video for analysis. Therefore, the upload feature of the app should allow the user to upload pre-recorded videos to the app and analyze them by applying the pre-trained PoseNet model.

Conclusion

All the requirements in the measurements were met in the second prototype testing. However, some requirements needed to be implemented for the app to perform more designated tasks, such as the threshold have not been set to determine good or bad swing. Even though the centroids have been calculated and stored, the threshold has not been set yet. Another part that

needed to be added is the auditory feedback for users. When the app detects users are doing a swing that is not balanced, the users will receive auditory feedback. Because they might stand far away from the screen and they may not face the screen, auditory is the best way to give feedback to them.