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Human Activity Recognition using Smartphone

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ABSTRACT

Sensor data can be recorded remotely, e.g. by video, radar or other wireless methods. It contains data generated by the smartphone's accelerometer, gyroscope and other sensors to train supervised prediction models using machine learning techniques such as SVM, random forest and decision tree to build a model. This can be used to predict the type of movement performed by the person, which is classified into six categories: Walking, climbing stairs, descending stairs, sitting, standing and lying down.

This research shows that the knowledge of experts does not differ semantically, but that the information tends to be interrelated. The experiments conducted have shown that the size of words and the speed with which words are retrieved from memory vary among individuals with different background knowledge.

Keywords:

Decision tree, Naïve Bayes, Random Forest, Sensors, Support vector machine.

1. INTRODUCTION

The general public knows that physical activity is crucial for a healthy life. Therefore, researchers are striving to better understand the relationship between physical activity and health. Accurate recording of the activities performed is an essential prerequisite for their research. This data can be used to design and construct activity recognition systems. These systems enable doctors to automatically and continuously check the development of their patients' recovery.

Activity recognition can be used by recommender systems to help users track their daily physical activity and motivate them to increase their activity levels. With recent advances in wearable technology, unobtrusive and mobile activity recognition has become useful. With this technology, devices such as smartphones and smartwatches are widely available, which have a variety of built-in sensors while providing a large amount of processing power.

All in all, the technical means are available to develop a mobile, unobtrusive and accurate system for recording physical activity. This will make it possible to record people's physical activities as they go about their daily routines. So far, no one has looked into using lightweight devices to detect human activity. An activity recognition system has several main requirements. First, it should detect activities in real time. This requires that the features used for classification can be calculated in real time. Also, short time windows must be used to avoid delayed response. Finally, the classification procedures should be simple, lightweight and computationally inexpensive so that they can be run on handheld devices.

2. LITERATURE SURVEY

P. William and A. Badholia, "Analysis of Personality Traits from Text Based Answers using HEXACO Model", 2021 International Conference on Innovative Computing Intelligent Communication and Smart Electrical Systems. This method, which uses fixed-point computations, because it requires less memory, CPU time, and power, it may be used for AR, and it produces higher levels of accuracy than other methods. [1]

Michalis Vrigkas, Christophoros Nikou and Ioannis Kakadiaris, A review of human activity Recognition methods, November 2016. Recognizing human activities from video sequences or still images is a challenging task due to problems such as background clutter, partial occlusion, changes in scale, viewpoint, lighting and appearance. [2]

Geetanjali Vinayak Kale and Varsha Hemant Patil, A Study of Vision based Human Motion Recognition and Analysis, July 2016. Vision based human motion recognition has fascinated many researchers due to its critical challenges and a variety of applications. The applications range from simple gesture recognition to complicated behaviour understanding in surveillance system. This leads to major development in the techniques related to human motion representation and recognition. [3]

Muhammad Shoaib, "A Survey of Online Activity Recognition Using Mobile Phones Sensors", 2015. One goal of activity recognition is to provide information on user behaviour that allows computer systems to assist people in their work in a proactive manner. [4]

Zhu, Y., Nayak, N.M., Roy-Chowdhury," Context-aware activity recognition and anomaly detection in video",2013. it is a mathematical framework to jointly model related activities with both motion and context information for activity recognition and anomaly detection. [5]

3. PROPOSED METHOD AND METHODOLOGY

The recognition of human activities takes place using the data include some algorithms and methods. this project implements the several algorithms namely svm (support vector machine), random forest, decision tree which will give the accuracy the data in their algorithms. a comparison graph is generated to compare the accuracies of the algorithms. after that the activities can be recognized using the data and the graph format.

Merits of proposed method:

• because of the usage of various algorithms, it gives a high accuracy.

• svm algorithm is memory efficient as it uses a subset of training points in the decision function called support vectors.

