Dynamic Fitness Plan Generator Using Wearable Data

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Introduction

The Fitness Plan Generator project aims to provide personalized workout plan using machine learning techniques. By leveraging data from fitness devices, the project seeks to predict workout intensity and type based on individual user characteristics.

Objective

Create a fitness plan generator that adapts workouts based on real-time data from wearables (e.g., step count, heart rate). The system should dynamically modify plans as new data comes in.

Example Use case

1. User A starts their daily workout.
2. The system fetches real-time heart rate and step count data from the wearable API.
3. The model predicts the effectiveness of the current workout.
4. Based on this prediction, the system suggests increasing the intensity or changing the type of exercise.
5. The user receives a dynamic adjustment in their workout plan, personalized to their current fitness level and performance.

Dataset Used

The dataset titled "Apple Watch and Fitbit Data" on Kaggle contains fitness and health-related data collected from users of Apple Watch and Fitbit devices. It includes various metrics such as heart rate, step count, calories burned, distance traveled, and other relevant health indicators. The dataset is designed to facilitate analysis and modeling of user fitness behaviors and health trends, making it suitable for projects focused on health monitoring, fitness prediction, and personalized fitness planning.

The dataset contains the following columns: age, gender, height, weight, steps, hear_rate, calories, distance, entropy_heart, entropy_setps, resting_heart, corr_heart_steps, norm_heart, intensity_karvonen, sd_norm_heart, steps_times_distance, device, and activity.

Link : Apple Watch and Fitbit data

Implementation

1. **Data Import and Preparation**
2. **Data Preprocessing**:
   - Identify and separate numerical and categorical columns.
   - Normalize numerical features to ensure all features contribute equally to model performance.
   - Encode categorical target variables into numerical format using label encoding.
3. **Regression Model Development**:
   - Define features and target variable for the regression task (predicting workout intensity).
   - Split the data into training and testing sets.
   - Train a regression model (Random Forest Regressor) on the training set.
   - Evaluate model performance using Mean Squared Error (MSE).
4. **Classification Model Development**:
   - Define features and target variable for the classification task (predicting workout type).
   - Split the data into training and testing sets.
   - Train a classification model (Random Forest Classifier) on the training set.
   - Evaluate model performance using accuracy and generate a classification report.
5. **Fitness Plan Generation**:
   - Develop a function that utilizes the trained models to predict workout intensity and type based on user input.
   - Return the predictions in a structured format.
   - Display the generated fitness plan to the user, including predicted workout intensity and type.

Frameworks/Libraries Used

- NumPy
- Pandas
- Scikit-learn
- Seaborn
- Matplotlib
- LabelEncoder
- RandomForestRegressor
- RandomForestClassifier

- LinearRegression
- mean_squared_error
- r2_score
- accuracy_score
- classification_report
- train_test_split
- StandardScaler
- OneHotEncoder

Machine Learning Models Used

- **Regression Model** : The regression model predicts the workout intensity based on user input data.

  It takes the following features:

  - Age
  - Weight
  - Average daily steps
  - Average heart rate
  - Daily calories burned
  - Average distance walked
  - Normalized heart rate

- **Classification Model** : The classification model predicts the type of activity to perform (e.g., lying, Running 3/5/7 METs, Self Pace Walk, Sitting) based on the same user input data.

Results

Model	Metric	Value
Random Forest Regressor	Mean Squared Error (Intensity Prediction)	0.0011848210043396304
	R^2 Score (Intensity Prediction)	0.9552763751165673
Linear Regression	Mean Squared Error (Intensity Prediction)	0.04274881107661606
	R^2 Score (Intensity Prediction)	0.9552763751165673
Random Forest Classifier	Accuracy (Workout Type Prediction)	0.8379888268156425

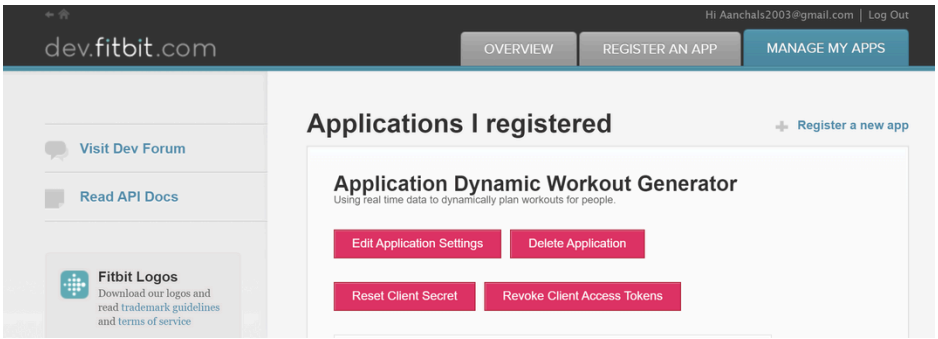
- **Random Forest Regressor**: Low mean squared error (MSE) indicates the model is performing well with very small prediction errors, and the R^2 score of 0.955 shows that it explains 95.5% of the variance in intensity prediction.
- **Linear Regression**: Has a higher MSE compared to Random Forest, but still retains a solid R^2 score.
- **Random Forest Classifier**: Achieves an accuracy of ~83.8%, indicating a good model for predicting workout type.

Generating workout plan based on the values entered by the user :

```
Generated Fitness Plan:
Workout Intensity: 4.770098749505864
Workout Type: Running 5 METs
```

Challenges and limitations

- One limitation of the project is that, although a Fitbit developer account was successfully created to fetch real-time data via the API, I was unable to establish the connection due to time constraints. As a result, the analysis relied on pre-existing data rather than live data from Fitbit devices.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