HUMAN ACTIVITY RECOGNITION USING SMARTPHONE

INTRODUCTION: ACTIVITY RECOGNITION

USING SENSORS TO IDENTIFY HUMAN ACTIVITIES SUCH AS WALKING, JOGGING, LIMPING.

- MOTIVATION

  HUMAN SURVEY (STUDY HUMAN DAILY ACTIVITIES)

  MEDICAL CARE (DIABETES, ELDERLY, REHABILITATION)

- SENSORS TYPES

  INERTIAL SENSORS (ACCELEROMETER, GYROSCOPE)

  CAMERA

  GPS

SMARTPHONE IS SMALL AND CONVENIENT TO CARRY AROUND AND ITS COMPUTATIONAL RESOURCE IS POWERFUL ENOUGH FOR OUR PURPOSE

DATA SET INFORMATION

30 SUBJECTS PERFORMING ACTIVITIES OF DAILY LIVING (ADL) WHILE CARRYING A WAIST-MOUNTED SMARTPHONE WITH EMBEDDED INERTIAL SENSORS.

EACH RECORD IN THE DATA REPRESENTS INFORMATION ABOUT FEATURES LIKE ACCELERATION ALONG X,Y,Z AXES, VELOCITY ALONG A,Y,Z AXES, 561 ATTRIBUTES DERIVED FROM THESE BASIC MEASUREMENTS, IDENTIFIER VARIABLE FOR THE USER & THE ACTIVITY BEING PERFORMED.

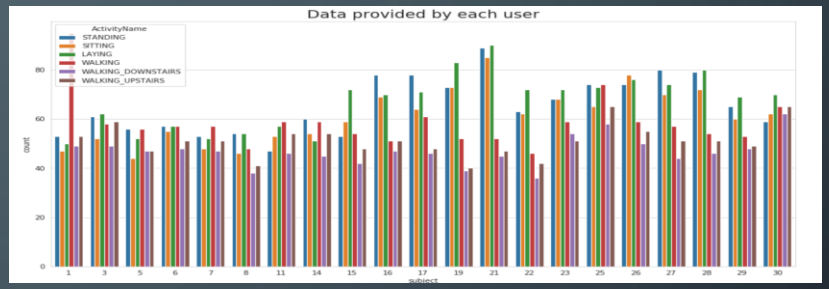
THERE ARE 6 CATEGORIES OF ACTIVITIES BEING PERFORMED:

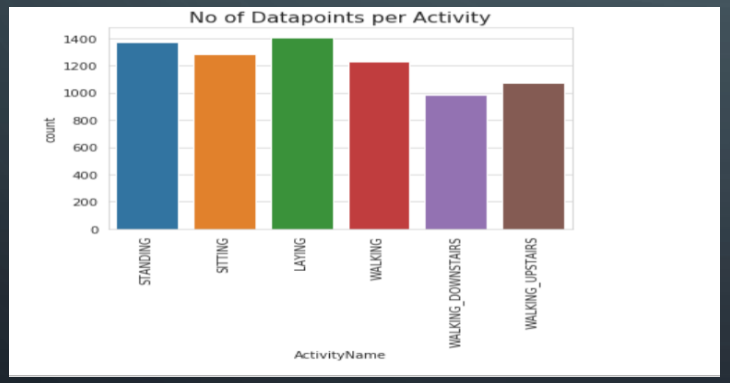
1. 'STANDING'
2. 'SITTING'
3. 'LAYING'
4. 'WALK'
5. 'WALKDOWN'
6. 'WALKUP'

EXPLORATORY DATA ANALYSIS

DATA AVAILABLE ON UCI ML REPOSITORY ARE CLEANED AND READY TO EDA.