In this human activity recognition, the user first uploads the essential dataset in the interface and explore the data by using explore command option. After that the dataset splits into training and testing data using the pre-processing phase. Training the data that divided and predicting accuracies by passing values in algorithm methods like support vector machine, decision tree and random forest can be done using the assigned commands. The accuracies of the algorithms can be compared using a graph format. The human activity can be recognized and differentiated using graph format by the data value and comparison char

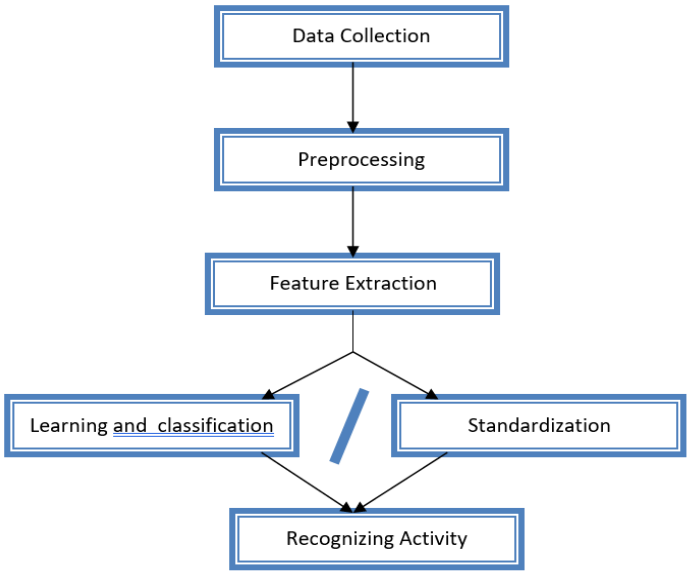

Fig-1: Architecture

Process:

Data collection:

The first step is to collect multivariate time series data from the phone and clock sensors. The sensors are sampled at a constant frequency of 30 Hz. Then, the sliding-window approach is used for segmentation, where the time series is divided into consecutive windows of fixed duration with no gaps between the windows. The sliding window approach does not require any pre-processing of the time series and is therefore ideal for real-time applications.

Pre-processing:

Filtering is then performed to remove noisy values and outliers from the accelerometer time series data so that it is suitable for the feature extraction phase. There are two basic types of filter that are usually used in this step: Average filter or Median filter. Since the type of noise that we are dealing with is similar to the salt and pepper noise found in images, i.e. extreme acceleration values occurring in individual snapshots scattered over the time series. Therefore, a median filter of order 3 (window size) is applied to remove this type of noise.

Feature extraction:

Here, each resulting segment is summarized by a fixed number of features, i.e. one feature vector per segment. The features used are extracted from both the time and frequency domains. This is because many activities have a repetitive character, i.e. they consist of a series of movements that are performed regularly, such as walking and running. This repetitive nature, also called dominant frequency, is a descriptive feature and was therefore considered.

Standardization:

Since features in the time domain are measured in (m/s 2), while features in the frequency domain are measured in (Hz), all features should have the same scale to allow a fair comparison between them, since some classification algorithms use distance metrics. In this step, Z-score standardization is used, which transforms the attributes to have a mean of zero and a unit variance.

4. IMPLEMENTATION

This Project consists of three modules:

- User
- Preprocess
- Process
- Output

1. User module:
   This section provides detail on the standard user management module used to manage users, roles, directories, etc.
   Here the user module is used in preforming two tasks they are,
   - Uploading dataset.
   - Exploring dataset.
2. Preprocessing module:
   It is responsible for executing the encoding, decoding, and preprocessing tasks corresponding to data.
   Here this module is used to split the dataset into training and testing data.
3. Processing module:
   A Process Module is a set of process elements that can be added to other processes. A process module can also contain other process modules, so process modules can be used to build a process architecture.
   Here in the processing module the data is algorithm models like Support vector machine, Random Forest, Decision tree is used to determine accuracies.
4. Output module:
   A module output is a variable in the module that contains information generated by the module and that can supply a value to other connected variables or modules. Here the output module is used to display the recognition of human activities in the format of graph.

Implementation process:

1. **UPLOAD**
   Here user can upload the smart phone dataset into project application.

2. **EXPLORE DATASET**
   This phase will explore the given data and shows 5 records from test and train dataset which have been uploaded.

3. **PREPROCESS**
   This phase splits the dataset into training and testing data.

4. **RUN SVM ALGORITHM**
   this phase creates a (SVM) model and training this support vector machine model with training data and predicting this model by passing test data and getting accuracy by passing predicted values to the accuracy method.

5. **RUN RANDOM FOREST**
   In this step creating RF model and training that random forest with training data and predicting this model by passing test data and getting accuracy by passing predicted values to the accuracy method.

6. **RUN DECISION TREE**
   In this step, creating decision tree model and training this decision tree model with training data and we are predicting this model by passing test data and getting accuracy by passing predicted values to the accuracy method.

