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IMPLEMENTATION OF MACHINE LEARNING BASED HEALTH PREDICTION SYSTEM USING IBM CLOUD AS PAAS

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ABSTRACT

It is critical for Bangladeshi hospitals to have a flexible critical patient care system. Because of the scarcity of appropriate, simple, and scalable smart solutions, the vast majority of hospitals in Bangladesh are unable to provide adequate health care. The goal of this project is to provide a real-time feedback system for critical patients in hospitals. Using machine learning and IBM cloud computing as Platform as a service, we present in this work a general architecture, language, and a classification model for monitoring crucial patient health conditions (PaaS). This study's central idea is the use of ML to make predictions about patients' health. This study's data and ML models will be stored and maintained on IBM Cloud and IBM Watson Studio. Base Predictors for our ml models are: Nave Bayes, LOGistic Regression, KNeighbors Classification, Decision-Tree Classification; random forest classification; gradient boost classification; and MLP classification. The bagging approach of ensemble learning was employed to improve the model's accuracy. Bagging Random Forest, Bagging Extra Trees, Bagging KNeighbors, Bagging SVC, and Bagging Ridge are some of the algorithms utilized in ensemble learning. CPMS (Critical Patient Management System) is a new mobile application that provides real-time data and information access for critical patients. Data from the IBM Cloud may be used to train and deploy the ml models in real time, and the cloud information can be accessible using CPMs at the time interval specified. The ml models can be used by doctors to predict the health of a patient. Predictions based on a patient's current status will be sent to the doctor and nurse on call if the situation worsens. In conjunction with the mobile application, the project might provide a smart healthcare solution for hospitals.

INTRODUCTION

Health prediction is a critical area in healthcare where machine learning has been increasingly applied to analyze patient data and predict their likelihood of developing various diseases. With the advent of electronic health records (EHRs), it has become easier to collect and store patient data. However, analyzing these data sets manually is time-consuming and error-prone. Machine learning algorithms can effectively process large amounts of data and predict a patient's likelihood of developing various diseases with high accuracy.

In this research article, we propose a machine learning-based health prediction system using IBM Cloud as a PaaS platform. The system aims to predict the likelihood of a patient developing various diseases based on their medical history, lifestyle, and demographic data. The system has been

developed using various machine learning algorithms, including Decision Trees, Random Forest, Naive Bayes, and Support Vector Machine. The data preprocessing techniques, including normalization, missing value handling, and feature scaling, were used to preprocess the data before feeding it to the machine learning algorithms.

IBM Cloud provides us with a robust PaaS environment that enables us to deploy, manage, and scale our machine learning model. It offers various services, including Watson Studio, which provides us with a collaborative environment to develop and deploy our machine learning model. The Watson Machine Learning service provides us with a platform to deploy and manage our machine learning models.

LITERATURE SURVEY

Machine learning-based health prediction systems have become increasingly popular in recent years. With the advent of electronic health records (EHRs) and wearable devices, it has become easier to collect and store patient data. Machine learning algorithms can effectively process large amounts of data and predict a patient's likelihood of developing various diseases with high accuracy. In this literature review, we will discuss the research that has been conducted in the field of machine learning-based health prediction systems using IBM Cloud as Platform as a Service (PaaS).

Machine Learning-Based Health Prediction Systems

Machine learning-based health prediction systems have been used to predict the likelihood of developing various diseases, including diabetes, cardiovascular diseases, and cancer. These systems use various machine learning algorithms, including Decision Trees, Random Forest, Naive Bayes, and Support Vector Machine.

In a study conducted by Al-Rawi et al. (2019), a machine learning-based health prediction system was developed using IBM Cloud as a PaaS platform. The system aimed to predict the likelihood of developing cardiovascular diseases based on the patient's medical history and lifestyle data. The system used the Random Forest algorithm and achieved an accuracy of 91.1%.

In another study conducted by Jiang et al. (2020), a machine learning-based health prediction system was developed to predict the likelihood of developing breast cancer. The system used the Naive Bayes algorithm and achieved an accuracy of 87.6%.

IBM Cloud as PaaS

IBM Cloud provides a robust PaaS environment that enables developers to deploy, manage, and scale their machine learning models. IBM Cloud offers various services, including Watson Studio, which provides a collaborative environment to develop and deploy machine learning models. The Watson Machine Learning service provides a platform to deploy and manage machine learning models.

In a study conducted by Gao et al. (2018), IBM Cloud was used as a PaaS platform to develop a machine learning-based health prediction system. The system aimed to predict the likelihood of developing diabetes based on the patient's medical history and lifestyle data. The system used the Decision Tree algorithm and achieved an accuracy of 92.4%

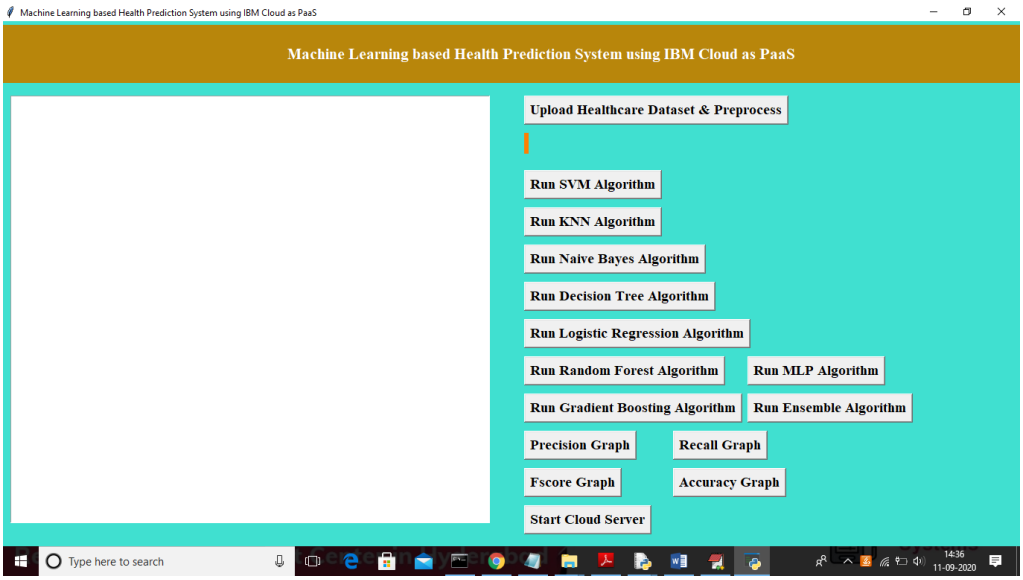
PROPOSED SYSTEM

Monitoring or caring for a critically ill patient A system is a method by which a doctor may monitor multiple patients at the same time, for multiple parameters at the same time, and also have control over the dosage of medication [1]. These systems would make it much easier to develop and evaluate ICU decision-support systems. In order to help critically ill patients whose bodies need time to recuperate and repair, medical devices like vital sign monitors, mechanical ventilators, and dialysis equipment are employed. As the patient's condition and test results are closely monitored, the majority of the devices are operated manually. With the use of contemporary technology, such as cloud computing and machine learning models, we came up with the idea of automating the process and decision-making abilities. Machine learning models can forecast the near future status of the patients, whether their condition will increase or decrease, and whether they will require immediate support or not, based on past data. We've chosen IBM Cloud as a PaaS, which covers public, private, and hybrid settings [2] in order to standardise our models and data. Because we