DATA PROVIDED BY EACH USER

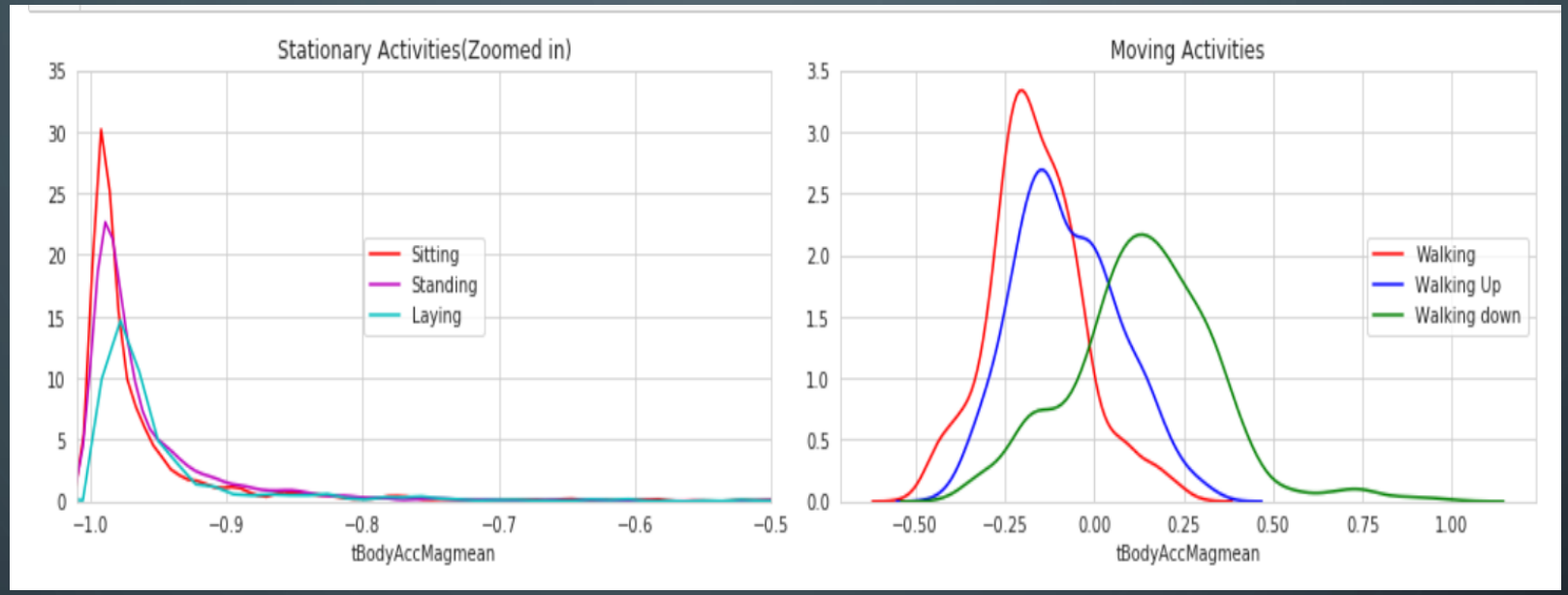




NO OF DATAPOINT PER ACTIVITY

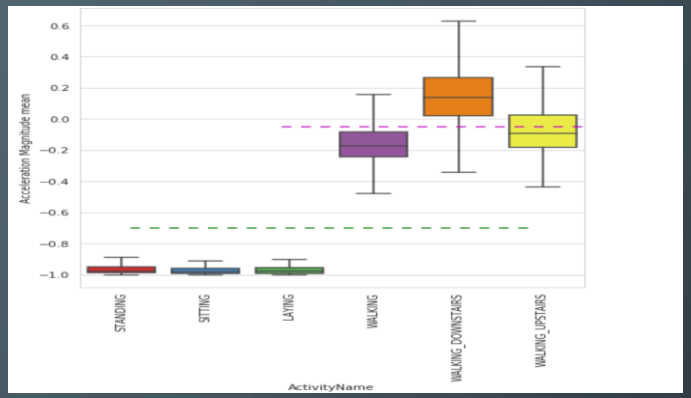
ACTIVATES ARE DIVIDED IN TWO CATEGORIES.

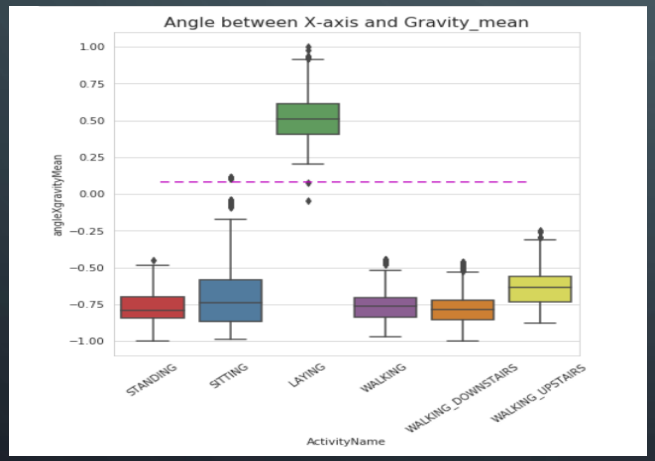
- STATIC ACTIVITY (MOTION INFORMATION IS NOT USEFUL)
  - SIT
  - STAND
  - LIE DOWN
- DYNAMIC ACTIVITY (MOTION INFORMATION IS USEFUL)
  - WALKING,
  - WALKING UPSTAIRS,
  - WALKING DOWNSTAIRS



STATIONARY AND MOVING ACTIVITY GRAPH

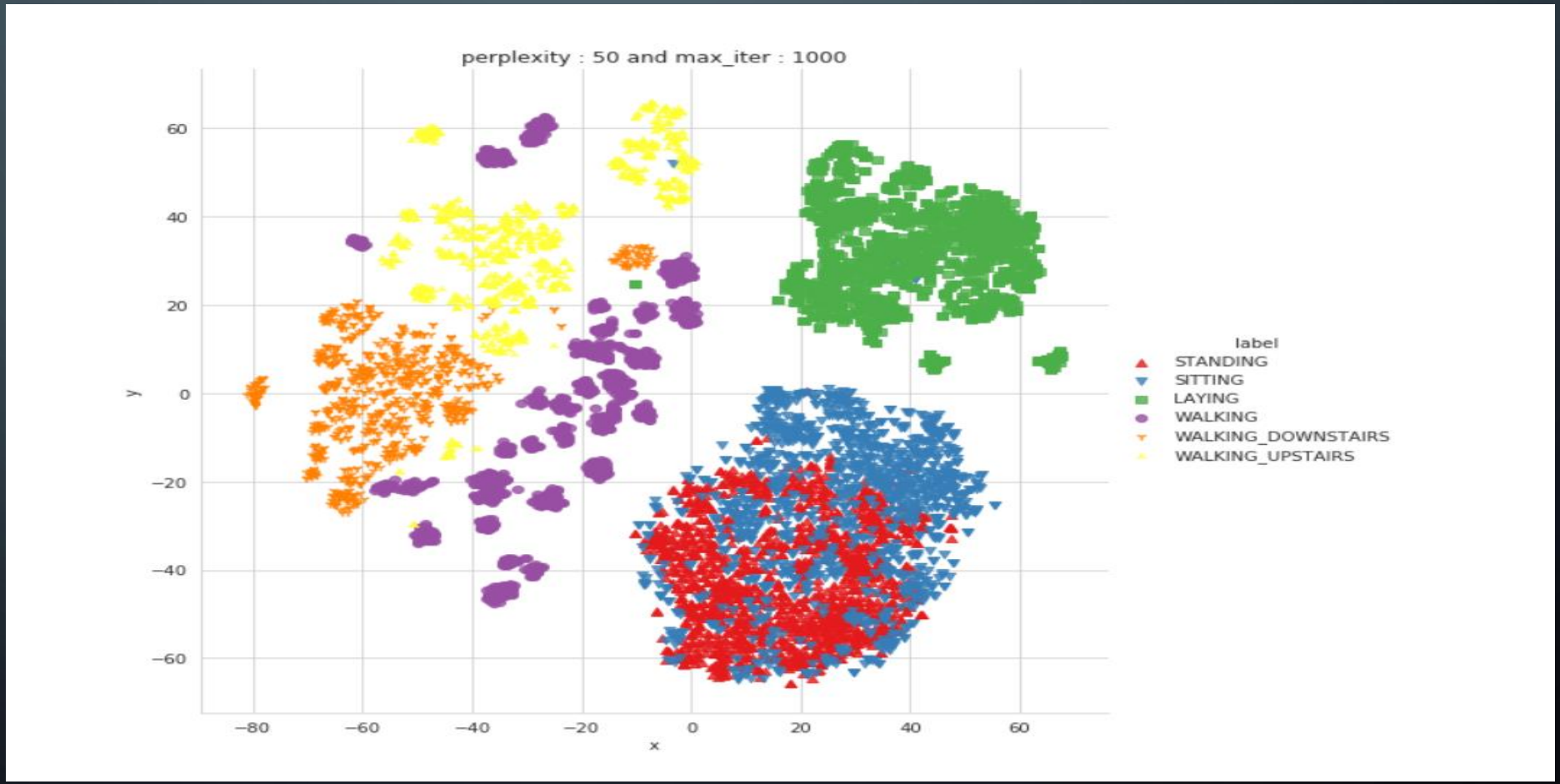
Mean value of the body acceleration is more variable for the activities of walking, walking upstairs and walking downstairs than the passive activities of sitting, standing and laying.





