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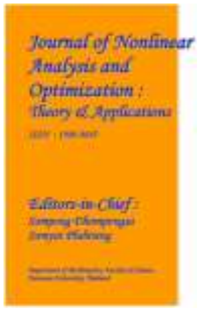

Machine Learning based Health Prediction System using IBM Cloud as PaaS

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ABSTRACT

A flexible Critical Patient Care system is a major need for hospitals in developing nations such as Bangladesh. Most hospitals in Bangladesh do not provide proper medical services due to a lack of effective, simple, and scalable smart systems. The aim of this project is to build an adequate system for hospitals to serve critical patients with a real-time feedback method. In this work, we propose a generic architecture, associated terminology and a classificatory model for observing critical patient's health condition with machine learning and IBM cloud computing as Platform as a service (PaaS). Machine Learning (ML) based health prediction of the patients is the key concept of this work. We developed a IBM Cloud application, which is the platform for this work to store and maintain our data and ML models. For our ML models, we have chosen the following Base Predictors such as Naïve Bayes, Logistic Regression, K Neighbors Classifier, Decision Tree Classifier, Random Forest Classifier, Gradient Boosting Classifier, and MLP Classifier,Support Vector Machine (SVM). For improving the accuracy of the model, the bagging method of ensemble learning has been used. The following algorithms are used for ensemble learning such as Bagging Random Forest, Bagging Extra Trees, Bagging K Neighbors, Bagging SVC, and Bagging Ridge. We also developed a client application, it is for information view. The system architecture is designed in such a way that the ML models can train and deploy in a real-time interval by retrieving the data from IBM Cloud and predicted results will be showed through client application. To help the doctors, the ML models will predict the condition of a patient and results will showed in a client application. The project may serve as a smart healthcare solution for the hospitals.

INTRODUCTION:

Adaptable Critical Patient Caring system is a key concern for hospitals in developing countries like Bangladesh. Most of the hospital in Bangladesh lack serving proper health service due to unavailability of appropriate, easy and scalable smart systems. The aim of this project is to build an adequate system for hospitals to serve critical patients with a real-time feedback method. In this paper, we propose a generic architecture, associated terminology and a classificatory model for observing critical patient's health condition with machine learning and IBM cloud computing as Platform as a service (PaaS). Machine Learning (ML) based health prediction of the patients is the key concept of this research. IBM Cloud, IBM Watson studio is the platform for this research to store and maintain our data and ml models. For our ml models, we have chosen the following Base Predictors: Naïve Bayes, Logistic Regression, KNeighbors Classifier, Decision Tree Classifier, Random Forest Classifier, Gradient Boosting Classifier, and MLP Classifier. For improving the accuracy of the model, the bagging method of ensemble learning has been used. The following algorithms are used for ensemble learning: Bagging Random Forest, Bagging Extra Trees, Bagging KNeighbors, Bagging SVC, and Bagging Ridge. We have developed a mobile application named "Critical Patient Management System - CPMS" for real-time data and information view. The system architecture is designed in such a way that the ml models can train and deploy in a real-time interval by retrieving the data from IBM Cloud and the cloud information can also be accessed through CPMS in a requested time interval. To help the doctors, the ml models will predict the condition of a patient. If the prediction based on the condition gets worse, the CPMS will send an SMS to the duty doctor and nurse for getting immediate attention to the patient. Combining with the ml models and mobile application, the project may serve as a smart healthcare solution for the hospitals.

PROPOSEDSYSTEM:

The proposed system is a Machine Learning-based Health Prediction System using IBM Cloud. It employs various ML models for real-time health predictions, integrated into a mobile app named "Critical Patient Management System (CPMS)." The system's SMS alert feature notifies healthcare professionals promptly, contributing to proactive intervention and improved patient care in hospital settings.

LITERATURE SURVEY:

2.1 .Building decision tree classifier on private data

AUTHORS: Du, W., & Zhan, Z.

ABSTRACT: This paper studies how to build a decision tree classifier under the following scenario: a database is vertically partitioned into two pieces, with one piece owned by Alice and the other piece owned by Bob. Alice and Bob want to build a decision tree classifier based on such a database, but due to the privacy constraints, neither of them wants to disclose their private pieces to the other party or to any third party.We present a protocol that allows Alice and Bob to conduct such a classifier building without having to compromise their privacy. Our protocol uses an untrusted third-party server, and is built upon a useful building block, the scalar product protocol. Our solution to the scalar product protocol is more efficient than any existing solutions.

2.2. Comparison of bagging, boosting and stacking ensembles applied to real estate appraisal

AUTHORS: Graczyk, M., Lasota, T., Trawiński, B., & Trawiński, K.

ABSTRACT: The experiments, aimed to compare three methods to create ensemble models implemented in a popular data mining system called WEKA, were carried out. Six common algorithms comprising two neural network algorithms, two decision trees for regression, linear regression, and support vector machine were used to construct ensemble models. All algorithms were employed to real-world datasets derived from the cadastral system and the registry of real estate transactions. Nonparametric Wilcoxon signed-rank tests to evaluate the differences between ensembles and original models were conducted. The results obtained show there is no single algorithm which produces the best ensembles and it is worth to seek an optimal hybrid multi-model solution. Keywords ensemble models-bagging-stacking-boosting-property valuation.

2.3. An empirical study of the naive Bayes classifier.

AUTHORS: Rish, I.

ABSTRACT: The naive Bayes classifier greatly simplify learn-ing by assuming that features are independent given class. Although independence is generally a poor assumption, in practice naive Bayes often competes well with more sophisticated classifiers. Our broad goal is to understand the data character-istics which affect the performance of naive Bayes. Our approach uses Monte Carlo simulations that al-low a systematic study of classification accuracy for several classes of randomly generated prob-lems. We analyze the impact of the distribution entropy on the classification error, showing that low-entropy feature distributions yield good per-formance of naive

Bayes. We also demonstrate that naive Bayes works well for certain nearly-functional feature dependencies, thus reaching its best performance in two opposite cases: completely independent features (as expected) and function-ally dependent features (which is surprising). An-other surprising result is that the accuracy of naive Bayes is not directly correlated with the degree of feature dependencies measured as the class-conditional mutual information between the features. Instead, a better predictor of naive Bayes ac-curacy is the amount of information about the class that is lost because of the independence assumption.

2.4. Practical bayesian optimization of machine learning algorithms.

AUTHORS: Snoek, J., Larochelle, H., & Adams, R. P.

ABSTRACT: Machine learning algorithms frequently require careful tuning of model hyperparameters, regularization terms, and optimization parameters. Unfortunately, this tuning is often a "black art" that requires expert experience, unwritten rules of thumb, or sometimes brute-force search. Much more appealing is the idea of developing automatic approaches which can optimize the performance of a given learning algorithm to the task at hand. In this work, we consider the automatic tuning problem within the framework of Bayesian optimization, in which a learning algorithm's generalization performance is modeled as a sample from a Gaussian process (GP). The tractable posterior distribution induced by the GP leads to efficient use of the information gathered by previous experiments, enabling optimal choices about what parameters to try next. Here we show how the effects of the Gaussian process prior and the associated inference procedure can have a large impact on the success or failure of Bayesian optimization. We show that thoughtful choices can lead to results that exceed expert-level performance in tuning machine learning algorithms. We also describe new algorithms that take into account the variable cost (duration) of learning experiments and that can leverage the presence of multiple cores for parallel experimentation. We show that these proposed algorithms improve on previous automatic procedures and can reach or surpass human expert-level optimization on a diverse set of contemporary algorithms including latent Dirichlet allocation, structured SVMs and convolutional neural networks.

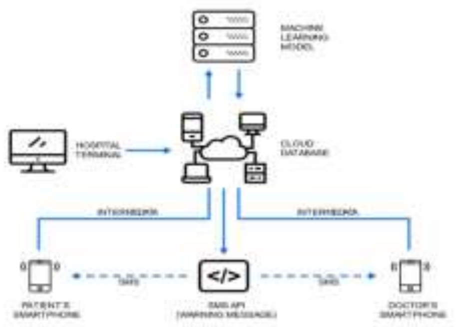
2.5. Fast approximate nearest neighbors with automatic algorithm configuration

AUTHORS: Muja, M., & Lowe, D. G.

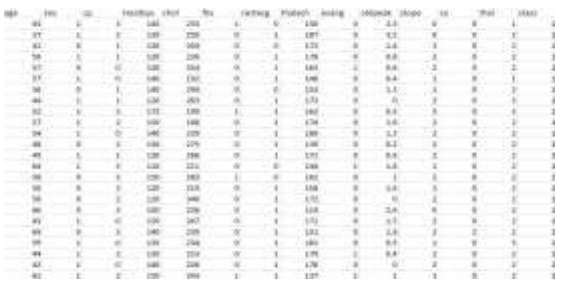
ABSTRACT: For many computer vision problems, the most time consuming component consists of nearest neighbor matching in high-dimensional spaces. There are no known exact algorithms for solving these high-dimensional problems that are faster than linear search. Approximate algorithms are known to provide large speedups with only minor loss in accuracy, but many such algorithms have been published with only minimal guidance on selecting an algorithm and its parameters for any given problem. In this paper, we describe a system that answers the question, "What is the fastest approximate nearest-neighbor algorithm for my data?" Our system will take any given dataset and desired degree of precision and use these to automatically determine the best algorithm and parameter values. We also describe a new algorithm that applies priority search on hierarchical k-means trees, which we have found to provide the best known performance on many datasets. After testing a range of alternatives, we have found that multiple randomized k-d trees provide the best performance for other datasets. We are releasing public domain code that implements these approaches. This library provides about one order of magnitude improvement in query time over the best previously available software and provides fully automated parameter selection.