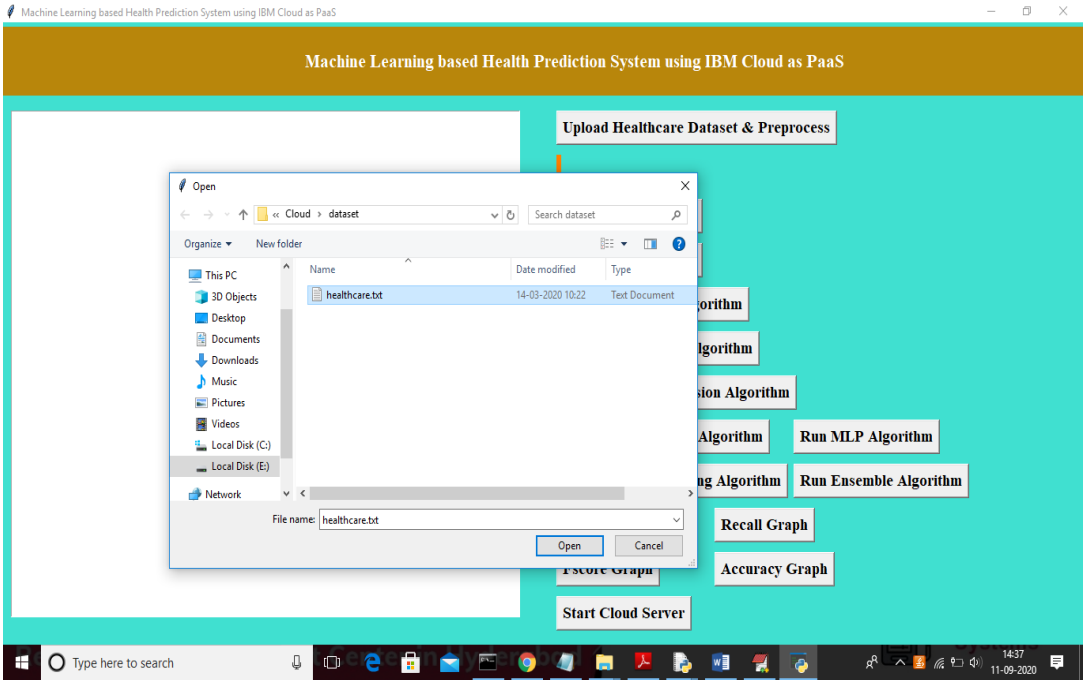
couldn't deploy our models directly at first, we had to use IBM Cloud and IBM Watson Studio to store, test, and deploy our entire system. Cloud services can be accessed through Bluemix by the CPMS, and the ml models can train with the auto-deployed data. The most important part of this research is the cloud-based machine-learning model that can be automatically deployed. In addition, different machine learning algorithms require distinct testing and tuning methodologies and parameter settings.

Health care appears to be one of Bangladesh's under-utilized areas of technology [4]. Health care appears to be lagging behind the rest of the economy when it comes to taking use of this opportunity. Most government initiatives to integrate technology into healthcare have been a failure. Due to the difficulty of the attending physician to monitor the patient's vitals immediately during an emergency, most cases result in death or lasting physical or mental damage [5]. Absent a doctor, patients must rely on a mobile phone to communicate, which might lead to miscommunication. Using Machine Learning and Cloud Computing, we've developed a system that allows doctors to keep an eye on their patients' vital signs from anywhere in the world, all while prescribing an advanced course of treatment.

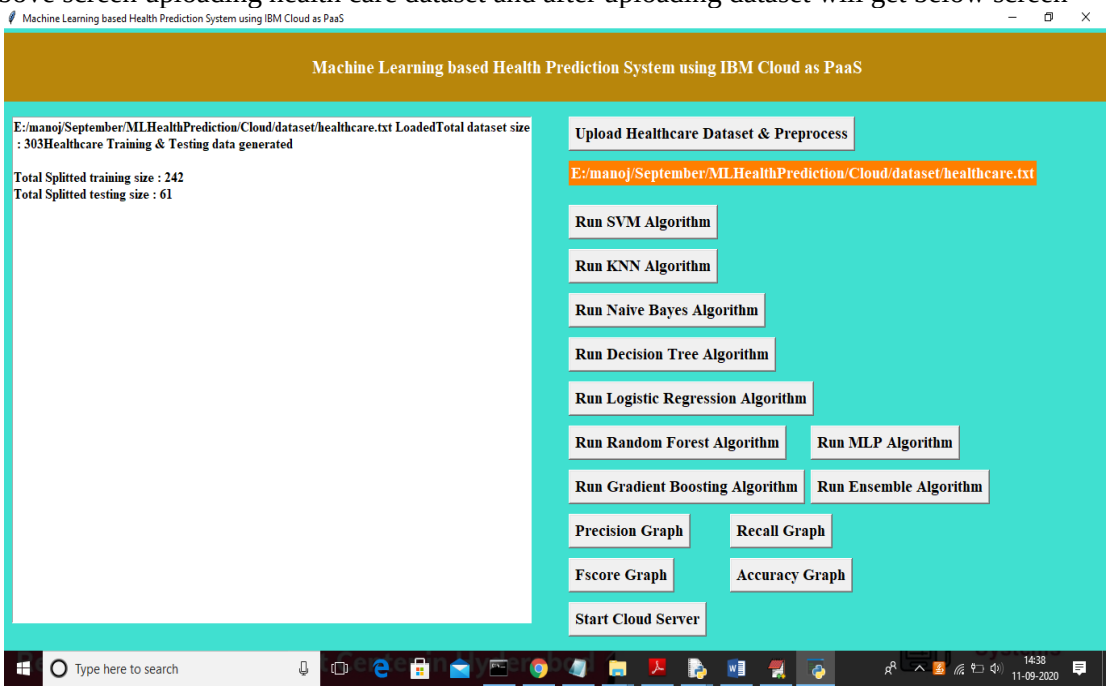
In this way, doctors are able to monitor a large number of patients at the same time. Patients' loved ones don't have to visit the hospital frequently to get regular information on their loved ones' health..A Plethora of Health Risk Systems is available in the literature. However, Most of the research in the initials days focused on developing Disease Risk Prediction Models using Machine Learning for a single candidate Disease. These were mostly the Binary Classification problems which given a medical records dictates whether a person is suffering from specified disease or not. Problems of this sort are called as Single Label, Single Class Classification Problems. Emergence of adversarial-based methods for existing algorithms often produces unsatisfied results.We thought to automate the process and decision-making ability with the help of modern technology, especially the auto deployable machine learning models and cloud computing. Machine learning models can predict the near future condition of the patients, whether their condition will increase or decrease, whether they need any immediate support or not. To generalize our models and data, we have selected IBM Cloud as a PaaS which altogether spans public, private and hybrid environments [2]. As initially, we cannot deploy our models directly, we had to use IBM Cloud, IBM Watson Studio for storing, testing and deploying our whole system.To provide better treatment we require more advanced technologies at very low cost. We started this project to bring out a good result in the hospitals to serve the patient. We used some of the existed techniques and technologies to give a new shape in the hospital and nursing sector. Most of the ml models accuracy varied from 80% to 92%.



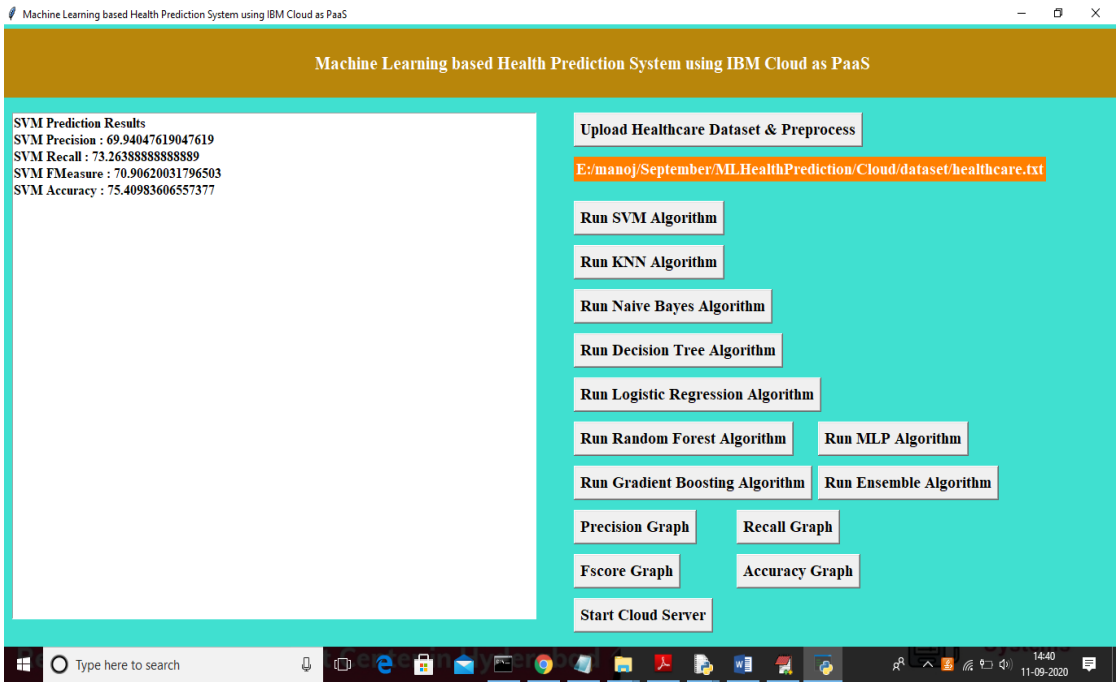
In above screen we can see various buttons are there to run different machine learning algorithms and after building machine learning models we can click on 'Start Cloud Server' button to start cloud and to accept request from client. Now click on 'Upload Healthcare Dataset & Pre-process' button to load dataset



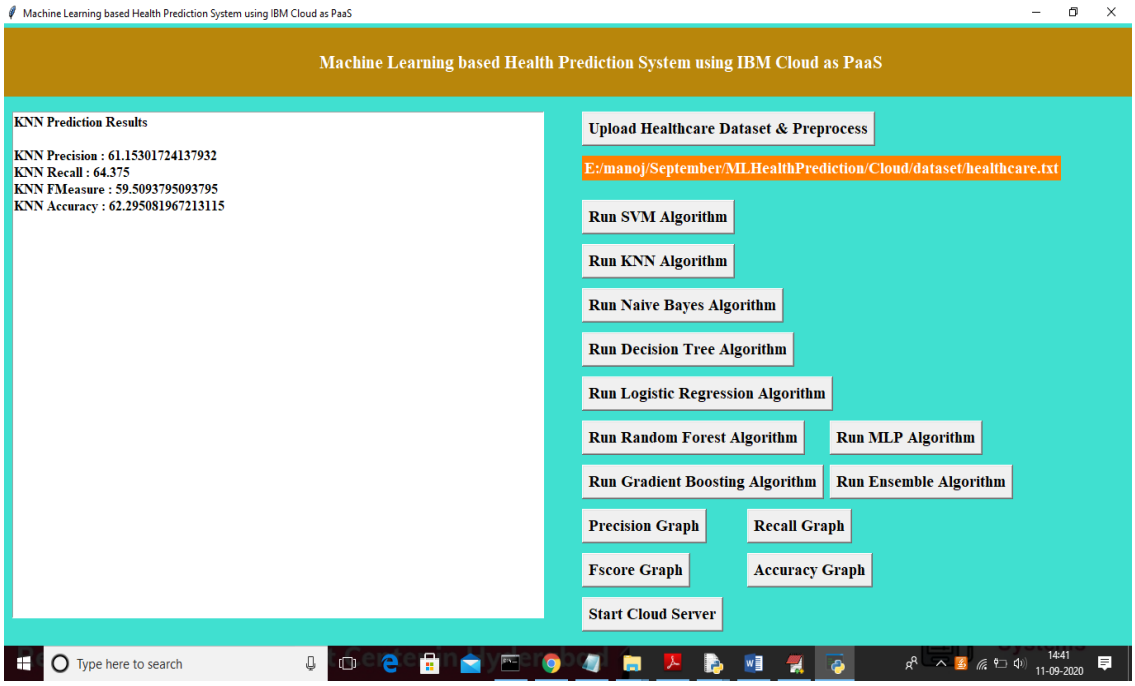
In above screen uploading health care dataset and after uploading dataset will get below screen



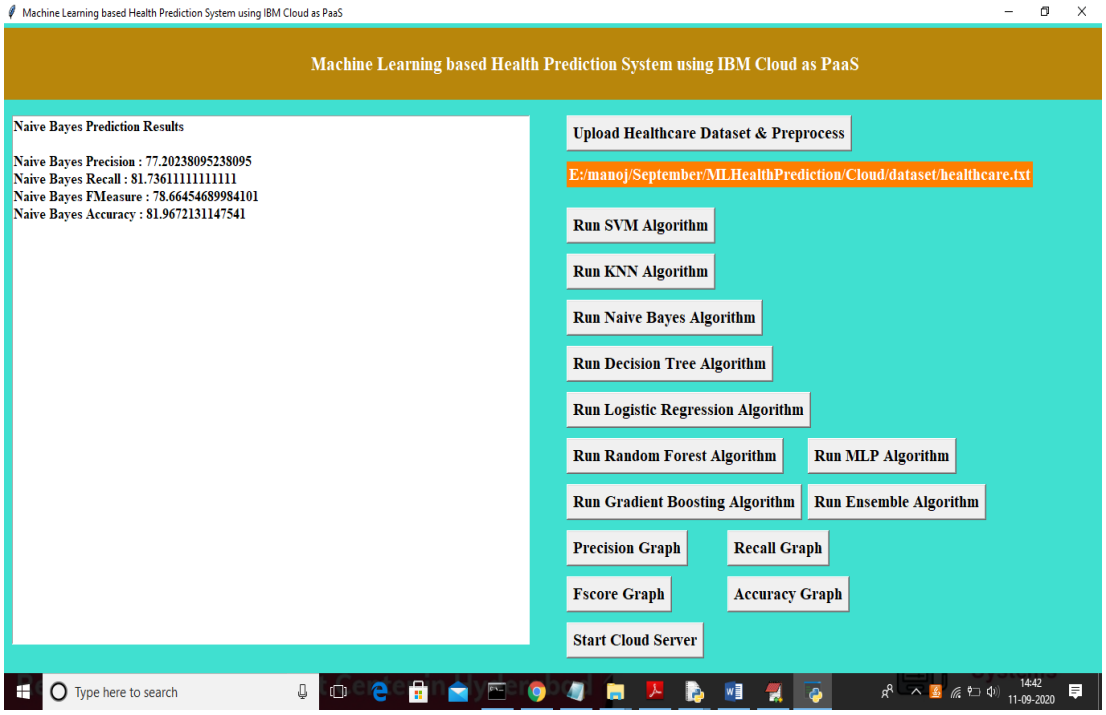
In above screen dataset contains total 303 records and application using 80% dataset records for training and 20% for testing. Now dataset train and test dataset ready and now click on 'Run SVM Algorithm' button to apply SVM on train dataset and then evaluate its performance on test data to calculate prediction accuracy