7. **COMPARISION GRAPH**
   A comparison graph with all three algorithms accuracy will be displayed.

8. **RECOGNIZE ACTIVITY**
   human's activity can be determined with both the smartphone dataset and accuracies displaying in graph format.

9. **CLOSE HERE**
   By clicking the button, destroying the frame can be done.

5. RESULT AND ANALYSIS

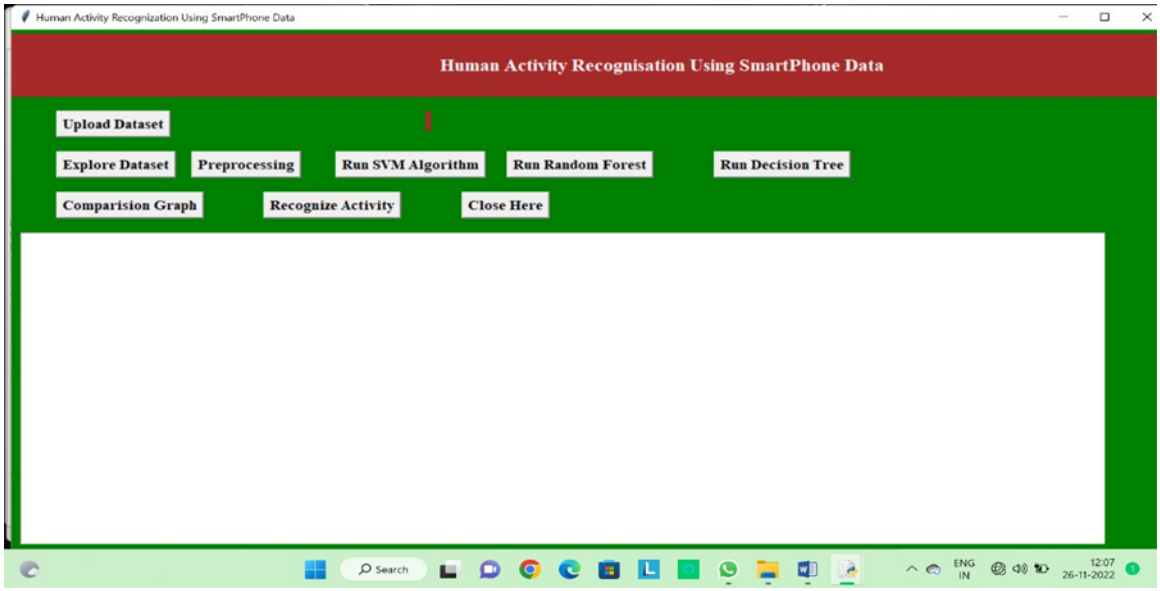

Fig-2: Homepage

By executing the program, an output screen will be displayed and it considered as the homepage.