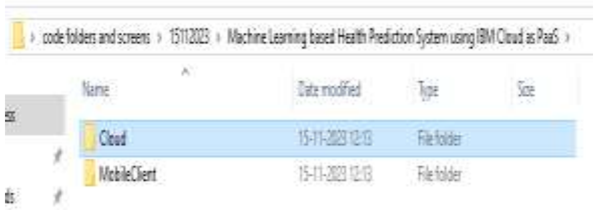
The aim of this project is to build an adequate system for hospitals to serve critical patients with a real-time feedback method. In this paper, we propose a generic architecture, associated terminology and a classificatory model for observing critical patient's health condition with machine learning and IBM cloud computing as Platform as a service (PaaS). Machine Learning (ML) based health prediction of the patients is the key concept of this research. IBM Cloud, IBM Watson studio is the platform for this research to store and maintain our data and ml models. For our ml models, we have chosen the following Base Predictors: Naïve Bayes, Logistic Regression, KNeighbors Classifier, Decision Tree Classifier, Random Forest Classifier, Gradient Boosting Classifier, and MLP Classifier. For improving the accuracy of the model, the bagging method of ensemble learning has been used. The following algorithms are used for ensemble learning: Bagging Random Forest, Bagging Extra Trees, Bagging KNeighbors, Bagging SVC, and Bagging Ridge. We have developed a mobile application named "Critical Patient Management System - CPMS" for real-time data and information view. The system architecture is designed in such a way that the ml models can train and deploy in a real-time interval by retrieving the data from IBM Cloud and the cloud information can also be accessed through CPMS in a requested time interval. To help the doctors, the ml models will predict the condition of a patient. If the prediction based on the condition gets worse, the CPMS will send an SMS to the duty doctor and nurse for getting immediate attention to the patient. Combining with the ml models and mobile application, the project may serve as a smart healthcare solution for the hospitals.

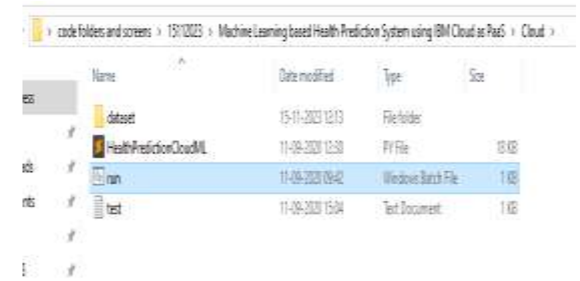
SYSTEM ARCHITECTURE:



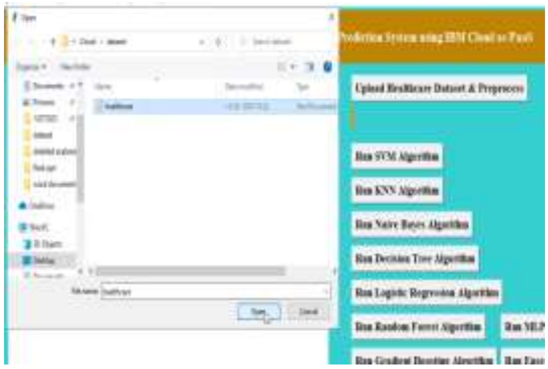
IMPLEMENTATION:







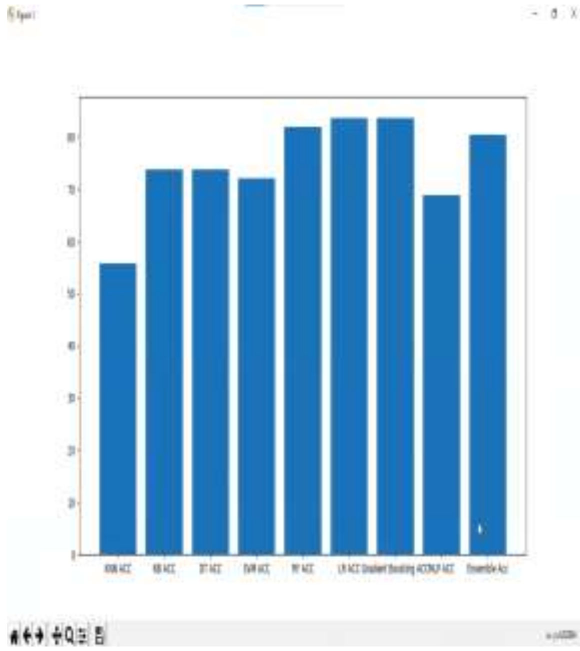
In above screen we can see various buttons are there to run different machine learning algorithms and after building machine learning models we can click on 'Start Cloud Server' button to start cloud and to accept request from client. Now click on 'Upload Healthcare Dataset & Pre-process' button to load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