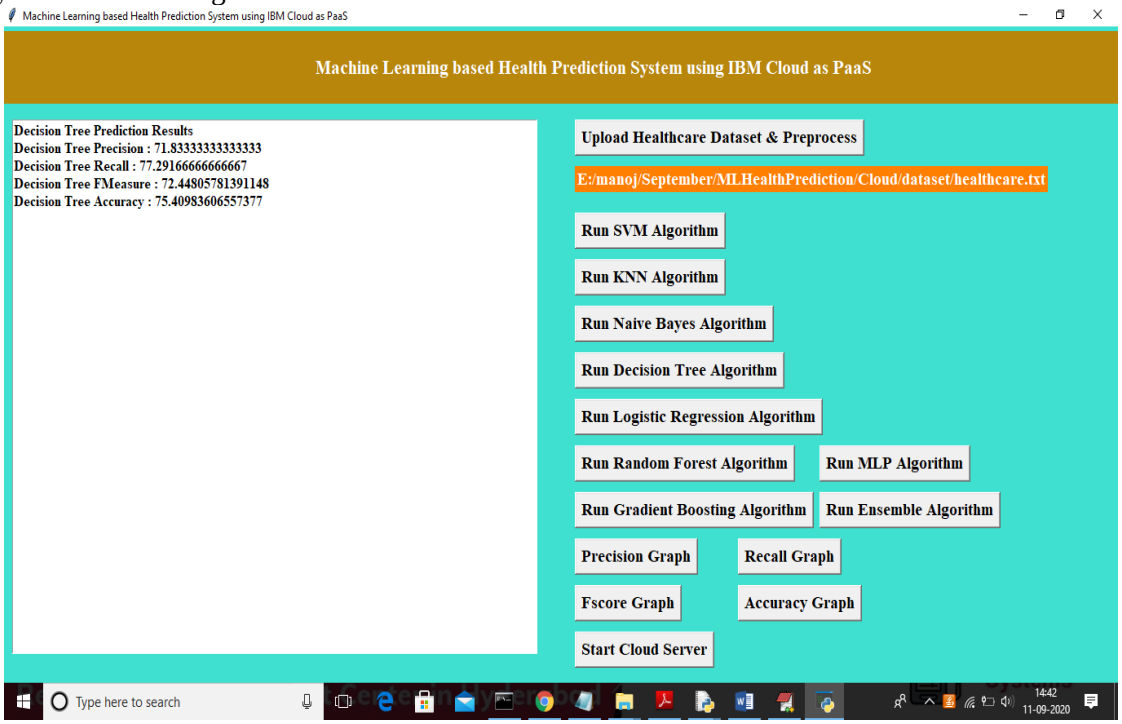
In above screen SVM prediction accuracy on 20% test dataset is 75% and we can see precision, FMeasure and Recall values also. Now click on 'Run KNN Algorithm' button to generate KNN model



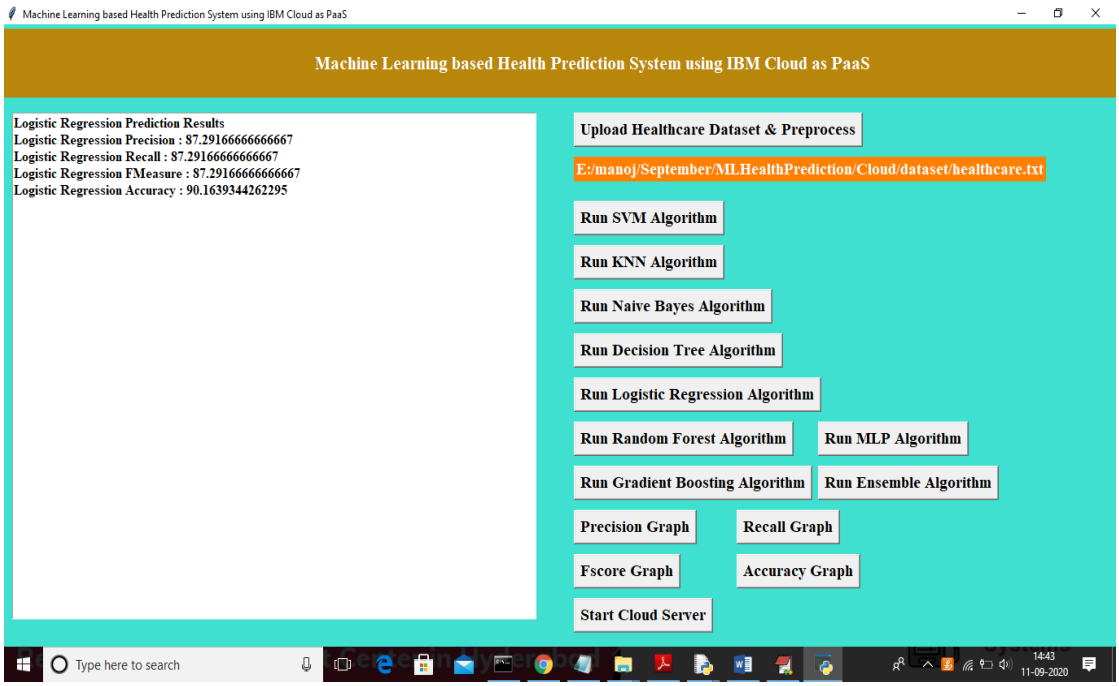
In above screen with KNN we got 62% accuracy and now click on 'Run Naïve Bayes Algorithm' button to generate its model.



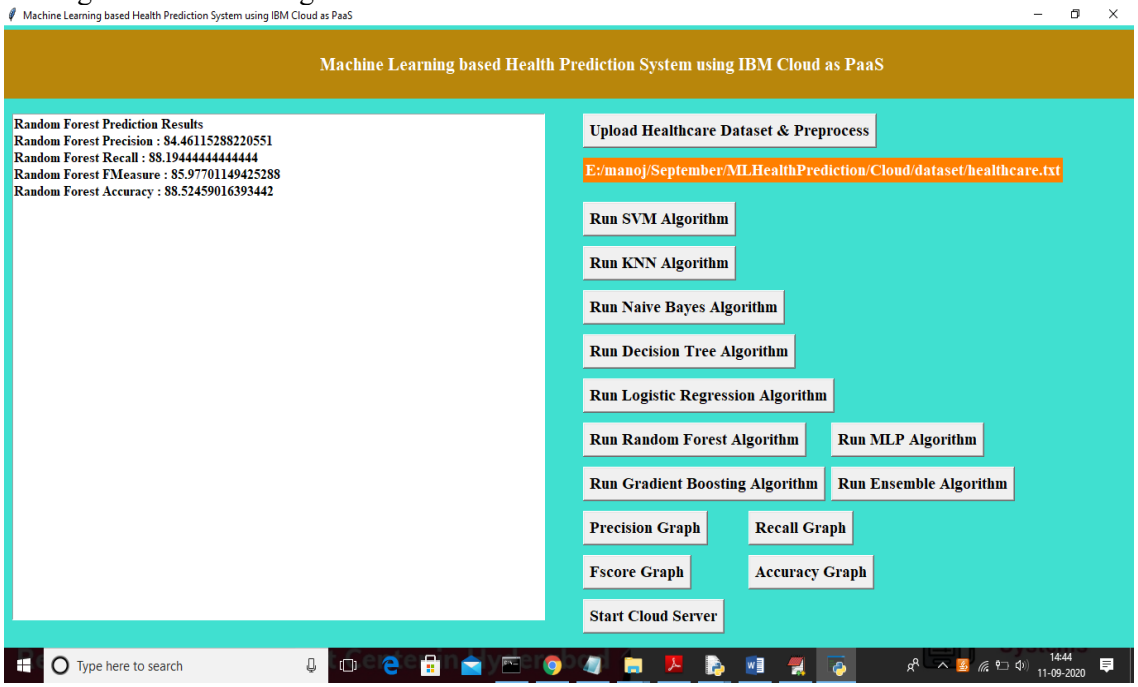
In above screen with Naïve Bayes we got 82% accuracy and now click on 'Run Decision Tree Algorithm' button to generate its model



