Back Squat Analysis

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We all want to work on this project very badly

Description

Our project aims to solve the problem of injured, entry-level athletes. We will do this by creating a grading system that will in turn reflect the accuracy of a certain athlete's ability to perform his/her skill. Our specific model will focus on the weightless back squat as a basic movement. The model would intake a video of a person doing a back squat, and the corresponding output would be a score 1-5, with 1 being the lowest and 5 being the highest. This will be based on its relation to a well performed squat as input by a professional (explained below). If possible, feedback would also be provided to improve form, but that is largely an extension for this simpler model.

Features and Data

Below is an example of a few features that would be used in a recurrent network.

LEFT ANKLE KNEE HIP ANGLE	LEFT ELBOW SHOULDER HIP ANGLE	LEFT SHOULDER HIP KNEE ANGLE	RIGHT ANKLE KNEE HIP ANGLE	RIGHT ELBOW SHOULDER HIP ANGLE	RIGHT SHOULDER HIP KNEE ANGLE	LEFT ANKLE HIP DISTANCE	LEFT ANKLE RIGHT ANKLE DISTANCE	LEFT KNEE RIGHT KNEE DISTANCE	RIGHT ANKLE HIP DISTANCE	Height of person
92.00	134.00	50.00	75.00	140.00	25.00	74.00	0.57	1.30	1.05	1.2
176.00	19.00	137.00	170.00	14.00	173.00	0.46	1.21	0.79	1.14	1.20

These features would be extracted from the input video using a pose estimation library such as MoveNet or OpenCV and calculated using Linear Algebra with Numpy. The height of the person may need to be a user input and not calculated. Overall the features are calculated from coordinates instead of using the resulting x,y, and z coordinates from the pose estimation because the distance from camera, height of person, and other factors are more uncontrollable and predictable. By using angles the variance in the distance from the camera and such are eliminated. However, if it is found to be irrelevant, it would be much simpler to input the x,y,z coordinates into the network of major body points.

Data Gathering

We will be gathering quick videos of individuals performing this specific movement. They will need to do it at a 45 degree angle so as to not confuse the model.

Here we have an example of what an ideal video input should look like. Each of these videos originally input in the model will have been graded by a professional for model training purposes. The model will then output the corresponding grade based on its relation to the professional's inputs. To date, there is a collection of around 200 videos that are in the necessary position and have received their initial grade.