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Review on Detection of Hypoglycaemia by Machine Learning Approach

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Abstract: Doctor concluded related to an indication that someone has the potential against* diabetes mellitus (*DM) the architecture of the proposed method is designed. With the data obtained from the authorities in the laboratory, the model has been adjusted. Split points and using the Gina index the best split points are identified in this paper. By identifying false split points to minimize the calculation of Gini indices a method is proposed and Gaussian fuzzy function is used because the clinical data sets are not crisp, in this paper review the different method of diabetes classification.

Keywords: Detection, Machine Learning, Hypoglycaemia.

I. INTRODUCTION

DIABETES MELLITUS (DM**)** is a group of the metabolic diseases, over a prolonged period in which there are high blood sugar levels, DM (Diabetes mellitus) is commonly referred as diabetes. Increased thirst, frequent urination, and increased hunger are included in the symptoms of high blood sugar. Diabetes can cause many complications if left untreated. Nonketotic hyperosmolar coma, death and diabetic ketoacidosis can include by the acute complication. Stroke, kidney failure, damage to the eyes, heart disease and foot ulcers include in the serious long-term complications. Diabetes mellitus are mainly three types:

I. **Type 1:** To produce enough insulin the DM results from the pancreas's failure. The type 1 diabetes is known as juvenile diabetes and usually diagnosed in young adults and children. Due to the destruction of the beta cells of the pancreas the Type 1 diabetes mellitus (IDDM) patients do not produce insulin. So, the exogenous administration of insulin consist the therapy.

II. **Type 2:** Type 2 DM is a condition with insulin resistance, in which cells fail to respond to insulin properly. A lack of insulin may also develop as the disease progresses. As "adult-onset diabetes" or "non-insulin-dependent diabetes mellitus" (NIDDM) is referred this form. The most common form of diabetes is Type 2 diabetes. Insulin endogenously is produced by the Type 2 diabetes mellitus (NIDDM) patients but as compared to the healthy subjects the secretion and effect of this insulin are reduced. The not enough exercise and excessive body weight is the most common cause.

III. **Gestational diabetes:** It occurs when pregnant women without a previous history of diabetes develop high blood sugar levels, it is the third form of the Diabetes Mellitus (DM).

At the worldwide, an estimated 415 million people had diabetes in 2015, about 90% of the cases is made up with the type 2 DM. With the equal rates in both men and women, the 8.3% of adult population is represented by this. From diabetes, approximately 1.5 to 5.0 million deaths each year resulted in 2012 to 2015. In 2014, the global economic cost of diabetes was estimated to be US$612 billion. In 2012 diabetes cost was $245 billion, in United States [5].

HYPOGLYCEMIA: Commonly the Hypoglycemia is a perceived problem. It occurs when blood glucose drops below normal levels and also called low blood glucose or low blood sugar. Generally, below 70 mg/dL, the hypoglycemia is defined as a serum glucose level (the amount of sugar or glucose in your blood). Medication is the most common cause of hypoglycemia. In diabetics who have eaten less than usual, drunk alcohol exercised more than usual, there is risk is greater. The certain tumors, such as insulinoma, severe infections, an inborn error of metabolism, a number of drugs including alcohol, starvation, liver disease,

reactive hypoglycemia are including in the other causes of hypoglycemia. In healthy babies, low blood sugar may occur who have not eaten for a few hours. Hypoglycemia is defined by the glucose level is called variable [6]. In Type 1 diabetes mellitus (T1DM) patients it represents a significant risk and can even lead to neurological death or damage. With type 1 diabetes to describe the sudden unexplained deaths of young people the term, Dead in bed syndrome is used and it is also known as a dead-in-bed syndrome. Testing with a glucose monitor is recommended when people feel their blood sugar is low.
As a medical problem, by the presence of three key features hypoglycemia is diagnosed:-

1. with hypoglycemia the symptoms consistent,
2. a low plasma glucose concentration and
3. After the plasma glucose relief of symptoms, the level is raised.

At levels below 60 mg/dL symptoms of hypoglycemia are typically appear. Above this level, some people may feel symptoms. Brain function affected by below levels 50 mg/dL. Glucose level regulates by the body- for the muscles, brain and other essential cells the primary source of energy- by different hormones actions. The insulin (which lowers the blood sugar level and other chemicals) (which raise blood sugar such as epinephrine and glucagon growth hormone) included in these hormones. From the blood, the role of insulin helps in the absorption of glucose by transported into other tissues of the body or causing it to be stored in the liver.

II. LITERATURE REVIEW

Cheng-Hsiung Weng et.al. [7] investigated the performance of different classifiers is the major purpose of this study, in a solo classifiers and ensemble classifier the individual classifiers is involved. Moreover, with real-life datasets to examine the performance of these classifiers the various evaluations is used in this paper. In performance among the three classifiers to evaluate the significance of the difference, the statistical testing is used, finally. Within an ensemble, an ensemble classifier performs better than an individual classifier by statistical testing. However, as compared to the ensemble classifier built the solo classifier does not perform worse with the same size training dataset.