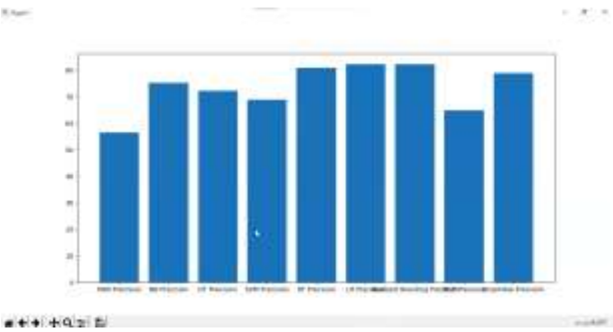


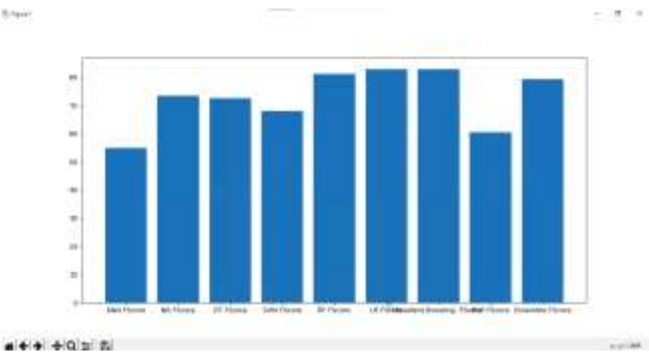
In above screen uploading health care dataset and after uploading dataset will get below screen

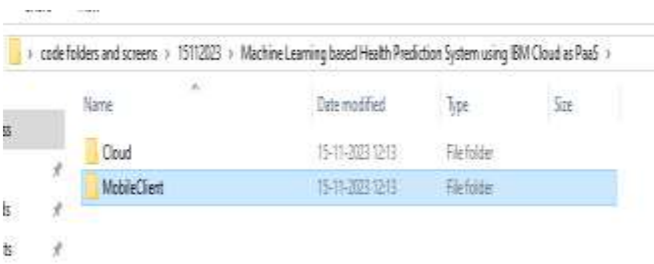
In above screen dataset contains total 303 records and application using 80% dataset records for training and 20% for testing. Now dataset train and test dataset ready and now click on 'Run SVM Algorithm' button to apply SVM on train dataset and then evaluate its performance on test data to calculate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





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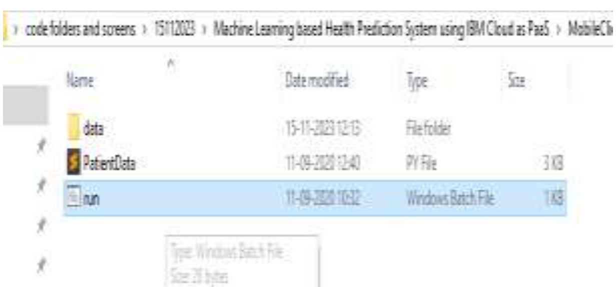
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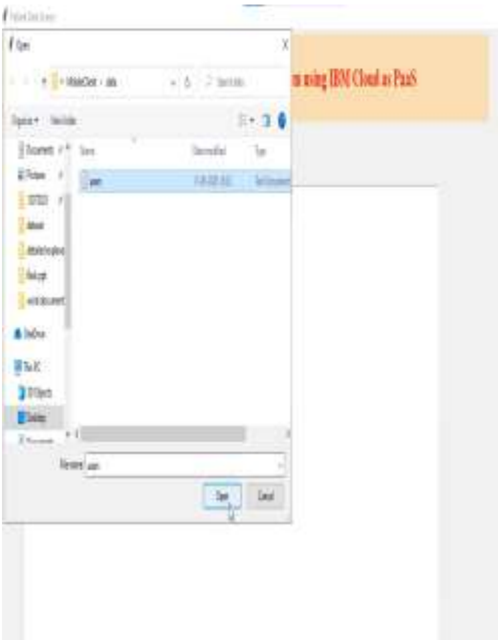

FUTURE SCOPE AND CONCLUSION

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.

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