Workout Form Classifier

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Goal

- ❑ Create a system that can detect a weightlifter's form
- ❑ Classify whether the form is good or bad
- ❑ Offer suggestions for improvement based on further classification
- ❑ Our proof of concept focuses only on deadlifting due to it's high injury potential and complicated movement

Motivations and Objectives

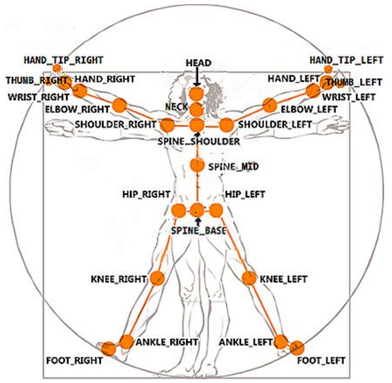
- ❑ Motivations
  - Everyone starts off as a beginner when it comes to weightlifting and the proper form is not always intuitive
  - When using improper form, it can lead to injuries that can take a long time to heal and leave the weightlifter prone to injuries in the future
  - Proof of concept system that could replace a personal trainer
- ❑ Objectives
  - Using a Microsoft Kinect, detect lifter's form
  - Retrieve joint coordinate data from the major joints
  - Classify the lifter's form with a machine learning model
  - Provide feedback to the weightlifter to improve form

Research Challenges

- ❑ Inferring the lifter's skeleton and retrieving data from the shadow given by the Kinect
- ❑ Learning proper body mechanics related to deadlifting
- ❑ Learning about and building a machine learning model from training data to determine proper and improper form
- ❑ Classify form and provide feedback in real time with commodity hardware

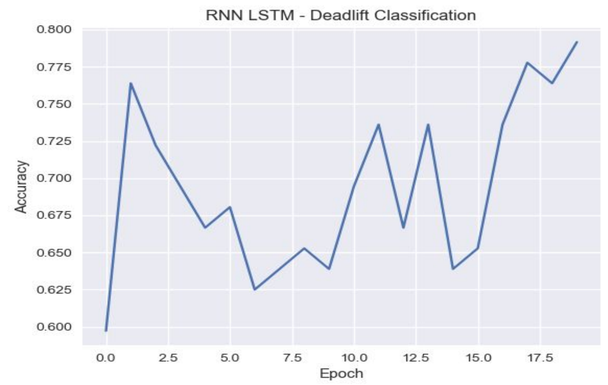
Methodology

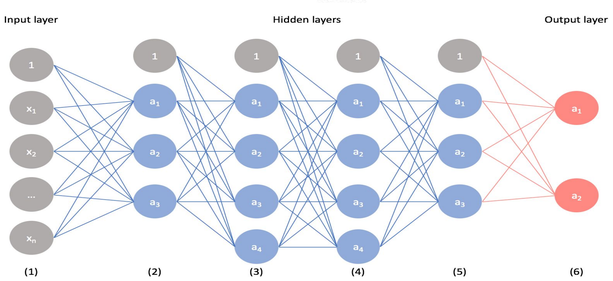
- ❑ Retrieve joint coordinate data points from the skeletal model of the lifter using a Microsoft Kinect
- ❑ Collect information from veteran weightlifters and academic sources on proper and improper deadlift methodology
- ❑ Create our own dataset and classifications by recording ourselves and others at Livingston gym
- ❑ Create a RNN-LSTM (Recurrent Neural Network – Long Short Term Memory) using Keras and adjust the layers to minimize loss
- ❑ Determine if the form is good and if it's incorrect, provide feedback on where to improve based the recorded movement's classification



Results

- ❑ Our model is able to classify proper and improper form with 72.5% accuracy including the different types of improper form
- ❑ The accuracy of our model could easily be increased with better equipment, more accurate sensors with more joint-points, and more trials to create a larger dataset to train with
- ❑ Overall, our capstone shows that any movement could be broken down into the individual joint mechanics and classified according to a neural network. This project can be extended for applications in athletic training and physical therapy with a respecting dataset.





Acknowledgements

Our advisor Roy Yates for giving us a clear direction for our project and pushing us when we were behind. Our fellow students for their suggestions and willingness to help us create data. The ECE department for their resources and guidance in our final semester.

References

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