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**Human Activity Recognition with Smartphones:**

**OVERVIEW**

The problem this capstone project aims to detect the Human Activity from the Recognition database. The experiments have been carried out with a group of 30 volunteers within an age bracket of 19-48 years. Each person performed six activities (WALKING, WALKING\_UPSTAIRS, WALKING\_DOWNSTAIRS, SITTING, STANDING, LAYING) wearing a smartphone on the waist. Using its embedded accelerometer and gyroscope, we captured 3-axial linear acceleration and 3-axial angular velocity. The objective of this capstone project is to classify activities into one of the six activities performed.

# THE CLIENT

The Classification of ADL Activity have real world applications in health care and fitness monitoring. Physical activity has positive effects on all body functions and studies proved that the risk of cardiovascular diseases is up to 50% lower on physically active people.

So, for this project, our client will be the existing fitness tracker band.

**Below is the list of the potential client (Apple Watch, Fitbit, Garmin, MI band) of our project. From the below table we can see that the existing fitness band lacks with the basic human activity features (Standing, Sitting, Laying, Walking, walking upstairs, walking downstairs).**

For example, Apple Watch doesn’t show any information on laying, walking upstairs and walking downstairs Activity. So using this project, they can fill this gap and then they will able to show all the basic human activity.

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| **Activity** | **Apple Watch** | **Fitbit** | **Garmin** | **MI Band** |
| Standing | In Apple Watch, it shows a stand ring by standing up for one min an hour in 12 separate hours.  So you have sit/walk at least 1 min in every hrs, so that you don’t have long sitting | Doesn’t Shows any information. | Doesn’t Shows any information. | Doesn’t Shows any information. |
| Sitting | Have an alert feature that telling you that you haven’t moved in a little while. | Move alert. | Doesn’t Shows any information. | Move alert. |
| Laying | Doesn’t Shows any information. | Record how many hours sleep per night | Sleep tracking. | Sleep tracking. |
| Walking | 1.    How many steps you have taken till now.  2.    How much Cal you burned.  3.    Distance covered | 1.    How many steps you have taken till now.  2.    How much Cal you burned.  3.    Distance covered. | 1.    How many steps you have taken till now.  2.    How much Cal you burned.  3.    Distance covered. | 1.    How many steps you have taken till now.  2.    How much Cal you burned.  3.    Distance covered. |
| Walking upstairs | Doesn’t Shows any information. | Records how many floors climbed. | Records how many floors climbed. | Doesn’t Shows any information. |
| Walking downstairs | Doesn’t Shows any information. | Doesn’t Shows any information. | Doesn’t Shows any information. | Doesn’t Shows any information. |

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# We used accelerometer and gyroscope to get our dataset to recognize human activity. Most of our potential client (Apple watch, Fitbit, Garmin) uses the same sensors, but still, they don’t show all the basic human activity.

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| --- | --- | --- | --- | --- |
| Hardware | Apple watch | Fitbit | Garmin | MI band |
| Accelerometer | Yes | Yes | Yes | Yes |
| Gyroscope | Yes | Yes | Yes | No |

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# THE DATA

The data is already by the Kaggle’s website “. <https://www.kaggle.com/uciml/human-activity-recognition-with-smartphones>”. Therefore, there isn’t a need for additional data mining or web scraping

The data is in the form of CSV files and are listed below:

1.             **train.csv**: The training set of users.

2.             **test.csv**: The test set of users.

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# APPROACH AND MILESTONES

The approach to solving this problem is subject to change as I progress with the Career Track and learn new concepts and approaches. The tentative broad overview of solving the problem is explained below.

# Data Wrangling

The first step would be to load the given datasets into Pandas data frames and clean them. This would be followed by various wrangling methods to arrive at data on which analysis and prediction can be performed.

**Data Visualization**

The second step is to create visualizations for the cleaned data and try to come up with a few preliminary hypotheses. The graphs, charts and other visualizations will also be a very important part of creating our story for the project.

# Statistical Analysis

Based on the hypothesis formed in the previous step, the next step would be to perform various statistical analysis on it to test if the hypothesis is indeed correct. A wide array of tools such as regression analysis, scatter plot conclusions, chi-square significance tests, z statistics and t statistics will be employed in this step.

# Machine Learning

The Approaches used are Linear Discriminant Analysis (LDA); Multinomial Logistic Regression; Support Vector Machines (SVM) and kNN. The comparison is performed based on the confusion matrix of those classification results on the test data using the different training classifiers, presented by confusion matrices. SVM with linear kernel approach is the best fit classifier to our dataset. It gives the best performance for all the accuracies and error rates. SVM with the linear kernel is a flexible approach which is capable to reduce overfitting.

# Data Story, Results and Conclusion

The final step is to report the results of the analysis performed and the accuracy of the model. This step will involve creating a story around the initial problem, the problems it aims at solving and the insights gained from the data. This will be followed by explaining the intuitions involved in building the ML model, the incremental improvements involved, the accuracy and prospects of improvement.

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# DELIVERABLES

The following should be considered as deliverables as part of the project:

**1.  Jupiter Notebook:**Contains all the code involved as part of wrangling, analysis and building predictive models.

**2.  Project Report:**A Document highlighting the entire process of the project.

**3.  Presentation:**A Slide Deck to be presented to the clients as the final product of the analysis performed and the model built.