CLASSIFICATION AND PREDICTION FOR HOSPITAL ADMISSIONS THROUGH EMERGENCY DEPARTMENT

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Abstract: Crowding within Emergency Departments (EDs) can have serious negative effects on patients. EDs need to explore the use of novel approaches to improve patient experience and reduce overcrowding. One possible approach is the use of data mining to predict ED admissions using machine learning techniques. We use two algorithms to build the predictive models: Logistic Regression and Random Forests. Drawing on logistic Regression, we identify several factors related to hospital admissions including hospital site, age, arrival mode, care group, previous admission in the past month and previous admission in the past year. Practical implementation of the models produced in this study would provide a snapshot of predicted admissions from an emergency department at a given time, allowing for advance planning of resources, and inpatient movement to prevent bottlenecks, as well as analysis of the predicted and actual admission rates When interpretability and key consideration, EDs should consider adopting logical regression models, although GBMs will be useful for giving an accuracy amount.

Index Terms **- Emergency department, triage, GBM, hospital admissions.**

I. INTRODUCTION

In Emergency Department overcrowd is one of the major concern in the present society. Overcrowding in emergency ward may sometimes lead to harmful outcomes. Here all the patients who admits in the hospital need not be shifted to inpatient ward. For a single patient we can easily say that patient may or may not need to be admitted in hospital. But if we have large collection of patient values we cannot analyse each case manually and come to conclusion. So for this purpose we need classification and prediction of patient details in the emergency ward. Here we have used supervised machine learning algorithms. All the machine learning algorithms need not be the best fit for the dataset. It all depends on the data labels and continuity in the data. The performance cannot be solely dependent on one instance. To get the better fit algorithms for the dataset we have taken multiple machine learning algorithms and calculated their performance. Based on this performance we can easily suggest the best fit algorithm for this approach. The prediction part gets the actual output where we can provide this as an input to the hospital management and they can take necessary precautions for patient well-being. We can increase the patients fatality rate by implementing these machine learning techniques.

II. LITERATURE SURVEY

[1]Byron Graham developed a prediction model in which machine learning techniques such as Logistic Regression, Decision Tree and Gradient Boosted Machine were used. The most important predictors in these model were age, arrival mode, triage category, care group, admission in past-month, past-year. In which the gradient boosted machine outperforms and focus on avoiding the bottleneck in patient flow.

[2] Jacinta Lucke and team has designed the predictive model by considering age as main attribute, where the age is categorized in two category below 70 years and above 70 years. They observed that the category of people below 70 years was less admitted in compare with the category of people above 70 years. Younger patient had higher accuracy while the older patient had high risk of getting admitted to hospital. The decision of prediction was based on the attributes such as age, sex, triage category, mode of arrival, chief complaint, ED revisits, etc.

[3]Xingyu Zhang in there predictive model, they have used logistic regression and multilayer neural network. This methods were implemented using the natural language processing and without natural language processing. The accuracy of model with natural language processing is more than the model without natural language processing.

[4]Boukenze with his team created a model using decision tree C4.5 for predicting admissions which overall gave a good accuracy and less execution time. The author has used the prediction model for predicting a particular disease that is chromic kidney disease.

[5]Dinh and his team developed a model which uses multivariable logistic regression for prediction. For the prediction the two main attributes were demographics and triage process, which helped to increase the accuracy.

III. WORKING

Whenever the patient enters the emergency ward a triage process is carried out. In this triage process, patient condition is partially analysed and given the prioritized values based on his condition. Remaining data can be gathered by the patient or the corresponding nurse. Dataset that we gained from the hospital may not be always pure. So that we can filter out the unnecessary data by applying pre-processing techniques. Clustering can be done to the dataset to label the same group of data. We have used K-means clustering technique. Once if all the pre-processing steps like dimensionality reduction, filling the missed values are completed we classify the data according to the labels. For classification we have used multiple classification

algorithms to ensure better accuracy. The dataset is splitted for training and testing accordingly. Here we are considering relative feature importance for the labelled data. Once the classification tasks is finished then we are going to predict the labelled data for the admission chances. The performance of the algorithm is calculated by using performance metrics score. The score is calculated using confusion matrix with precision, recall and f-1 score values. Finally after we get the predicted values we can deploy a bar graph for better visualisation. For prediction we have taken Random forests and logistic regression algorithms which are found to be the best fit for this dataset.

