CP-26

Pose Extraction for Real-time Workout Assist

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Abstract

The goal of this capstone project was to test and analyze various open sourced pose extraction software packages and compare their effectiveness against each other. Additionally, we leveraged built in components of these solutions, as well as custom built software solutions, to extract information on coordinates for key points to track movement of specific points on the body (IE, a hand) across the length of a given video. This allowed us to plot the movement of individual points across a 2D space throughout the video and create visualizations and reports based on the data. This same technology was then able to be applied to a 3D space to provide more realistic data.

Introduction

This project stemmed from a research perspective and the initial goals were focused on comparing the performance of open-source products against expensive commercial products used by Kennesaw State University's Exercise Science department. Due to the timing of this project amid the Coronavirus pandemic, we were unable to perform in person testing and had to adjust the goals of the project. This pivot adjusted our focus from comparing potential open-source solutions against Kennesaw State's existing solution towards focusing on the effectiveness of the available open-sourced packages against each other in both a 2D and a 3D comparison.

Research Goals

- Install different existing pose extraction technologies
- Test the installed packages on different situations
- Provide a report on the packages' strengths and weaknesses
- Field experiment on comparing the chosen open-source package with professional KinaTrax.

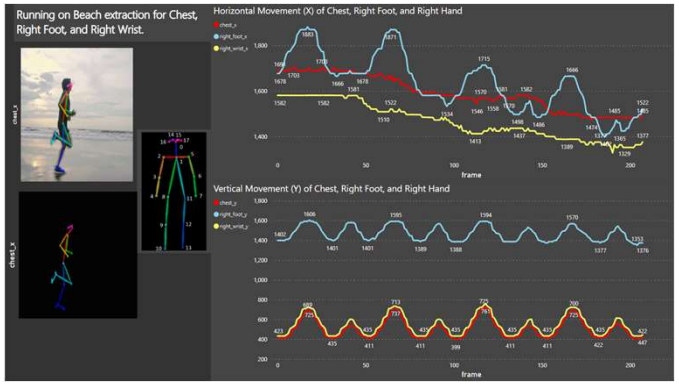
- As we were unable to go to campus to compare our chosen solution with KinaTrax, our Goals evolved with the project. Instead of comparing with KinaTrax, we compared our chosen solution with other provided software solutions.

Materials and Methods

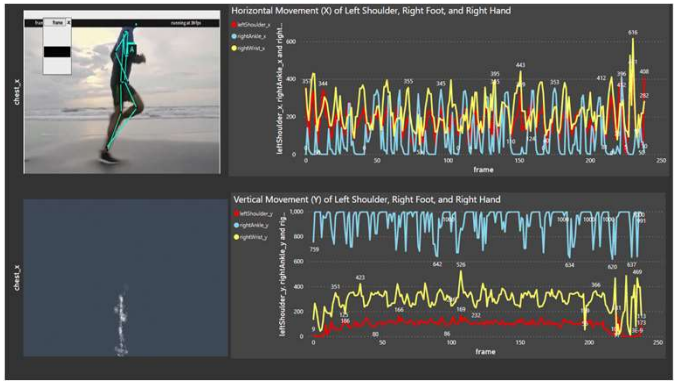
We utilized GitHub for much of the source code, as well as PowerBI for formulating the final results display for each of the software solutions. One of our members also created a web app to use for extracting the data from a .json file in order to export the data into PowerBI.

Results

Results of OpenPose Pose Extraction:



Results of FastPose Pose Extraction:



Conclusions

After analyzing both our 2D software solution—OpenPose—and our chosen 3D software solution—FastPose—we were able to determine that OpenPose was the more accurate solution. However, it is worth noting that FastPose was much quicker to analyze the given footage. This faster processing likely resulted in the discrepancy between the two solutions when graphing the key points from the duration of the provided video. If we were to move forward with this project after this point, a key interest would be determining whether the more jagged graphs displayed by the key point coordinates generated by FastPose could be normalized to reduce the outliers and provide a more accurate display of the movements in the video.

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References

https://github.com/CMU-Perceptual-Computing-Lab/openpose

https://github.com/CMU-Perceptual-Computing-Lab/openpose/blob/v1.7.0/doc/quick_start.md#running-on-video

https://github.com/ZexinChen/FastPose

https://github.com/Drnoodle/fastpose

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