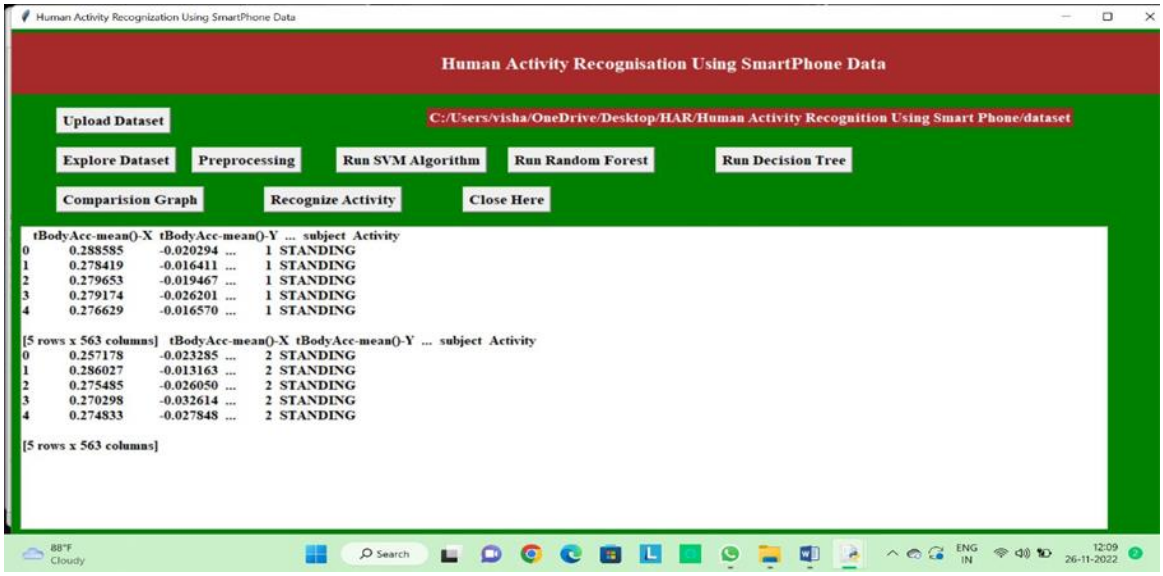

Fig-3: Load dataset

To add the dataset, the upload procedure is initiated by selecting the upload dataset option and specifying the dataset from the proper location.

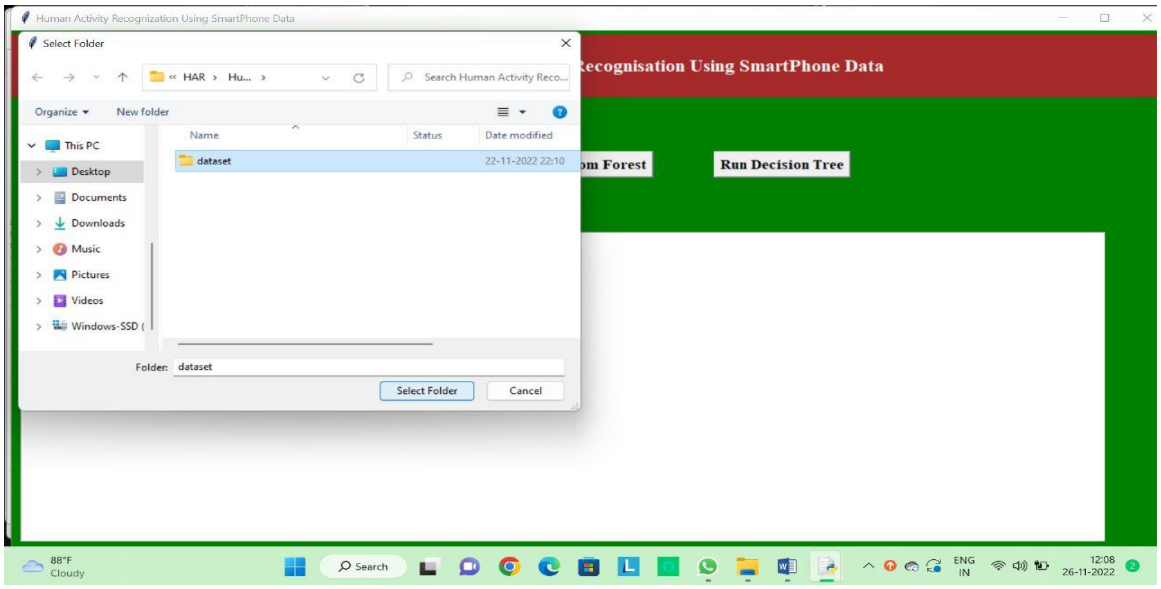

Fig-4: Explore dataset

The uploaded dataset is analysed using the explore option, and 5 records are presented as instances.

