Human Activity Recognition Using Machine Learning

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Abstract:

This research is for analyzing and integrating human activity with computer system. Our research targets to collect human body motion using a wearable device with embedded initial sensors and smartphone. The recorded information stored in the activity recognition database are classified using SVM, KNN, LSTM and HMM classifier ; thus results are obtained through further modeling.

Introduction:

Human activity recognition identifies human activities analyzing a set of observations retrieved from environment or sensors. Sensors can be body worn used in different body parts such as waist, wrist, chest, thighs etc. Though these sensors are uncomfortable to use but they provide noticeable performance. Smartphone is another sensing tool with built-in sensors such as accelerometers, gyroscopes, dual cameras and microphones. All of these provide flexibility while monitoring Activities of Daily Living (ADL). Dataset being used in our research consists of data collected through a wearable device in human waist which takes data of six human activities such as: Laying, Sitting, Standing, Walking, Walking Downstairs and Walking Upstairs. We have used accelerometer, gyroscope sensors in our device. For storing data we have used memory card module and for recording the time for each person's data we have used clock module. Time calculation is done using the smartphone. Therefore, further results are obtained by exploiting SVM, KNN, LSTM and HMM classifiers.

References:

[1]Anguita, D., Ghio, A., Oneto, L., Parra, X., & Reyes-Ortiz, J. L. (2013, April). A public domain dataset for human activity recognition using smartphones. In Esann."

[2]Cheng, L., Guan, Y., Zhu, K., & Li, Y. (2017, January). Recognition of human activities using machine learning methods with wearable sensors. In 2017 IEEE 7th annual computing and communication workshop and conference (CCWC) (pp. 1-7). IEEE.

[3]Gammulle, H., Denman, S., Sridharan, S., & Fookes, C. (2017, March). Two stream lstm: A deep fusion framework for human action recognition. In 2017 IEEE Winter Conference on Applications of Computer Vision (WACV) (pp. 177-186). IEEE.

[4] Su, X., Tong, H., & Ji, P. (2014). Activity recognition with smartphone sensors. *Tsinghua science and technology*, *19*(3), 235-249

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Literature Review:

From the paper ,the research team introduced a new publicly dataset For Human Activity Recognition using smartphones and acknowledged some results using a multiclass Support Vector Machine approach. They also improved the classification performance of the learned model using the dataset[1].

In this paper, performance of classification is observed using three machine learning algorithms which are SVM, HMM and ANN. Body activity recognition are obtained using numerical data collected from wearable sensors as well as the classification algorithms. Apart from activity motions other features like age, weight, acceleration statistics, physiological measurements are also taken into consideration. In future, they intend to make SVM approach for finding optimal parameters more efficient, decreasing the consumed time and computational complexity. They also plan to make HMM approach more convenient in producing accurate results. Lastly, they will try to recognize body activities from the perspective of sparse representation and random projections[2].

In this paper, human activities are recognised using LSTM network by evaluating four fusion methods for combining convolutional neural network outputs. Performance improvement is obtained by adding a third LSTM layer. Final illustrated results represents an attention mechanism to direct the LSTM through the noticeable fields of convolutional feature sequence[3].

In the paper , the research group introduced a comprehensive survey of the recent advances in activity recognition with smartphone sensors. They review the core data mining techniques behind the mainstream activity recognition algorithms, analyse their major challenges and introduced a variety of real application enabled by the activity recognition[4].

In the paper, it is analyzed that activities can be detected using a single triaxial accelerometer providing high accuracy. Meta-classifier usage is feasible to detect activities related to hands or mouth which are hard to detect using single accelerometer. They found that plurality voting classifier is the best classifier for activity recognition. They would like to extend their research recognizing short activities such as opening door using swipe card from accelerometer data. Also there motto is to study the effect of ontology of activities in terms of classifying activities which are hard to recognize[5].

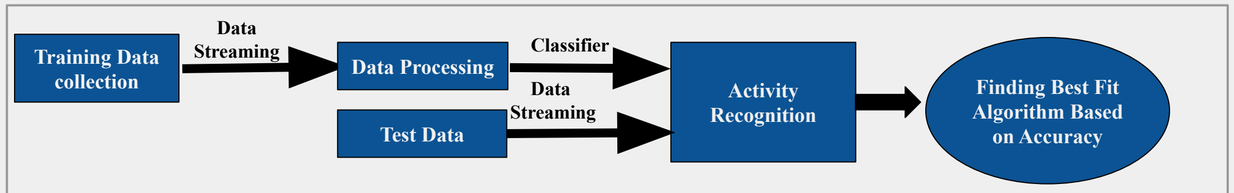
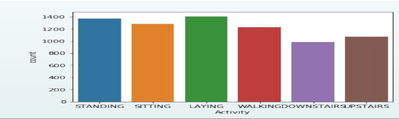
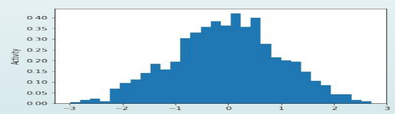
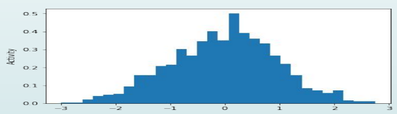
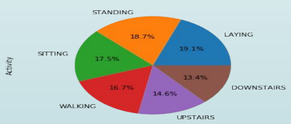
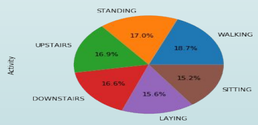


Fig1. Work-flow of Human Activity Recognition

Attributes	Existing Dataset	New Dataset
No. of Person	30	25
No. of Activity	6	6
Age	19-48	55-65 , 21-26, 30-35
Environment	Sensor responsive environment	Homely environment
Device	Smartphone (Samsung Galaxy S II)	Waist mounted device
Pause Between Activity	5 second	3 second

Table 1. Comparison between attributes of dataset.

Comparative Visualization Figures of Existing Dataset & New Dataset:

Name of Figures	Existing Dataset	New Dataset
Count Plot:		
Histogram:		
Pie Chart:		
Heatmap: