Hypothermia

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*Abstract*— Hypothermia is a medical condition where the speed of loss of heat from body is faster than the production rate[1]. The related and relevant studies many times have adopted an ML-driven technique that speeds up the estimation of body temperature through high-speed calculation in order to provide the exact needed data of the patient's body heat level.

To start with, the authors had performed a virtual screening session on the data on core, surf, and bp, etc., which eliminated the imbalance in classes and higher varying dimensions of the temperature.

Then, 8 ML algorithms namely J48, Bayes Net, AdaBag, AdaBoost, SMO, Naive Bytes, Random Forests, logistic regression were trained by the virtually screened data, which they had used to find predictions of the patient’s temperature along with various factors. On this basis, they ensemble machine.

# Introduction

Hypothermia is a term given to a health condition where body temperature reaches below 35.0 C or 95.0 F in humans. Symptoms range by temperature. Specifically in mild hypothermia, we find shivering cases frequently. In this paper, first we would be elaborating over the symptoms and cures of this health condition and then we would be discussing about the various methods of machine learning methods to fight over this issue.

We would be comparing the data of various machine learning algorithms in order to achieve final appropriate answer over the question that which fits best as per its accuracy, error rate, TP rate, FP rate and AUC.

* 1. Prediction at an early stage will easily tell the condition of the patient. So that he can recover at the early stage. The early-stage prediction will easily help us to find the problem with the patient. While predicting at an early stage and finding bp, core surf, and then their stability(s), we can easily tell the condition, and also at an early stage, the problem is not too serious and can be cured easily with ease without much equipment and mental confusion. In moderate hypothermia, the shivering gets stop increasing the confusion. In severe hypothermia, there could also be paradoxical undressing, during which а person removes their clothing, also as an increased risk of heart stopping.
  2. Hypothermia has two main sorts of causes. It classically occurs from exposure to extreme cold. it's going to also occur from any condition that decreases heat production or increases heat loss. Commonly this includes alcohol intoxication but can also include low blood glucose, anorexia, and advanced age. blood heat is typically maintained near an unbroken level of 36.5-37.5 °C (97.7-99.5 °F) through thermal regulation, so as to extend the blood heat, the body puts many efforts that involve the method of shivering the entire body, increasing the voluntary activity also as putting on warmer clothing.
  3. Diagnosis of hypothermia could be also diagnosed by two methods:

I) By symptoms of the patient having the presence of risk factors

II) By measuring an individual's core temperature.

* 1. We are predicting core, surf and by and checking whether it is stable or not also checking the temperature. Here we are predicting whether person is suffering from disease or not and checking comfort and decision of the patient whether he is discharged or not. The prediction will tell the condition of the person what he is likely to have. The symptoms will show if there is a sign of low temperature or low by than the person is suffering from the disease and the temperature is normal than person is fit and fine.
  2. Prediction is important to find the condition of a person. If a person is showing symptoms, it may be likely to have hypothermia. While predicting and then analysing we may find the actual position and state of a person, and much labour and hard work there are lots of chances for the person to survive. If we find it at early stage
  3. Machine learning, a well-known method of data analysis is particularly used to automate analytical model building. It extends as a branch of AI that is based on the idea that algorithmically designed systems can learn and gain knowledge of data from data itself, identify patterns and make decisions on them with the least human intervention.
  4. Because of new computing technologies, machine learning has developed far away from what it was in the past. It has been born from pattern recognition as well as the theory that computers could learn without specifically being programmed to perform certain tasks. Many researchers interested in AI wanted to experiment on the learning done by the computer-based on a data set. The recursive aspect of ML becomes furthermore necessary as when these models are exposed to a new data set, they easily adapt the data independently without error. They achieve the ability to learn from previous computations in order to produce a set of reliable and repeatable decisions and results. It seems like a science that is not new, but that branch that has achieved high momentum. Even when we all know that the machine learning algorithms have been under development for a long time, the ability to automatically apply complex mathematical calculations over big data over and over, on a regular interval in a faster way has been achieved as a recent development.

# CLASSIFIER

A. lazylBk

IBK is called Instance-Based Learner. Algorithm: To locate the k "close" instances in the training data set, it uses a distance measure for each test instance and would use those selected instances to make a prediction. For classification and regression in pattern recognition, the k-nearest neighbour algorithm (k-NN) is used for the non-parametric method. A class membership forms as the output in the k-NN classification.

A.1 Disadvantages:

1. Low efficiency with large datasets: The calculation cost of distance between each of the existing and new points is huge in large datasets degrading the algorithm performance.

2. Low efficiency with high dimensions: For KNN algorithm, in high dimensional datasets, the efficiency decreases as it becomes difficult for the algorithm to calculate each distance in each and every dimension.

3. The dataset’s noise disrupts it due to being sensitive to it.

B. Random Tree (trees)

Random tree, a supervised classifier is used as an ensemble learning algorithm that generates many individual learners. It employs a bagging idea to produce Earldom set of data for constructing a decision tree. It is the combination of two existing algorithms in machine learning: single model trees are combined with Random Forest ideas.

C. Random Forest (Trees)

It is a combination of tree predictors in a way where every tree has dependence on the values of a random vector, that is being sampled with independence and with the identical distribution for all of the trees in the forest. It is one of the special kinds of ensemble learning process and robust having concern over the noise and the number of attributes.

C.1 Advantages:

1. Random Forest have the ability to provide the solution to both classification as well as regression problems.

2. Random Forest shows high efficiency with both categorical and continuous variables.

3. Random Forest have the capacity to automatically handle missing values.

C.2 Disadvantages:

1. Complexity: Random Forest creates a lot of trees and at the end combines their outputs.

2. Longer Training Period: Random Forest takes much more time as compared to decision trees as they generate a high number of trees and results its output based on the number of votes.

D. LOGISTIC (FUNCTIONS)

Logistic regression is one of the famous and highly used classification algorithms that has been developed in order to assign observations to a discrete set of classes. Examples of classification problems includes Boolean values for spam reports pf emails, fraud occurred in online transactions and Tumour being Malignant or Benign. By the use of sigmoid function, a probability value is returned which transforms the output of Logistic regression.

D.1 Advantages:

1. High efficiency for linearly separable data set.

2. Easy to implement, interpret and highly efficient to train.

D.2 Disadvantages:

1. The first and foremost limitation of the Logistic Regression is its pre-occupied assumption that there is a state of linearity between the independent variables and dependent variable. In the real-world scenario, we rarely find linearly separable data and usually it’s a whole lot of jumbled mess.

2. In a case where the number of observations is much lesser than the features in it, than Logistic Regression fails to deliver proper check over data leading to data being over fit.

E. BAGGING (META)

It is a "bootstrap-based" accumulation method to make individuals for its ensemble by getting each classifier on a random redistribution of the training set properly trained. Each classifier's training set is generated by randomly drawing, with replacement, N examples -where N is that the size of the first(original) training set. Every individual classifier within the ensemble is generated with a unique random sampling of the training set.

E.1 Advantages:

1. It is very easy to interpret where only several levels are contained by the trees.

2. The qualitative features can be easily handled.

3. Shows high efficiency where decision boundaries are available parallelly to the feature axis.

E.2 Disadvantages:

1. High chances of over fitting.

2. Chances of occurrence of problems with diagonal decision boundaries.

F. J48(Trees)

J48 was developed to be used as an algorithm to help in generating a decision tree that was developed by Ross Quinlan mentioned earlier. It is a very popular machine learning algorithm It solves the problem of machine learning by transforming the data into tree representation.

F.1 Advantages:

1. It does not require normalization of data.

2. It does not require scaling of data as well

3. A model is very intuitive and easy to explain to technical teams as well as stakeholders.

F.2 Disadvantages:

1. It often involves higher time to train the model.

2. Its training is relatively expensive as complexity and time taken is more.

G. PART (Rules)

Among the various ML techniques, we find a highly popular algorithm named as Rule Induction algorithm and it’s because of the smartly designed output system in it which provides it intelligence, when compared to other black-box classification methods Here we’ll focus on PRC(s) that is Possibilistic Rule-based Classifiers with the mindset of dealing with such problems that are on the path of extension and some modification of the Frank and Witten' PART algorithm.

G.1 Advantages:

1.The main advantage is ease of interpretation basically a human can understand how the model makes predictions & whether it makes sense.

2. Rule-based methods are better for data with categorical features.

G.2 Disadvantages:

1.The main disadvantage is that rule-based methods are usually not the best performers in terms of prediction quality. Other methods (forests, SVM, deep nets) tend to be better

H. MULTI CLASS CLASSIFIER (META)

In ML, we face a problem where we need to classify instances into 1 or 3 or more classes and this problem is known as multiclass classification. When we study deeply, we get to find out that some classification algorithms by default permits us to use 2+ classes, however others are by nature binary algorithms, which we can however, turn into multinomial classifiers by using a variety of strategies.

H.1 Advantages:

1. Parameter of regularization exists here.

2. The kernel trick is eased in this.

3. It acts as an approximation to a limit on the error rate of the test.

H.2 Disadvantages:

1. The disadvantages are that the theory only really covers the determination of the parameters for a given value of the regularization and kernel parameters and choice of kernel.

I. RANDOM SUBSPACE(META)

The arbitrary subspace system RSM is one of all the ensemble learning algorithms extensively employed in pattern claudication operations. In machine learning the arbitrary subspace system, also called trait bagging or point bagging assembles a literacy system that attempts to cut back the correlation between estimators in an Ensemble by training them on arbitrary samples of features rather than the whole feature set.

I.1 Advantages:

RSM has gained a positive side because it has a plus of the error rate being small and improved insensitivity toward the noise thanks to ensemble construction of the base-learners.

