Title : Exercise classifier

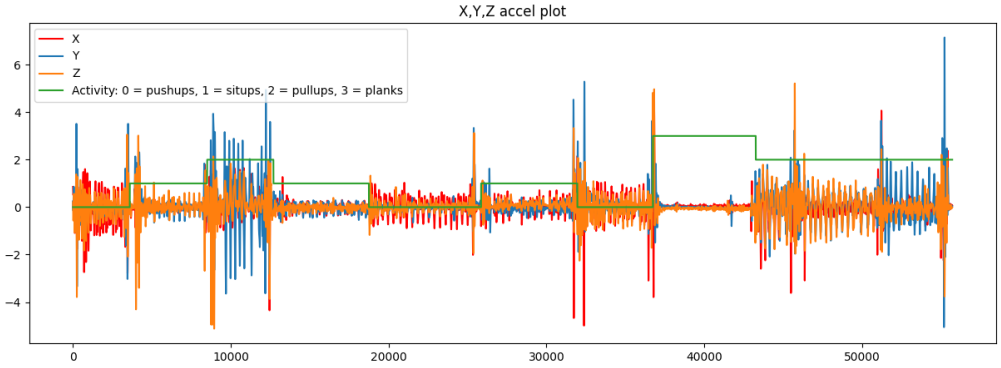
Contributions:
Connor Gibbons: Collected data, worked on analysis graph plotting and classification
Nicholas Kenney :Collected data, worked on analysis graph plotting and model training
Wellan Sok: Collected data, worked on feature extraction, model training

Problem Statement:
The goal of this project was to use machine learning to differentiate between different exercises by analyzing patterns in data we recorded. This project focuses on the user being able to accurately record activities throughout their day using their mobile devices, allowing users to gain insight into their daily activities.

Potential Applications of the Project:
The application has multiple applications, it can be used by athletes or fitness enthusiasts to detect activities based on user accelerometer and gyroscope data, and use the data to count the number of repetitions. It could also be used by physical therapists or trainers who need to track patient activities and repetitions.

Data Collection, Model Training, and Testing/ Analysis:
Data collection for this project involved using a sensor logging application on our smartphones that we placed in our left pockets to reduce variability. Within the application we specifically used the accelerometer and gyroscope sensors. The data we collected is then exported in csv files, and then we use various ways to extract features from the data and then use those features to train our model with k fold cross validation. For our classification we used a window size of 150 which is about 1.5 seconds with a sampling rate of 100hz. The features we used were dominant frequencies, entropy, averages, pitch, and standard deviations.

Results




```
[[ 7  0  4  0  0  0]
 [ 1  4  2  0  0  0]
 [ 0  2 11  0  0  0]
 [ 0  0  2  4  0  0]
 [ 0  2  1  0  0  0]
 [ 0  1  3  0  0  0]]
```

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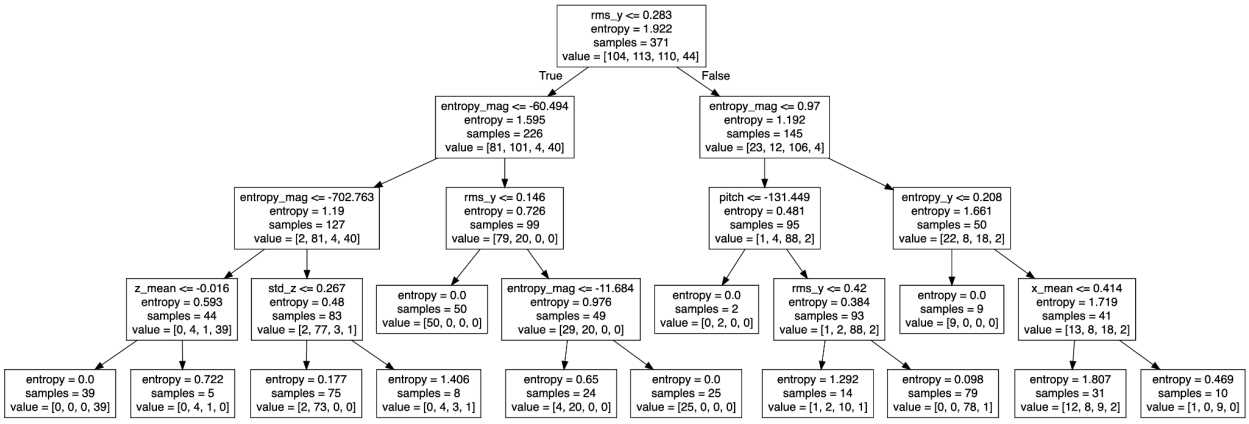
Accuracy:0.5521141649048624
Precision:0.6916621810882816
Recall:0.4936892492039551
```



Learnings from the Project:

We learned that more data is oftentimes harder to produce but the value it brings when training a model/classifier is tremendous. We also learned that when collecting our own data we should think of what we can record to make it easier in the future if we do decide to use another sensor, so we wouldn't have to go back and record again. We also learned that by trying to add additional exercises to classify it greatly reduced the accuracy of our classifier.

How to Improve the Project Further:

We could improve upon this project by fine tuning our algorithm to allow for minimal error when detecting activities and counting repetitions. We also can find more participants to collect a wider variety of data to make sure we can generalize appropriately among a wider audience. We also could expand upon what activities can be detected and counted accurately.

References: