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Human Activity Recognition using Machine Learning

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Abstract: ***Activity recognition in humans is one of the active challenges that find its application in numerous fields such as, medical health care, military, manufacturing, assistive techniques and gaming. Due to the advancements in technologies the usage of smartphones in human lives has become inevitable. The sensors in the smartphones help us to measure the essential vital parameters. These measured parameters enable us to monitor the activities of humans, which we call as human activity recognition. We have applied machine learning techniques on a publicly available dataset. K-Nearest Neighbors and Random Forest classification algorithms are applied. In this paper, we have designed and implemented an automatic human activity recognition system that independently recognizes the actions of the humans. This system is able to recognize the activities such as Laying, Sitting, Standing, Walking, Walking downstairs and Walking upstairs.*** ***The results obtained show that, the KNN and Random Forest Algorithms gives 90.22% and 92.70% respectively of overall accuracy in detecting the activities.***
Keywords: Human Activity Recognition, Machine Learning, K-Nearest Neighbors(KNN), Random Forest

I. INTRODUCTION

Recognizing the activities performed by humans is one of the open challenges and that attracts more interest which is required by several other applications such as entertainment, sports training, security, military and health monitoring and management. Recognized activities will allow the computing systems to help the person with respect to the requirement. Sensor based and vision based are the two approaches using which the human activity can be monitored. Both of these techniques are non-intrusive in nature and will not affect human activities in any means. The sensor-based method of collecting data from humans is found to be more superior than the other approach. Since this non-intrusive approach does not invade the privacy of the humans and will not be susceptible to external noises that tend to confuse and corrupt the data collected. With the development of advanced technologies, the usage of smartphones is substantial for performing day-to-day activities of humans. Having the smart phones enabled with sensors pave the way for monitoring the activities of humans. Data collected via sensors help in monitoring the behaviors especially for the old people so that the medical care can reach them quickly. When the monitoring is done via computing system by building a model, that will essentially will reduce the time delay of the help that is meant to be given for the person under requirement. The objective of Human Activity Recognition (HAR) should be to build a model that reduces the difference between predicted activity and the actual activity that was performed. Generally, a smartphone has many movement tracking devices, such as accelerometers and gyroscopes, as part of its hardware structure. So, it becomes quite natural that the data generated from these devices can be used for analysis and for reaching conclusions. Since these in-built devices collect data constantly, they act as very helpful sources to classify and study the basic activities that humans do: walking, sitting, standing etc. In this study, we compare and contrast between many classical machine learning methods to classify various activities effectively. We have developed a model that is capable of recognizing all the activities of humans that are collected through sensors. We use machine learning algorithms like KNN and Random Forest classifier.

II. LITERATURE REVIEW

Research in the field of Human Activity has been motivated by a number of factors. Whether it is to derive human based activity behavior for 3D models, or for identity recognition, or for medical purposes, HAR is indispensable. In [1] authors applied a number of standard machine learning algorithms and have got the best results by using the Random Forest algorithm approach. Human Activity Recognition is an important aspect of computer vision and its applications. Activity recognition in humans is one of the active challenges that find its application in numerous fields such as, medical health care, military, manufacturing, assistive techniques and gaming. The sensors in the smartphones help us to measure the essential vital parameters. These measured parameters enable them to monitor the activities of humans, which we call as human activity recognition. Four deep learning approaches and thirteen different machine learning classifiers such as Multilayer Perceptron, Random Forest, Support Vector Machine, Decision Tree Classifier, AdaBoost Classifier, Gradient Boosting Classifier and others are applied to identify the efficient classifier for human activity recognition. Their system is able to recognize the activities such as Laying, Sitting, Standing, Walking, Walking downstairs and Walking upstairs.

Benchmark dataset has been used to evaluate all the classifiers implemented. In [2] authors have investigated all these classifiers to identify a best suitable classifier for this dataset. The results obtained show that, the Multilayer Perceptron has obtained 98.46% of overall accuracy in detecting the activities. The second-best performance was observed when the classifiers are combined together.