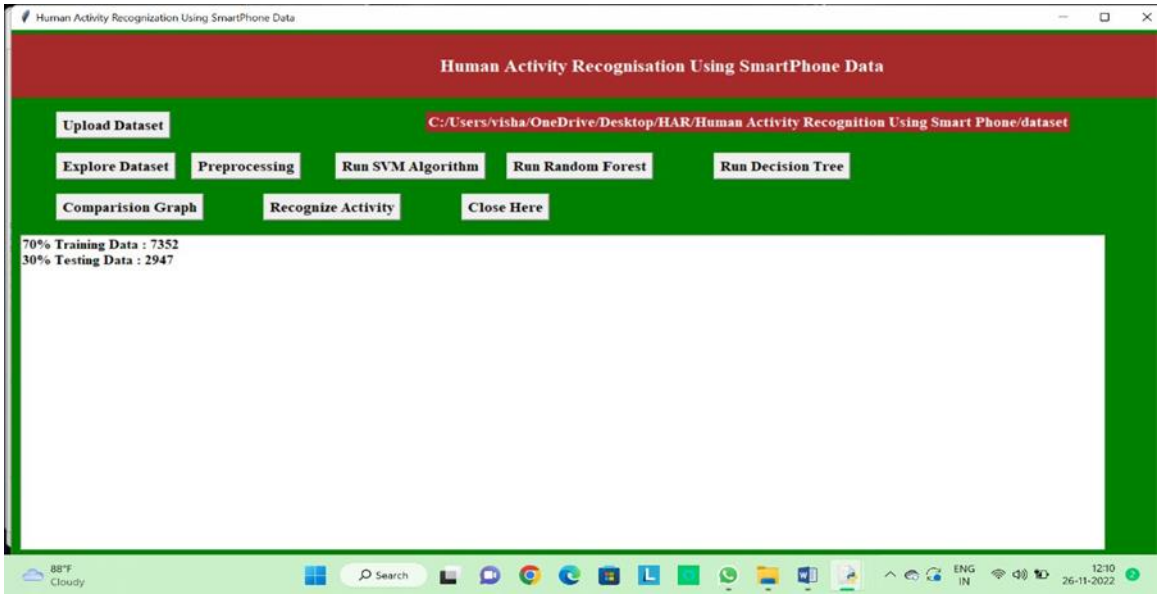

Fig-5: Pre-processing

The analysed dataset is pre-processed and splits the data into training and testing sets.

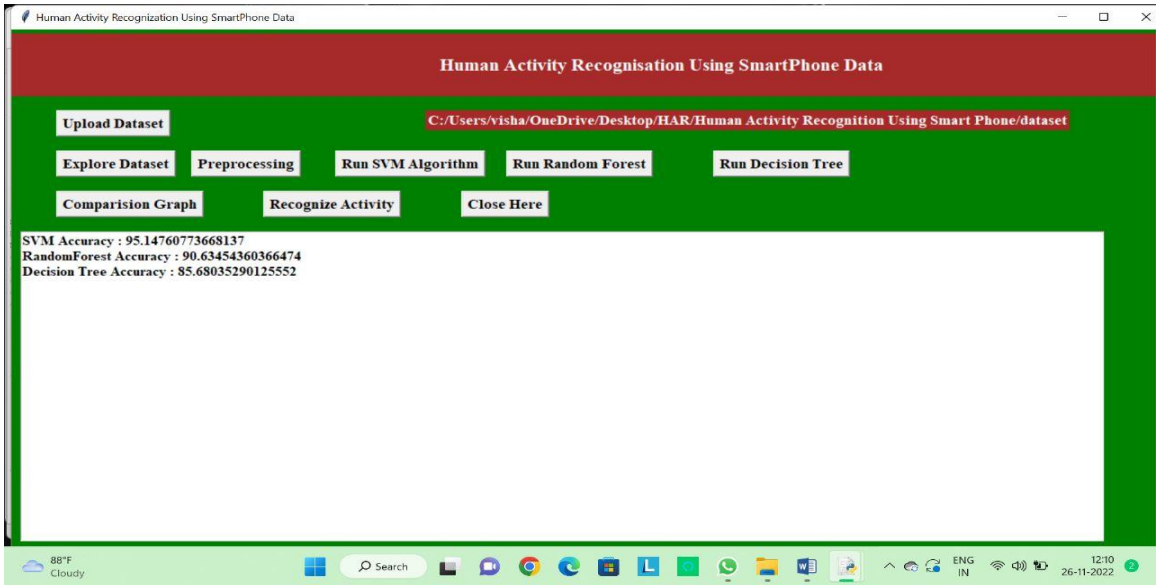

Fig-6: Algorithms

The datasets are trained using several algorithm models such as support vector machine, random forest, and decision tree to estimate accuracy.