The feature of 'Angel Gravity mean' along the X, Y, Z axis was documented as a box plot graph. We can classify all data point belongs to Laying activity with just observation on angle x gravity mean >0

t-Distributed Stochastic Neighbor Embedding (t-SNE) is a non-linear technique for dimensionality reduction that is particularly well suited for the visualization of high-dimensional datasets. We can see with different perplexities, all the different activity names are clustered Pretty well, except standing and siting.



MACHINE LEARNING

BELOW SIX MACHINE LEARNING CLASSIFICATION MODELS HAVE BEEN PERFORMED ON DATA AND SELECTED FEATURES FOR PREDICTION

1. LOGISTIC REGRESSION WITH GRID SEARCH
2. LINEAR SVC WITH GRIDSEARCH
3. KERNEL SVM WITH GRIDSEARCH
4. DECISION TREES WITH GRIDSEARCHCV
5. RANDOM FOREST CLASSIFIER WITH GRIDSEARCH
6. GRADIENT BOOSTED DECISION TREES WITH GRIDSEARCH

WE CAN CHOOSE LOGISTIC REGRESSION OR LINEAR SVC OR RBF SVM AS THEY ARE GIVING THE HIGHEST ACCURACIES BUT WE CAN SEE THAT THERE IS STILL A LITTLE CONFUSION BETWEEN THE ACTIVITY NAMES - 'SITTING' AND 'STANDING', AS WE SAW IN THE T-SNE VISUALIZATION AS WELL

	Accuracy	Error
Logistic Regression	96.27%	3.733%
Linear SVC	96.88%	3.122%
rbf SVM classifier	96.27%	3.733%
DecisionTree	86.46%	13.54%
Random Forest	91.01%	8.992%
GradientBoosting DT	91.01%	8.992%

LSTM (LONG SHORT-TERM MEMORY LAYER) : LSTM IS AN ARTIFICIAL RECURRENT NEURAL NETWORK(RNN) ARCHITECTURE USED IN DEEP LEARNING. LSTM NETWORKS ARE WELL-SUITED TO CLASSIFICATION, PROCESSING AND MAKING DECISION

SCORE[0.4165588609687154, 0.8954869508743286]

WITH A SIMPLE 2-LAYER ARCHITECTURE, WE GOT APPROX. 90% ACCURACY AND A LOSS OF 0.49. WE CAN FURTHER IMPROVE THE PERFORMANCE WITH HYPER PARAMETER TUNING

CONCLUSION AND NEXT STEP

- MODEL LINEAR SVC OR RBF SVM ARE PROVIDING HIGHER ACCURATE (96%) PREDICTION
- BETTER FEATURE SELECTION METHODS AND IMPROVEMENT IN TUNING THE PARAMETERS CAN ASSIST FURTHER TO IMPROVE ACCURACY AND DECREASE COMPUTATIONAL COST.
- WORK WITH EXPERT TO GET DIFFERENCE BETWEEN SITTING AND STANDING ACTIVITY RECORDED DATA