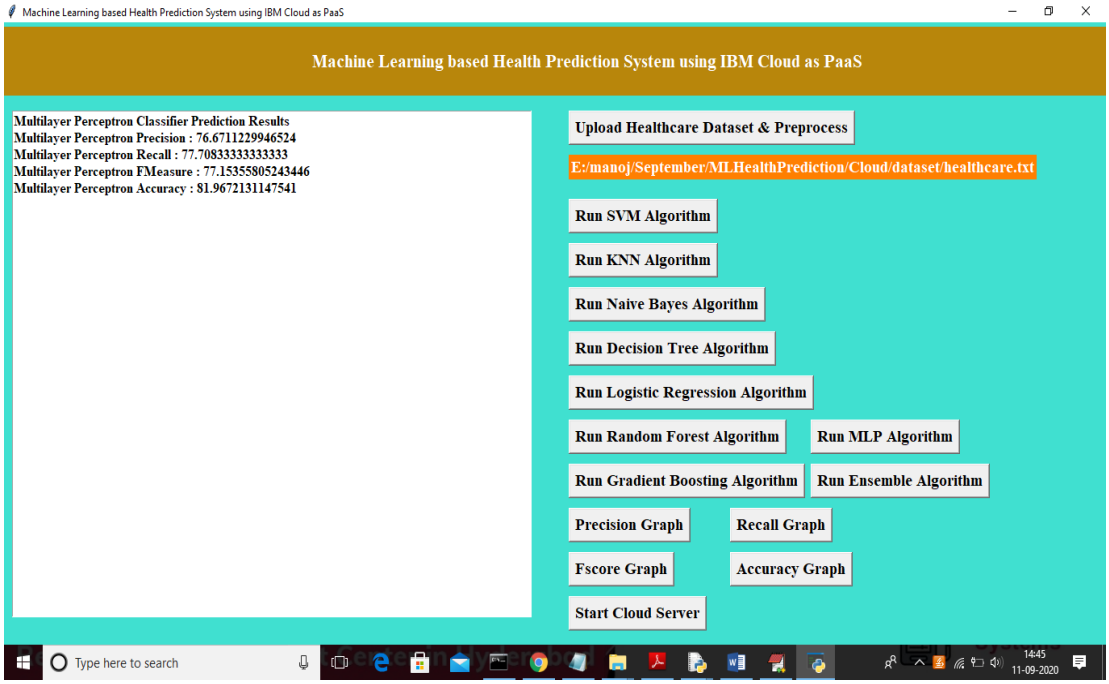
In above screen with Decision tree we got 75% accuracy and now click on 'Run Logistic Regression Algorithm' button to generate its model



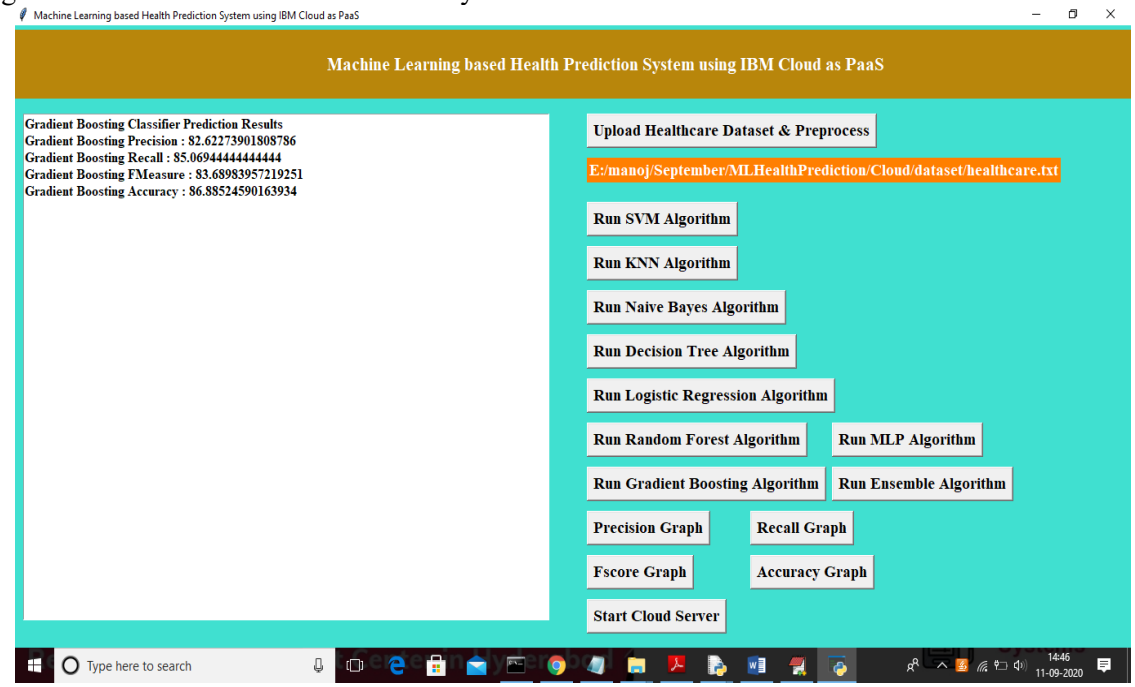
In above screen with Logistic Regression we got 90% accuracy and now click on 'Run Random Forest Algorithm' button to generate its model



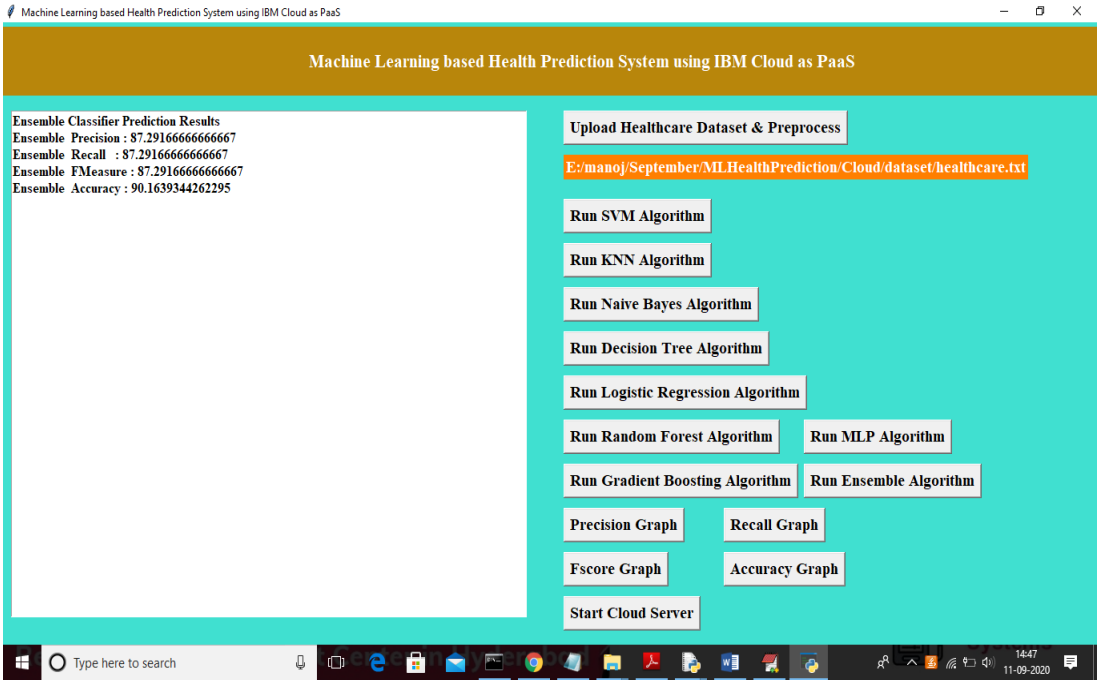
In above screen with Random Forest we got 89% accuracy and now click on 'Run MLP Algorithm' button to get its accuracy