3.1. Implementation

The figure below shows the block diagram for the proposed system:

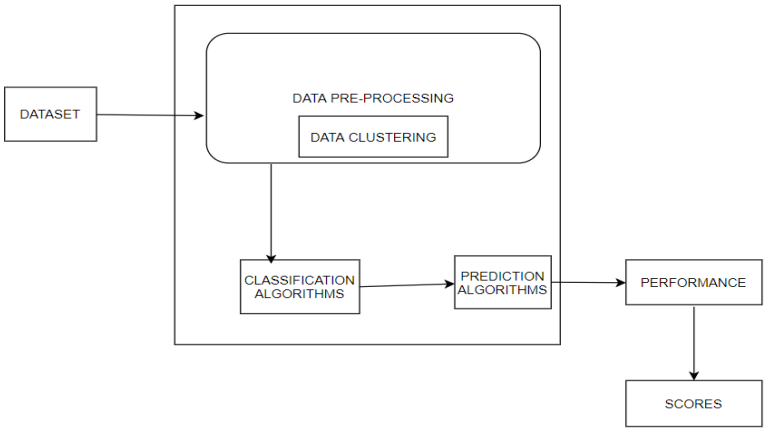

Fig-1: Block Diagram of predicting the admissions in hospital

V.RESULT AND DISCUSSION

One the major advantage is the overcrowding of the emergency ward can be controlled properly. By performing multiple machine learning algorithms on the data set can tell us the best fit algorithm which cannot be declared manually. Relative feature graph depicts the overall readmission count for the patients dataset. But the real problem lies in labelling the dataset. Here the data is in the form of huge chunks where the relevant data is minimal. Gathering the salient features makes the task more efficient. Ofcourse all the algorithms may not always provide better accuracy.

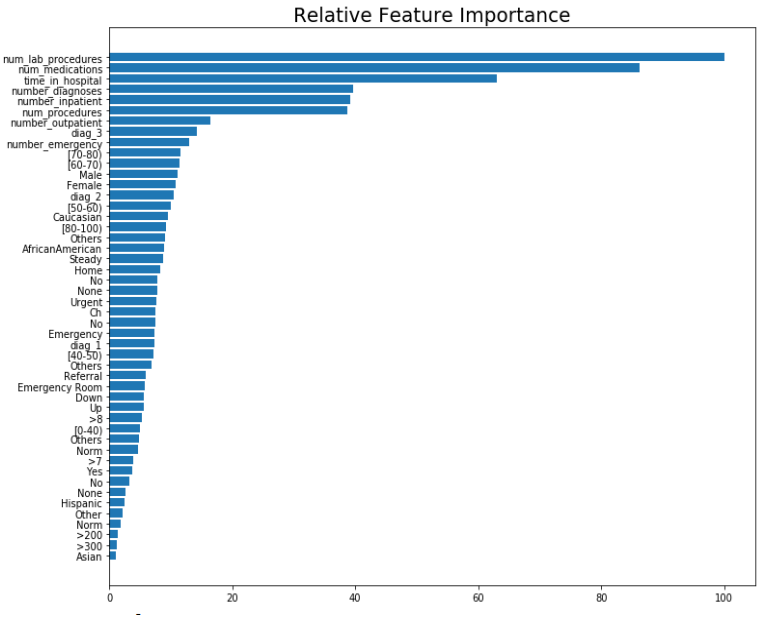

Fig-2: Relative Feature Graph

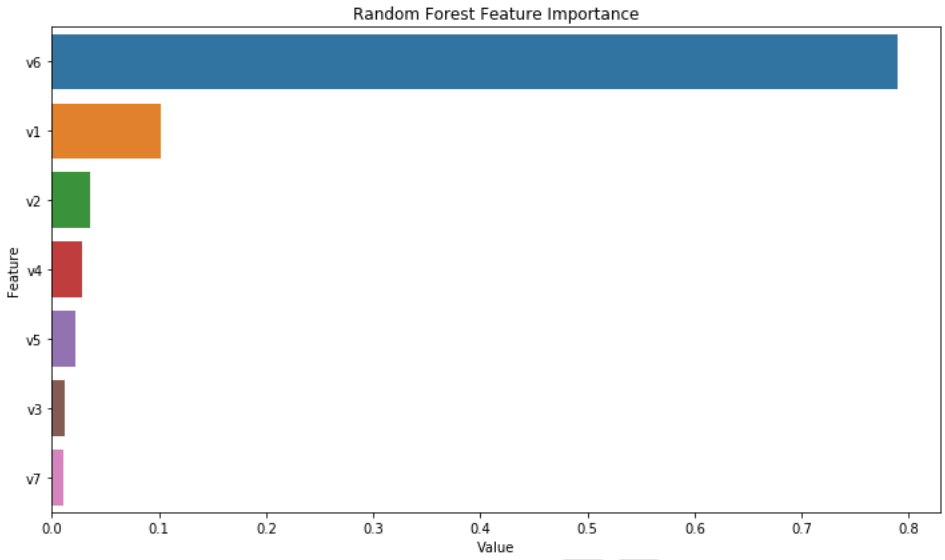

Fig-3: Prediction for Random Forest Algorithm

VI. CONCLUSION

The prediction model for hospital admission involves a survey of different methods. It also comprises of different machine learning algorithms such as logistic regression and random forests machine which are used to predict the hospital admission from emergency department. So, the random forest algorithm performs better when compared to the other. Implementation of these algorithms makes the decision makers of the hospital to plan and manage the hospital resources much more effectively based on the patient flow. In future different models regarding deep learning and machine learning can be used to implement other models.

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