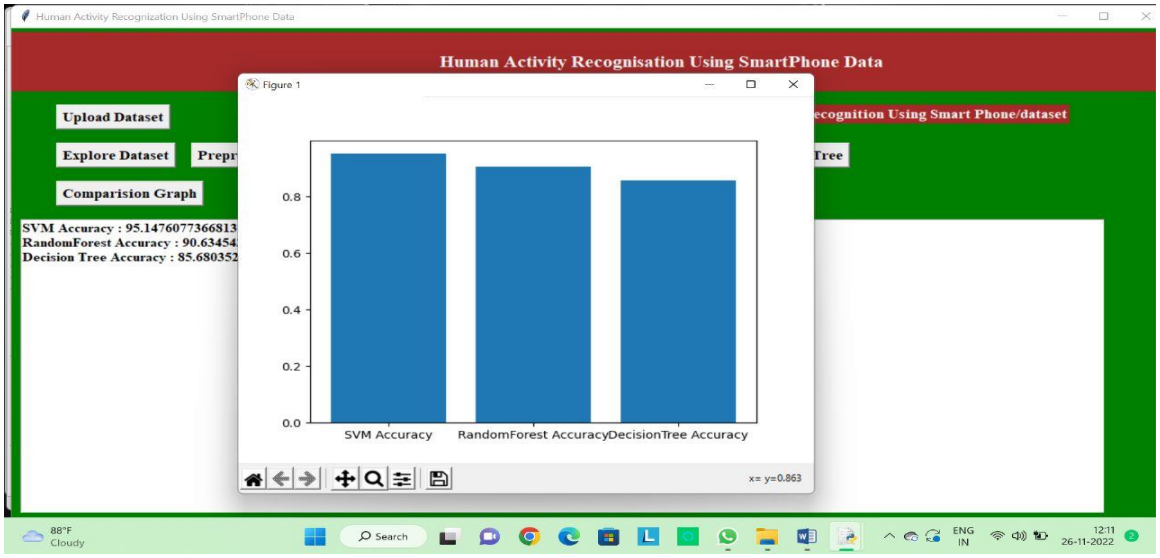

Fig-7: Comparison graph

The accuracy of algorithm implementations is compared using a graph representation.

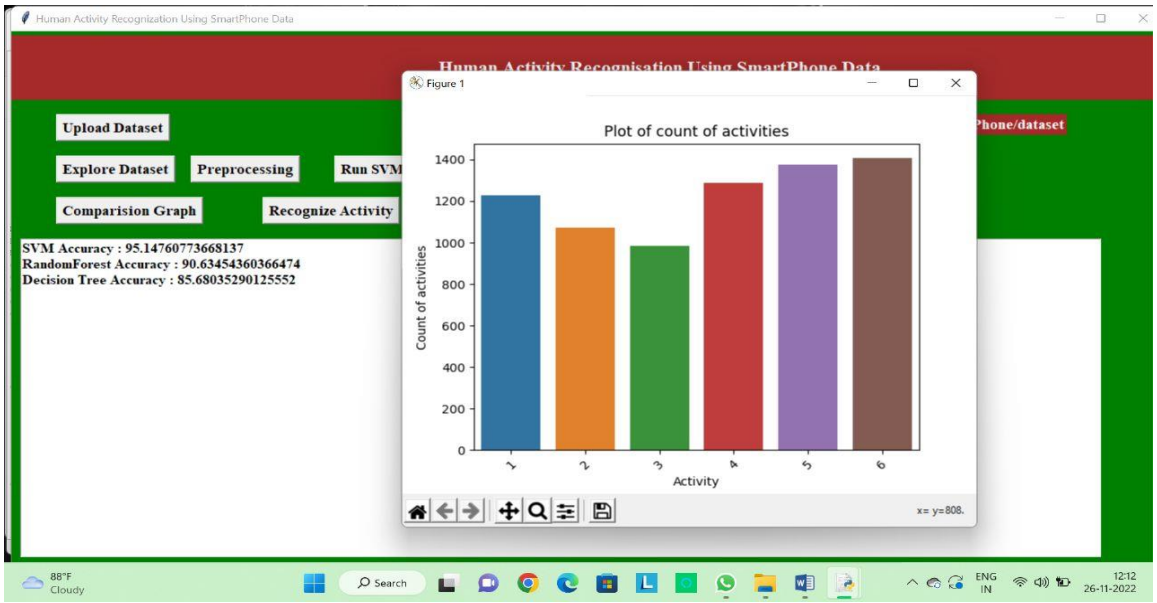

Fig-8: Recognize activity

1=WALKING

2=WALKING_UPSTAIRS

3=WALKING_DOWNSTAIRS

4=SITTING

5=STANDING

6=LAYING

6.CONCLUSION

This proposed platform combines sensors from smartphone to classify various human activities. It detects activities in real time. Moreover, this approach is lightweight, computationally inexpensive and can be run on handheld devices. Naive Bayes theorem performs best in our experiment in both classification accuracy and efficiency. The overall accuracy ranges from 84.6% to 89.4%. Additionally, it is found that adding the smartwatch sensor data to the recognition system improves its accuracy by at least six percentage points. Finally, it is calculated that the best sampling frequency is in the range of 10 Hz.

7. REFERENCES

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