The limitation problem of traditional human activity recognition (HAR) tasks which use features extracted manually and some shallow machine learning models, a novel multi-task layer neural network (LSTM) model is designed based on the ability of deep neural network to automatically extract features in a smart home, combined with the recent successful recurrent neural network and convolution neural network. Prediction techniques based on LSTM neural networks in smart home environments have been used to predicting the next activity as well as on the task of predicting the timestamp of the next event as well. The performance of the model [3] is evaluated on the real dataset. Experimental results show that the LSTM neural networks outperform the other approaches for the prediction of the direct next event, meanwhile, the application of multi-task learning by jointly predicting the next activity and the timestamp of the next event outperforms separate LSTM models for both tasks separately.

In [4] acceleration-based human activity recognition method using popular deep architecture, Convolution Neural Network (CNN) authors construct a CNN model and modify the convolution kernel to adapt the characteristics of tri-axial acceleration signals. Also, for comparison, authors used some widely used methods to accomplish the recognition task on the same dataset. The large dataset constructed consists of 31688 samples from eight typical activities. The experiment results show that the CNN works well, which can reach an average accuracy of 93.8 % without any feature extraction methods.

III. SYSTEM ARCHITECTURE

The Fig.1 refers to the system architecture of Human Activity Recognition.

1) Pre-processing of Data: The dataset used for our initial analysis is taken from publically available dataset which is recorded through gyroscope and accelerometer using smartphone. Filtering and Cleaning of data is done.
2) *Classification on Original Data:* Dataset is divided into two parts. One is training dataset used to train the model and other is testing dataset used to test the trained model. K-Nearest Neighbour and Random Forest Classifier are used to detect the activity of human like walking, waling upstairs, walking downstairs, sitting, standing and laying.

A. K-Nearest Neighbors

k-Nearest Neighbors(k-NN) is a directed solicitation approach that can be viewed as a brief game-plan framework since it doesn't require a learning technique. It just requires the breaking point of the entire information. To organize another acknowledgment, the K-NN algorithm utilizes the standard of likeness (remove) between the status set and new perception to plan. The new acknowledgment is doled out to the most for the most part seen class through a lion's offer vote of its k closest neighbors. The unit of the neighbors of a perception is settled utilizing a division estimation called likeness limit, for example, Euclidean parcel. In addition, one ought to see that while utilizing the K-NN approach and another point of reference is doled out to a class, the check of parcels (i.e., the calculation time) increases as a section of the present models in the dataset. Foerster et al. were the first to apply the k-NN strategy to confine between nine human exercises utilizing time-space highlights picked up from three uniaxial accelerometers. In Foerster and Fahrenberg joined k-NN with an alternate leveled choice way to deal with oversee see nine exercises utilizing rehash locale highlights. This method has had every one of the reserves of being ceaselessly proficient, to the degree demand exactness, showed up distinctively in connection to the k-NN. Assorted examinations subject to k-NN for human action confirmation have additionally appeared to be bizarre state of exactness and satisfactory segmentation results.

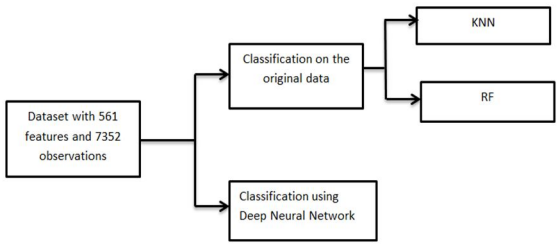

Figure 1: System Architecture.

B. Random Forest

Random Forests (RF) incorporates a combination of decision trees. It improves the social event execution of a solitary tree classifier by combining the bootstrap totaling (bagging) technique and randomization in the choice of dividing server farm nodes in the headway of decision tree. The task of another observation vector to a class depends upon a lion's offer vote of the specific choices given by each tree including the forested territories. In any case, RF needs tremendous extent of named information to achieve good performances.

IV. IMPLEMENTATION AND EXPERIMENTS

A. Dataset Description

We have used the standard dataset named, Human Activity Recognition, which was created from inertial sensors embedded in a waist-mounted smartphone. This was collected from 30 volunteers aged from 19 to 48 years and asked them to perform six basic activities: walking, walking upstairs, walking downstairs, sitting, standing and laying .The data collection took place in two stages: first the smartphone was attached on the left side, and then on the right side. Moreover, the performance of each task is separated by a time-gap of 5 seconds. 17 primary signals were collected using the in-built accelerometer and gyroscope at a 50 Hz sampling rate, and preprocessed with a median filter and a third order low-pass Butterworth filter with a 20 Hz cut-off frequency for effective noise management. These 17 primary signals are used to obtain a vector of other features–mean, correlation, energy of frequency bands, frequency skewness etc.

B. Implementation

The computation is light enough to be performed on a system with 3.1 GHz Intel Core i3 processor, 4 GB RAM and 1 TB hard disk. The programming language in which computation is carried out is Python (version 3.5 and above).

C. Experiments

For the experimental results we use data with 561 features, 7352 observations and 6 labels. The idea is to recognize the activity. From the dataset, we used 70% of the dataset for training and the rest of 30% is used for testing. The objective of this work is to find a best suitable model that recognizes the human activities. We have identified two classifiers i.e. KNN and Random Forest out of which Random Forest Classifier gives better results as compared to KNN as shown in Table I.
Accuracy Score is the testing accuracy and number of neighbors is the value of K which determines the complexity of KNN model as shown in the fig. 2.

Table I: Comparison of Accuracies (%) of the classical ML models

KNN	Random Forest
90.22	**92.70**

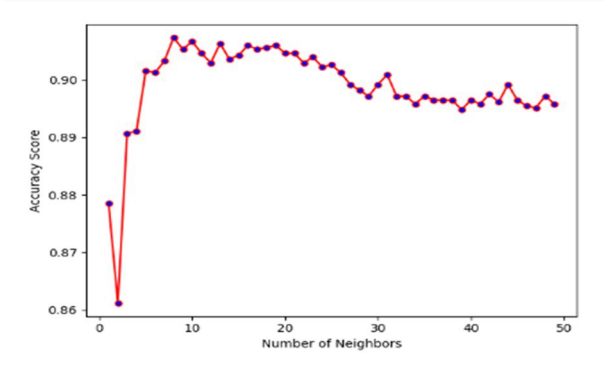

Figure 2: Accuracy Score.

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V. CONCLUSION

In this paper we have demonstrated the use of machine learning approaches for Human Activity Recognition. The sensors embedded with the smart phones help us to collect the measurements of human actions. This work has implemented and evaluated several machine learning algorithms on these measurements to recognize the human actions. The objective of this study is to identify the best performing learning algorithm that recognizes the human actions. The conventional machine learning algorithms namely KNN and Random Forest have performed well on recognizing the six human actions.

The results and insights inferred from this study can prove to be very fruitful in providing assistance to many individuals and organisations that require reliable and accurate information about the basic healthcare and maintenance of the human body. It could also be used for further studies related to human behaviour. It could aid an individual in preventing certain habits or behaviours that deteriorate the functioning of the body.

