To use the Python code in a Jupyter Notebook or a standalone Python script, you can follow these instructions:

1. Requirements: Ensure you have Python 3 installed on your computer. You should also install the necessary packages using pip or conda:

pip install pandas numpy matplotlib seaborn scikit-learn tensorflow scikeras

1. Download and save the data: Download the dataset files (train.csv and test.csv) and save them in the same directory as your Python script or Jupyter Notebook.
2. For Jupyter Notebook:
   * Open Jupyter Notebook in the directory where the dataset files and the notebook are located.
   * Run each cell in the notebook by clicking on the cell and pressing Shift + Enter.
3. For Python script:
   * Open a terminal or command prompt in the directory where the dataset files and the Python script are located.
   * Run the Python script by typing python your\_script\_name.py (replace your\_script\_name.py with the name of your Python script) and pressing Enter.

Documentation for the code:

The code performs the following tasks:

* Import necessary libraries and packages
* Load train and test data
* Preprocess the data, including:
  + Label encoding the 'Activity' column
  + Combining train and test data
  + Dropping irrelevant columns
  + Imputing missing values
  + Scaling and normalizing features
  + Applying PCA for dimensionality reduction
* Split the data into train and test sets
* Create and train machine learning models, including:
  + Decision Tree
  + Random Forest
  + Neural Network
* Evaluate the models using cross-validation and test set
* Perform exploratory data analysis, including:
  + Distribution of motion types
  + Correlation matrix of features
* Select the best model and tune its hyperparameters (if applicable)
* Save and load the best model
* Integrate the model into a function for use in a smartwatch's software
* Test the function with simulated sensor data

To use the classify\_motion function in your smartwatch's software or any other application, follow these steps:

1. Make sure you have the required dependencies installed, as mentioned earlier.
2. Load the trained model using the load\_model function from TensorFlow (for neural network) or pickle.load (for other models).
3. Preprocess any new sensor data using the same scaling and PCA transformations used during training.
4. Call the classify\_motion function with the preprocessed data to obtain the predicted motion type.

To use the provided Python code in Google Colab, follow these steps:

1. Open Google Colab: Visit [Google Colab](https://colab.research.google.com/), sign in with your Google account, and click on "File" > "Upload notebook" to upload the downloaded Jupyter Notebook (.ipynb) file.
2. Install necessary packages: Run the following command in a new code cell in the Colab notebook to install the required packages:

!pip install pandas numpy matplotlib seaborn scikit-learn tensorflow scikeras

1. Upload dataset files: In the Colab notebook, click on the folder icon in the left sidebar, and then click on the "Upload" button to upload the dataset files (train.csv and test.csv). Make sure they are saved in the same directory as your Colab notebook.
2. Run the notebook: Run each cell in the notebook by clicking on the cell and pressing Shift + Enter.
3. Download the trained model (optional): If you want to download the trained model, you can use the following code to download the model file to your local machine:

from google.colab import files files.download('your\_model\_filename.h5') # Replace 'your\_model\_filename.h5' with the actual filename

1. Download the modified notebook (optional): If you have made any changes to the notebook and want to download it, click on "File" > "Download" > "Download .ipynb" in the Colab notebook menu.