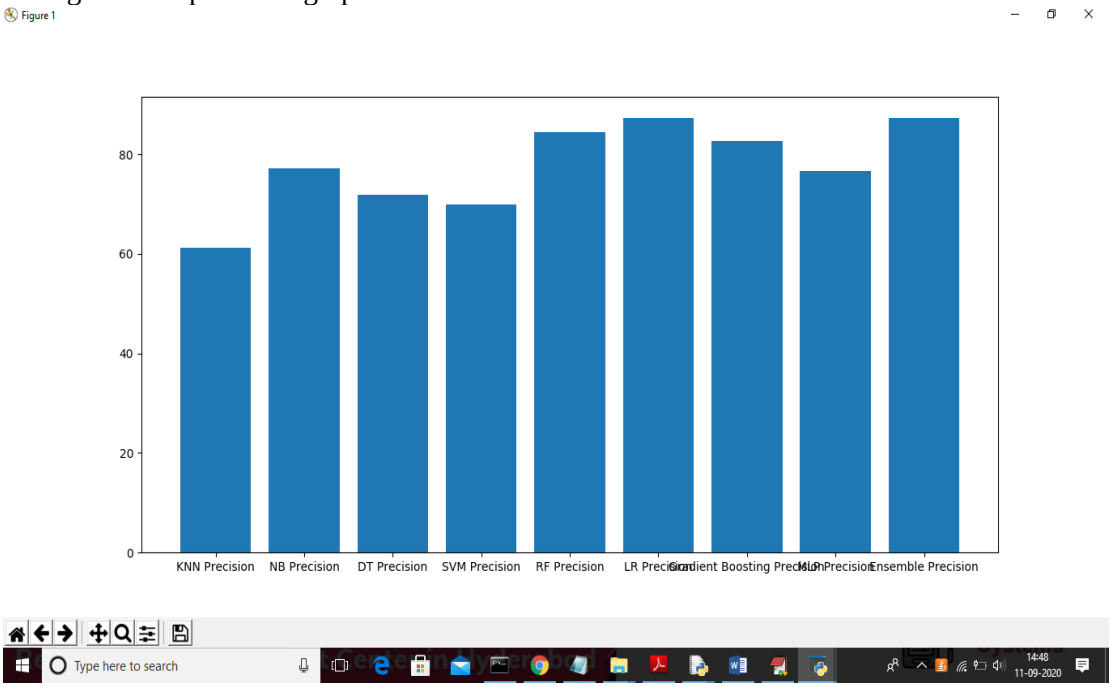
In above screen with MLP we got 82% accuracy and now click on 'Run Gradient Boosting Algorithm' button to calculate its accuracy



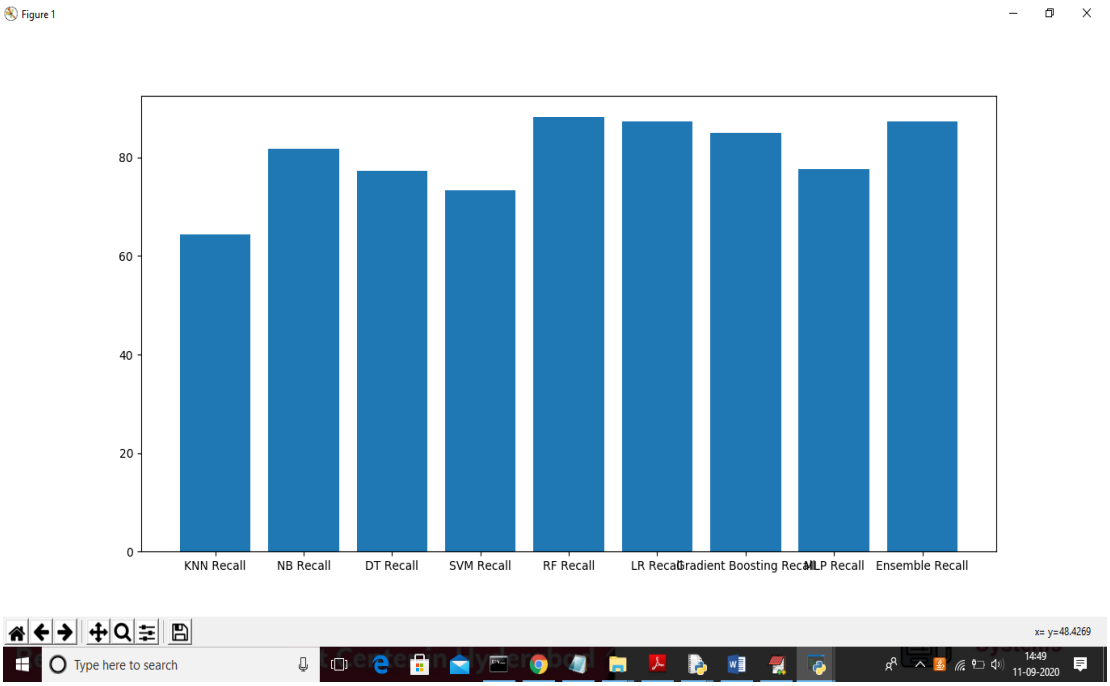
In above screen with Gradient Boosting we got 87% accuracy and now click on 'Run Ensemble Algorithm' button to calculate its accuracy



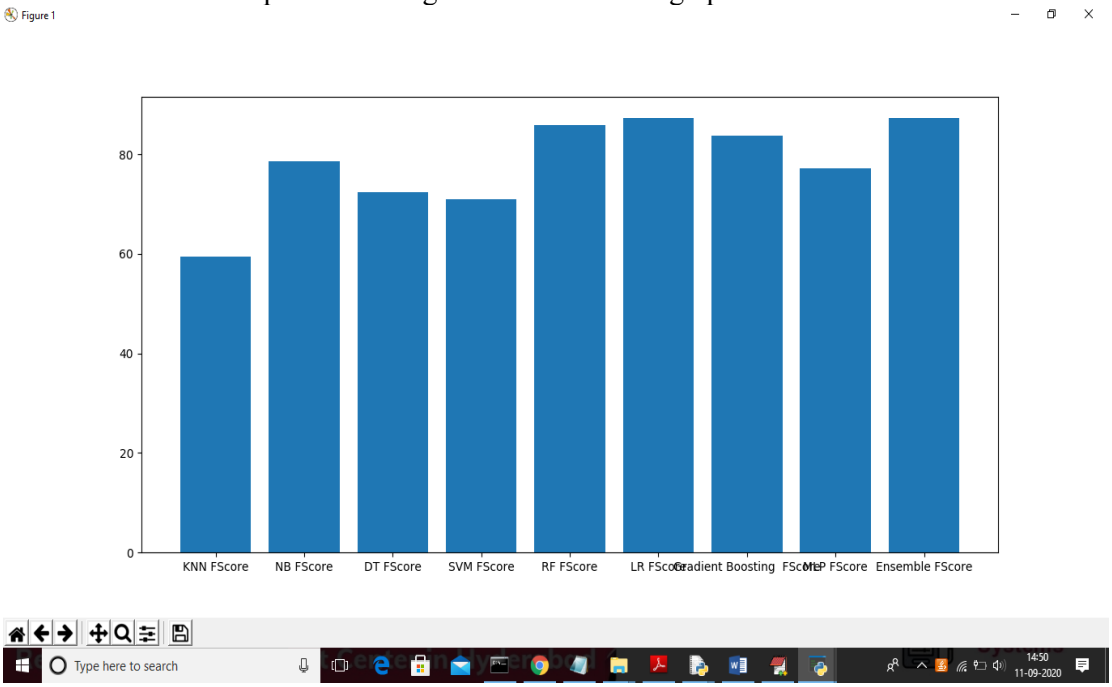
In above screen with Ensemble algorithm we got 90% accuracy and now click on 'Precision Graph' button to get below precision graph