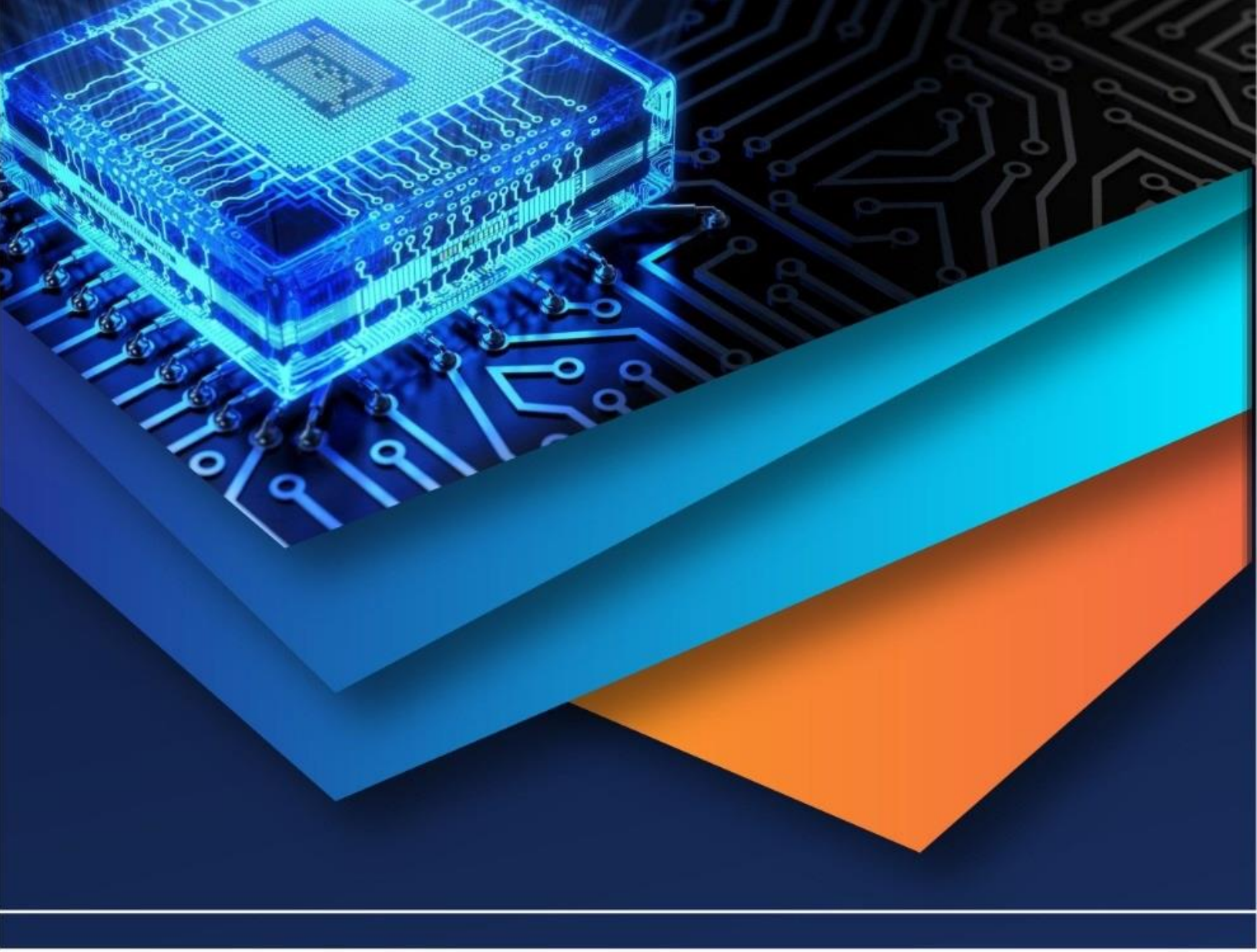
REFERENCES

[1] Sarthak Singh Rawat, Abhishek Bisht and Rahul Nijhawan(2020), " A Classifier Approach using Deep Learning for Human Activity Recognition", International Conference on Image Processing(ICIIP),July 2020

[2] Bharathi B and Bhuvana J(2020), "Human Activity Recognition using Deep and Machine Learning Algorithms", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-4, February 2020

[3] Wang Cheng and Peng Zhihao(2020)," Deep Learning Model for Human Activity Recognition and Prediction in Smart Homes", International Conference on Intelligent Transportation, Big Data and Smart City(ICITBS),2020

[4] Yuqing Chen and Yang Xue(2015), " A Deep Learning Approach to Human Activity Recognition Based on Single Accelerometer", IEEE International Conference on Systems, Man and Cybernetics.



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