# Related Work

A. Budihardjo, J. Grzymala-Busse, L. Woolery (1991) proposed a tool for knowledge acquisition in nursing, Proceedings of the 4'h Int. Conference on Industrial & Engineering Applications of AI & Expert Systems.

L. Woolery, J. Grzymala-Busse, S. Summers, A. Budihardjo (1991). the employment of machine learning program LERS\_LB 2.5 in knowledge acquisition for expert system development in nursing. They proposed the necessity for computers in nursing.

In the operating theatre and medical aid unit, patients are closely observed by the clinical teams and are well equipped with monitoring solutions. However, outside these high-acuity settings, like at the overall ward, the quality of taking care of postoperative deterioration detection still relies on the manual periodic measurement of significant signs, usually every 4 to six hours [4].

Laboratory tests may additionally be used but are infrequently performed for surgical ward patients [5]. Yet, several studies have established an association between a lab test result and a complication for a given surgical subpopulation [6,7,8].

Vital signs are used as indicators of decay in an exceedingly more structured approach. Indeed, criteria of physiological instability have emerged with the introduction of medical emergency teams (MET) [9].

These criteria depend on vital signs, systolic force per unit area, and rate of respiration, among others. The introduction of MET has been shown to cut back the incidence of postoperative adverse outcomes [10].

Several single-parameter systems are described in Gao et al.'s review of track and trigger systems for identifying at-risk patients on the ward [11]. Interestingly in their survey, they found that there is an outsized variability of track and trigger solutions, with little evidence of reliability and validity. Sensitivity was found to be poor, which could be because of the character of the (pathos) physiology monitored or the selection of trigger threshold [11].

# Model proposed

The prediction of recovery chances of disease Hypothermia using machine learning. The given dataset is extremely imbalanced and has many features. within the machine learning framework first, it balances the dataset to form it more accurate and specific by using different algorithms. the subsequent step is to coach an algorithm. Generally, training data could be a certain percentage of an overall dataset together with a testing set. The testing set is to check the model. K-Fold Cross Validation divides the dataset into k number of folds and ensures that every fold is employed as testing set at some point. It aims to decide on the simplest subset features which are useful and good relationship with the target feature. After selecting a crucial feature, examine different classifiers on the training data by validating with the test data and in last check the performance of the model, which classifiers give the most effective results.

Diagram

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# Class balancing by algorithms

Preprocessing means the preparation of knowledge before training the classifier. it's important to regulate our matrices and methods to regulate our goals. As we've got plenty of imbalance in our dataset it's necessary to balance the dataset. Our goal is to predict the recovery chances for hypothermia. So, after preparing the dataset we balance that dataset and prepare a performance sheet after checking the 32 possibilities.

# K-Folds

It is the cross-validation method. This method involves dividing the dataset into k groups or folds of roughly equal size. the primary fold is kept for testing and therefore the model is trained on k-1 folds. the method is repeated k times and every time different folds or a bunch of information points are used for validation. it's accustomed to evaluating machine learning models on a limited data sample. No randomness of using some observations for training vs. validation set like in validation set method as each observation is taken into account for both training and validation. So overall less variability than the validation set method thanks to no randomness.

# Tools description

We used work for analyzing this problem and performed all the operations using WEKA. Weka stands for Waikato Environment for Knowledge Analysis. it's developed at the University of Waikato, Hamilton New Zealand. it's a set of machine learning algorithms for data mining tasks. It contains tools for data preprocessing, classification and regression. Its aim is to investigate the performance of various classification methods for a collection of huge data its applications as Explorer (In this we make algorithms and use various classifiers), Experimenter, Knowledge Flow, Workbench, and straightforward CLI.

# results and discussion

This segment describes the results, performance estimation, and comparison of the framework on the benchmark dataset. We used various parameters to predict the recovery chances of Hypothermia. Prediction at an early stage will easily tell the condition of the patient in order that the patient can recover at the first stage. Solving this problem using machine learning by making algorithms helps us to grasp the patient's behavior faster and more accurately. The early-stage prediction will easily help us to seek out the matter with the patient. While predicting at an early stage and finding force per unit area, core surf, then their stabilities we will easily tell the condition, and also at an early stage, the matter isn't too serious and might be cured easily with ease without much equipment and confusedness.

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# Conclusion

In this paper, an efficient ensemble machine learning framework is proposed to predict the recovery chances of patients from hypothermia. K-fold is employed to coach the dataset and choose the simplest out of all. Class Balancing is finished by algorithms to balance the active and inactive classes within the training data. On testing the proposed model using the benchmark dataset the accuracy, error, TP rate, FP rate, F-measure, MCC, AUC are found to be 99.37%,0.63%,0.994,0.006,0.993, and 0.991 respectively. The efficient framework supported a machine learning algorithm also can be used as a call system for the prediction of recovery chances of patients from hypothermia. within the future, this prediction is enhanced by applying different machine learning algorithms.

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