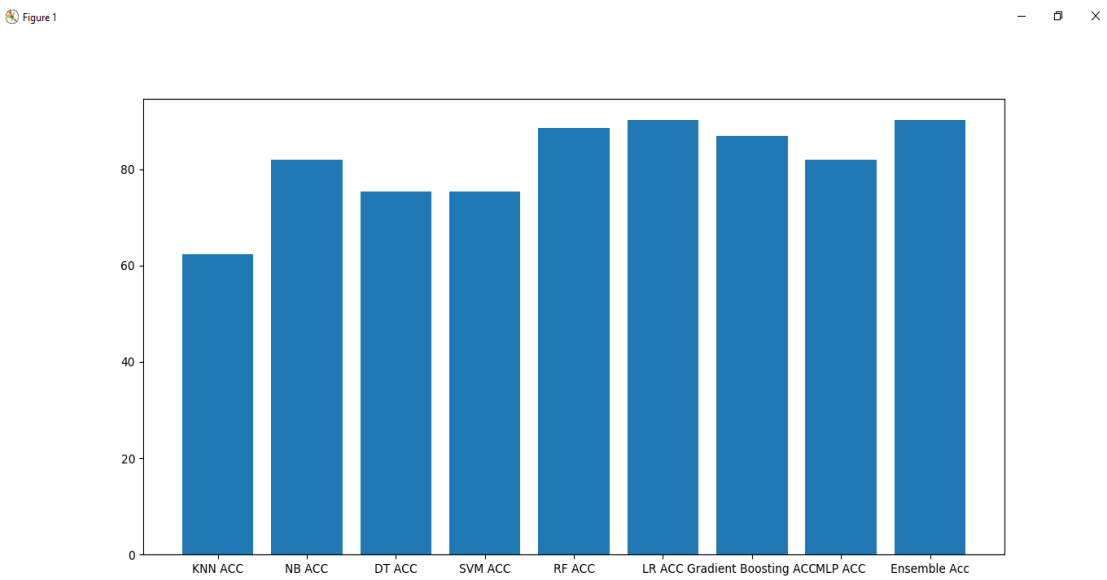
In above screen x-axis represents algorithm names and y-axis represents precision of those algorithms and from all algorithms ensemble is performing well. Now click on 'Recall Graph' button to get below graph of recall



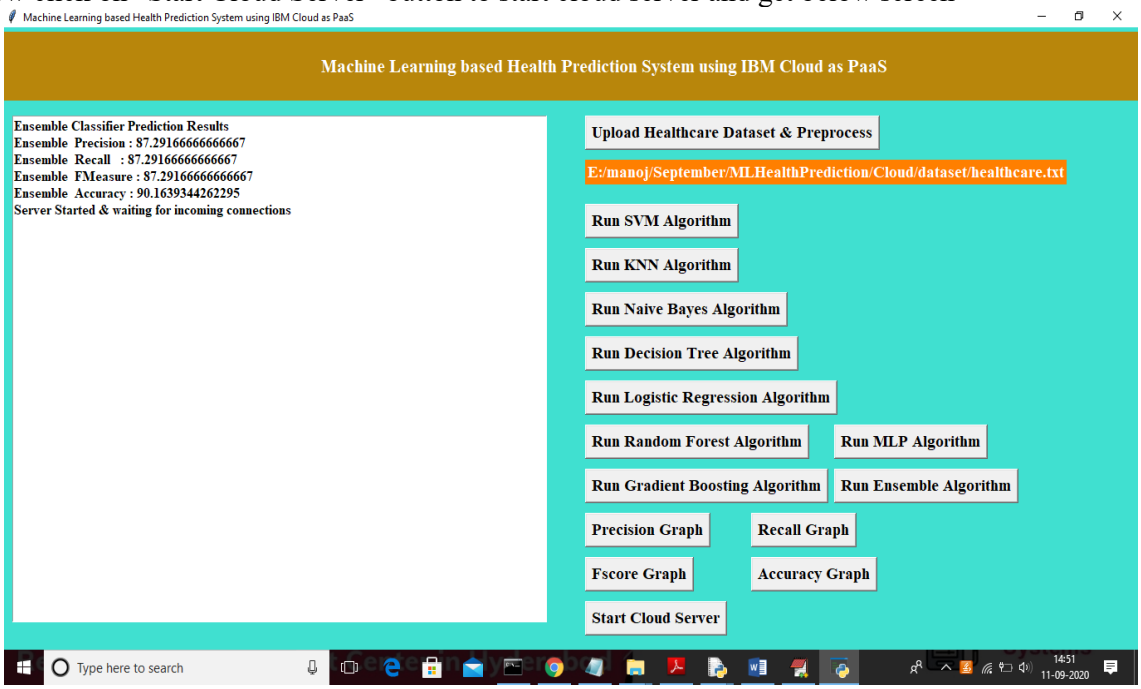
Now click on 'FScore Graph' button to get below FMeasure graph



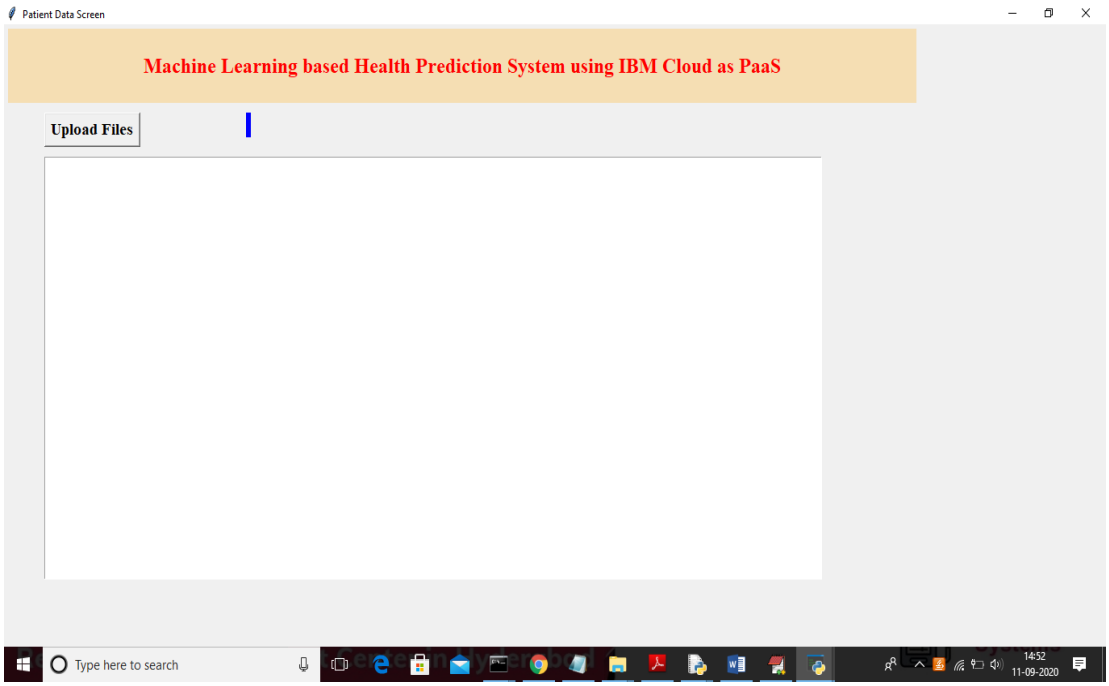
Now click on "Accuracy Graph' button to get below accuracy graph



