Project Plan

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Object Tracking in Weightlifting for Improving Form and Technique

# Description:

Several studies have found that video and visual feedback along with other standard forms of feedback is more effective than simply providing verbal feedback when attempting to learn and improve. There have also been a few attempts at creating software which is able to track and draw the path that a bar takes during the lift completed by an athlete. This project looks to create a more effective version of this whilst also being able to provide visual cues and advice that the athlete can follow in order to improve their technique whilst training on their own.

# Preliminary Preparation:

* A strong understanding of OpenCV and object tracking techniques in video
* An understanding of weightlifting technique and proper form

# Objectives:

## Minimum:

* Implementation of a system using Python and OpenCV that can detect, and track, a bar being lifted by an athlete, as well as trace the path that the bar follows.

## Intermediate:

* Implementation of additional features which track the distances the bar travels horizontally and vertically throughout the video, as well as calculating the velocity of the bar throughout the path
* Adaptation of base system to be able to run using live video rather than pre-recorded video, thus allowing for immediate audio cues in the case of urgent issues with athletes’ form
* Providing “ideal” paths that can be viewed alongside/overlaid with the path that the athlete had

## Advanced:

* Reimplementation of the system to be run on Android using OpenCV rather than Python
* Implementation of the ability to provide feedback and tips to the user, in order to improve their technique and form, through the analysis of data collected in the builds from the Intermediate step

# Project Plan:

The project plan can be broken down into relatively simple parts in line with each of the main objectives. Barring the basic objective, which is required to complete all the others, it is relatively easy to allow for readjustment of the objectives and their time frame to make up for any potential issues.

For the basic objective we will need to implement a tracking algorithm using OpenCV and Python, which can take a video input and trace the bar within that video. It should then allow the video to be traversed through as with any other video that you would play, to allow the user to examine the path at any point.

For the intermediate objectives, the main aim is to build on what has already been established in the basic objective. Using information from the tracking algorithm we have implemented, the next step would be to implement a way to calculate and display, ideally in a graph format, velocity vs time and distance travelled horizontally vs vertically. We would also look to implement the ability to use a live video recording, which would then be saved by the application and made available for playback rather than just using previously recorded videos.

The advanced objectives will likely be more difficult to implement. The reimplementation into a different language will present a technical challenge, as whilst the application will already exist, it will need to be adjusted to be able to be run on an Android device, and so considerations such as screen size, processing power, and energy consumption would also need to be made. The implementation of an ideal path overlay will not be as technically challenging, but it will require a lot of testing and investigation, as it is difficult to be able to say that one path is “perfect” in comparison to all others. Feedback may also pose an issue for similar reasons, though it would still be possible to implement at least to a limited extent, where for example it would warn the user if they are travelling over what would be considered a safe distance from the previously mentioned ‘ideal’ path.

Testing of the system will be carried out at each stage, ensuring that it works correctly and in order to find any deficiencies in the system. Evaluation will be carried out on the system itself to find its success rate, as well as questionnaires provided to participants to evaluate the HCI aspect of the system, and to receive feedback that can be used to improve the system before the final iteration.

