Title : HeartFit:A Real-Time Mobile Health Sensing Application for Workout Intensity Monitoring

Contributions:
Sapna Parihar: Worked on feature extraction and visualization for project.
Kyle Chua: Worked on classifier and final project report.
Tanishka Indorekar: Worked on data collection, features, and data analysis.

Problem Statement
The main goal of this project is to create a mobile health application capable of monitoring heart rate and activity levels in real-time. The program wants to let users know if their exercise is light, moderate, or vigorous. The program enables people to successfully control their fitness levels via mobile devices by utilizing sensor data and machine learning algorithms.

Potential Applications of the Project
The application that was created offers a wide range of demographic uses that are potentially significant. This program may be used by fitness enthusiasts to track their heart rate and activity levels throughout various workouts. In addition, those with certain medical problems, such as cardiovascular disorders, can use this program to maintain or enhance their health. This application is a flexible tool for health and wellness programs since healthcare providers may use it for remote patient monitoring as well.

Data Collection, Model Training, and Testing/ Analysis
Integrated sensors, such as the accelerometer for activity tracking, were used to gather the data for this research. The data was collected using a variety of exercises, such as walking, jogging, running, climbing stairs, crunches, sit-ups, moving planks, stretching, which are all categorized as low, moderate, and high intensity workouts. The processed data was then utilized for model training, model validation utilizing several techniques, and data splitting for training and testing.

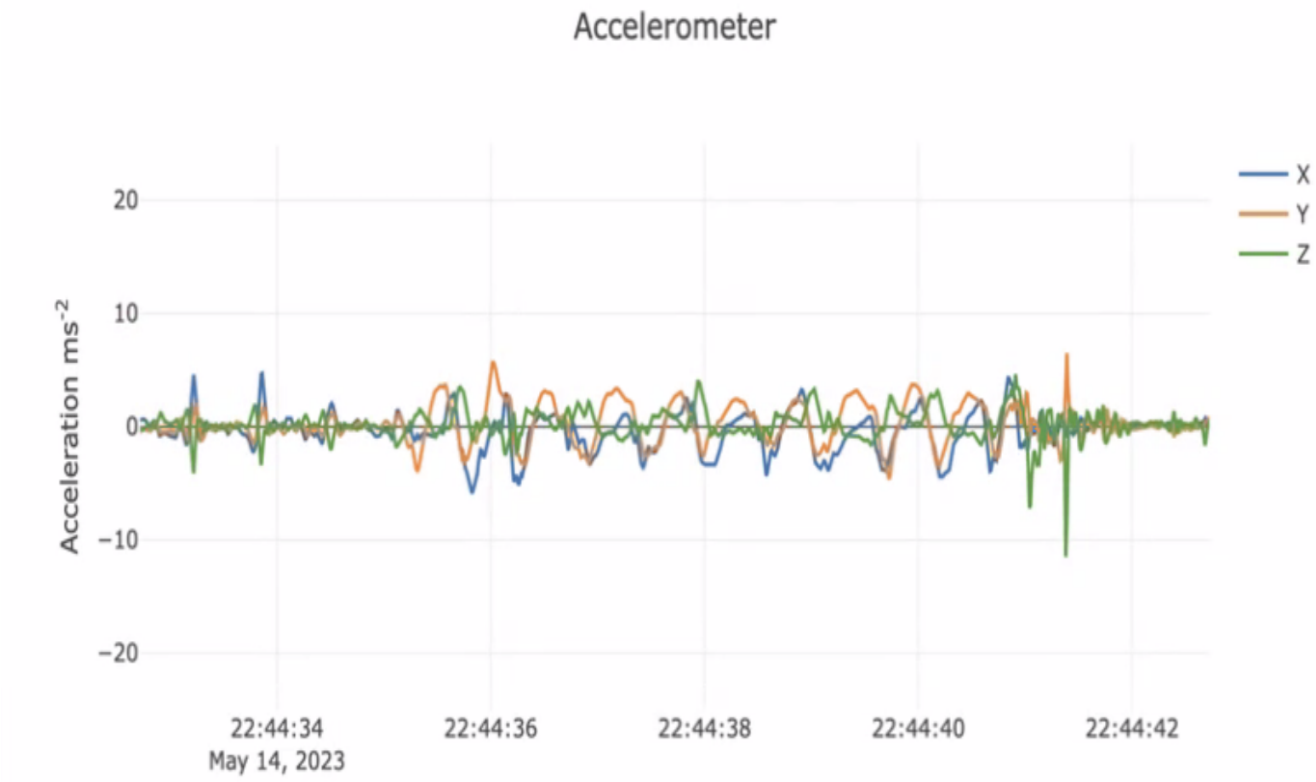
Mean, median, FFT, entropy and number of peaks were among the features used to evaluate the data. Through the use of a 10-fold data classification strategy, the model was trained and verified.