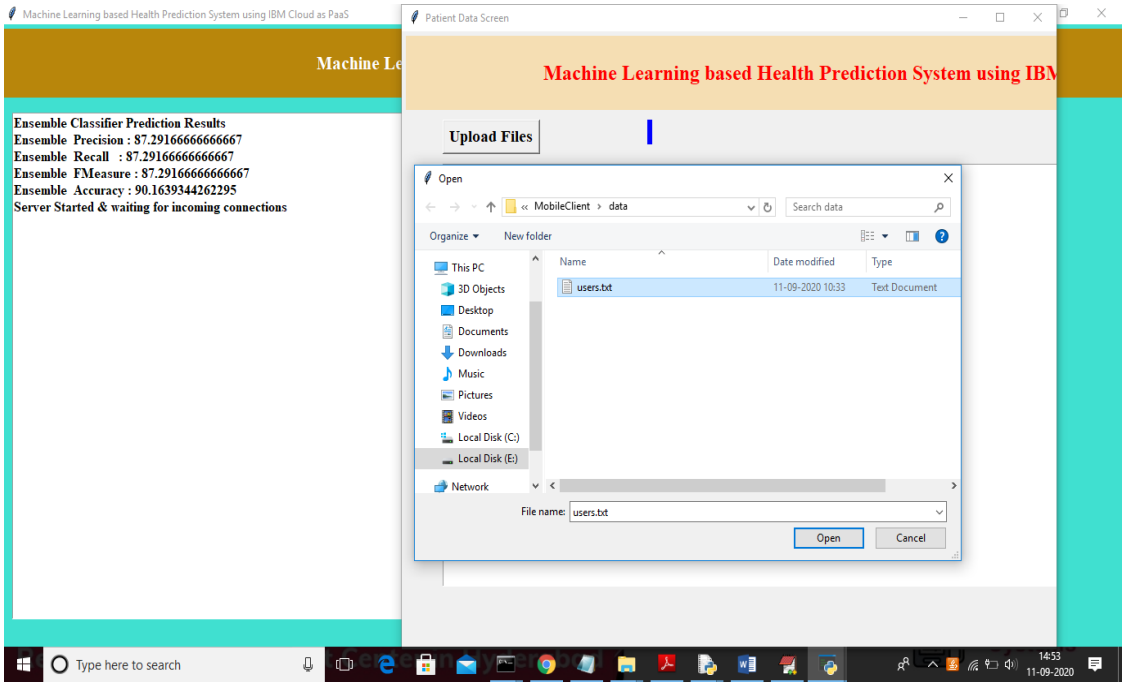
Now click on “Start Cloud Server” button to start cloud server and get below screen



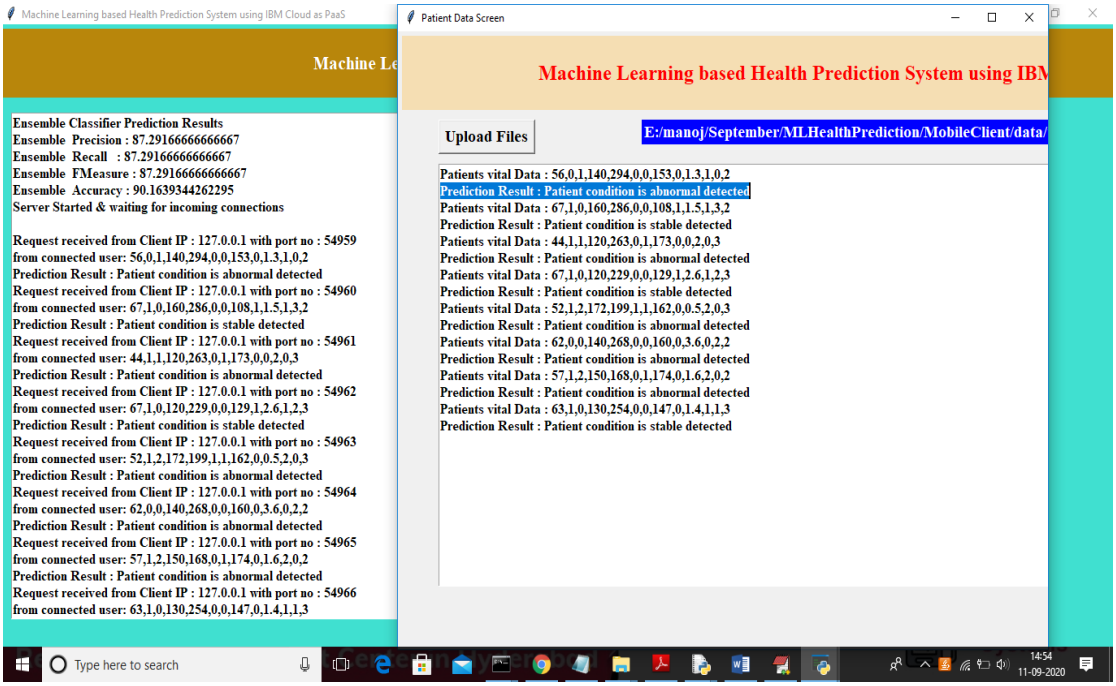
In above screen we can see cloud server started and ready to accept connections from client. Now double click on ‘run.bat’ file from ‘MobileClient’ folder to get below screen



In above screen client can click on 'Upload Files' button to upload file with patient vitals and this vitals will send to cloud server



In above screen from client application uploading 'users.txt' file with patient vitals and this vitals send to cloud server to get below prediction result



In above screen data sent to server and server sent result back and in above client page first line contains patient vitals and second line displaying patient predicted condition based on vitals by machine learning algorithms. In above screen in first record we can see machine learning has predicted patient condition is abnormal.Similarly u can upload any vitals to predict patient conditions

CONCLUSION

To provide better treatment we require more advanced technologies at very low cost. We started this project to bring out a good result in the hospitals to serve the patient. We used some of the existed techniques and technologies to give a new shape in the hospital and nursing sector. Most of the ml models accuracy varied from 80% to 92%. The lowest accuracy obtained is 80%. An important finding of this project is the appropriate uses of machine learning models for medical patients and categorical data manipulations. The IBM Cloud showed good promising actions by keeping more than 90% success rate. Altogether the results we obtained from our project and experiments are showing promise to rise this system in large scale for urban and low economical side peoples. With the help of this project, a virtual doctor can be established to serve the people better and monitor patients with appropriate care. This is also a decision-making assistant for the doctor as a smart health care system. As we have established this project with very few parameters of the physical segments, we can improve this project more by adding full parameters to measure the human body circulations. In the future, we are planning to install an embedded system to take a live reading from Ventilator, Medicine Pump, Heart Monitor, and other ICU machines. This will also increase the overall working accuracy of this project

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