Results
The analysis of the collected data resulted in a confusion matrix that showed an accuracy of 77% in classifying workout intensities correctly.

Graphs/Tables

Target Workout Intensity: moderate
Current Workout Intensity: ['moderate']

Great job! You are within target workout intensity



10 Fold Classification Confusion Matrix:

```
Fold 1:
Accuracy: 0.8218884120171673
Precision: 0.8426317974263179
Recall: 0.7580274926085186
Confusion Matrix:
[[245  21   0]
 [ 14  93   0]
 [ 16  32  45]]

Fold 2:
Accuracy: 0.8559139784946237
Precision: 0.8443427796839921
Recall: 0.7800211976682565
Confusion Matrix:
[[280  15   1]
 [  9  76   0]
 [ 11  31  42]]

Fold 3:
Accuracy: 0.8365591397849462
Precision: 0.8347066129975026
Recall: 0.7583127926685628
Confusion Matrix:
[[263  20   0]
 [ 11  87   2]
 [ 14  29  39]]

Fold 4:
Accuracy: 0.8150537634408602
Precision: 0.8096245989683389
Recall: 0.7422256237848441
Confusion Matrix:
[[263  23   0]
 [ 11  74   2]
 [ 18  32  42]]

Fold 5:
Accuracy: 0.8408602150537634
Precision: 0.8409486137397976
Recall: 0.7952861952861953
Confusion Matrix:
[[254  20   1]
 [  7  83   0]
 [ 16  30  54]]

Fold 6:
Accuracy: 0.8193548387096774
Precision: 0.8297183723540312
Recall: 0.74291253496059
Confusion Matrix:
[[265  20   0]
 [ 11  77   0]
 [ 21  32  39]]

Fold 7:
Accuracy: 0.821505376344086
Precision: 0.8370760694704357
Recall: 0.7498306233062331
Confusion Matrix:
[[259  28   0]
 [ 10  86   0]
 [ 17  28  37]]

Fold 8:
Accuracy: 0.8623655913978494
Precision: 0.8728197304856344
Recall: 0.8020014955531161
Confusion Matrix:
[[263  24   0]
 [  9  96   0]
 [ 13  18  42]]

Fold 9:
Accuracy: 0.8731182795698925
Precision: 0.8703745722011081
Recall: 0.8278461367919299
Confusion Matrix:
[[269  22   0]
 [ 10  83   0]
 [ 10  17  54]]

Fold 10:
Accuracy: 0.8236559139784946
Precision: 0.8357416277146209
Recall: 0.7779196844617405
Confusion Matrix:
[[234  24   1]
 [  7  99   1]
 [ 17  32  50]]

Average Accuracy: 0.837027550879136
Average Precision: 0.8417984775041779
Average Recall: 0.7734383777089987
```

Learnings from the Project

The significance of proper sensor selection and integration for precise data collecting was highlighted by this project. The experiment also highlighted how machine learning models have the ability to translate sensor data into actionable health information.

How to Improve the Project Further:

The application may be made even better by extending the set of health metrics it keeps track of. Users might receive a more complete picture of their health if features like sleep patterns, stress levels, and food habits were included. The effectiveness of the application

would also be improved by increasing the model's accuracy and adding feedback systems for user-specific recommendations.

Another way of improving the application would be the creation of a unique, user-friendly interface. Users should be able to simply explore and use the application's numerous functions due to this interface's intuitiveness and eye-catching design.

The application's reliance on the sensor logger application for data visualization represents another significant area for improvement. At the moment, the application uses an external sensor logger to show users the data that has been gathered. We may provide a more smooth and integrated user experience by embedding a built-in data visualization module within the program itself. Users would no longer need to switch to the sensor logger in order to view their heart rate, exercise intensity, and other health parameters.

References:

No References