Rian Budi Lukmanto et. al. [8] to perform early detection against DM by using fuzzy hierarchical model and application of computational intelligence is proposed in this paper. Based on how a medical doctor concluded related to an indication that someone has the potential against DM the architecture of the proposed method is designed. With the data obtained from the authorities in the laboratory, the model has been adjusted. With the medical doctor decision, they did a comparison of the data they have obtained from this method. The 311 relevant data result is 87.46% that is equal to the medical statement.

J. Pradeep Kandhasamy et.al. [9] To predict diabetes using data mining techniques the comparison of algorithms are used. With diabetes mellitus to classify patients, it compared the machine learning classifiers (J48 Decision Tree, K-Nearest Neighbors, and Random Forest, Support Vector Machines). From UCI machine learning data repository with data samples downloaded these approaches have been tested. The exhibitions of the calculations have been measured in both the cases i.e dataset with boisterous information (before pre-handling) and dataset set without uproarious information (after pre-preparing) and thought about as far as Accuracy, Sensitivity, and Specificity.

Klaus Donsa et.al. [10] to personalize diabetes therapy the relevant parameters are covered in this paper, it explains the role of machine learning and how CDSS can support the therapy process in the context. Furthermore, with focus on machine learning technology and decision support system for the personalization of diabetes therapy, it identified open problems and challenges.

Kamadi V.S.R.P. Varma et.al. [11] to predict the occurrence of diabetes disease this paper aims at developing a decision tree model. With crisp boundaries, the traditional decision tree algorithms have a problem. With the use of the fuzzy decision boundaries from these clinical data sets the much better decision rules can be identified. In the construction of a decision tree, the key step is the identification of split points and using the Gini index the best split points are identified in this paper. By identifying false split points to minimize the calculation of Gini indices a method is proposed and Gaussian fuzzy function is used because the clinical data sets are not crisp. The decision tree efficiency depends on many factors such as length of the tree, the number of nodes. With Pima Indian Diabetes (PID) clinical data set for accuracy the proposed modified Gini index-Gaussian fuzzy decision tree algorithm is tested.

Bum Ju Lee et.al. [12] by a combination of various measures among Korean adults the fasting plasma glucose (FPG) status is predicted and that is used in the diagnosis of type 2 diabetes. In this study, a total of 4870 subjects (1915 males and 2955 females) participate. Using two machine-learning algorithms the predictions of FPG status using individual versus combined is compared, based on the 37 anthropometric measures.

Longfei Han et.al. [13] to screen diabetes the support vector machines are utilized in this paper and added the ensemble learning module, which is useful for solving imbalance problem and turn the "black box" of SVM decisions into comprehensible and transparent rules. With weighted average precision 94.2% and weighted average recall, 93.9% for all classes the CHNS data show that the proposed ensemble learning method generates rule sets. Moreover, for diagnosis of diabetes and it supports a second opinion for lay users a tool is provided by the hybrid system.

Phyo Phyo San et.al. [14] using rough sets concepts and neural computing for decision and classification purposes this paper focused on the hybridization technology. To partition the inconsistent (random) part and input signal to a consistent (predictable) part the lower region and boundary region are defined, based on the rough set properties. To deal with the boundary region the neural network is designed. The different characteristics of the neural network (NN) applications owe, the optimal solution is not given by the same structure of conventional NN. In this paper, as a suitable classifier, a block-based neural network (BBNN) is selected due to its adaptability in dynamic environments and to evolve internal structures. The characteristics of application to the hybrid rough-block-based neural network (R-BBNN) are systematically incorporate by this architecture. For parameter optimization of proposed R-BBNN, with wavelet mutation a hybrid particle swarm optimization, the global training algorithm is introduced.

Arpneek Kaur et.al. [15] Artificial intelligence techniques are ending up noticeably extremely famous in medicinal applications because of high unwavering quality and ease. From the previous decades, Artificial Intelligence systems, for example, Artificial Neural Networks, Fuzzy Expert Systems, Mechanical autonomy and so on have found an expanded utilization in ailment determination, persistent observing, ailment chance assessment, foreseeing the impact of new medications and automated treatment of surgeries. This paper shows a presentation and overview on diverse man-made brainpower techniques utilized by specialists for the utilization of diagnosing or anticipating Hypertension.

Ross KK Leung et.al. [16] In a forthcoming companion of sort 2 diabetic patients, it chose 119 subjects with DKD and 554 without DKD at enrolment and after a middle follow-up time of 7.8 years for model preparing, testing and approval utilizing seven machine learning techniques (incomplete slightest square relapse, the grouping and relapse tree, the C5.0 choice tree, irregular backwoods, guileless Bayes grouping, neural system and bolster vector machine). It utilized 17 clinical traits and 70 single nucleotide polymorphisms (SNPs) of 54 competitor qualities to fabricate distinctive models. The top properties chosen by the best-performing models were then used to manufacture models with execution practically identical to those utilizing the whole dataset.

AUTHOR NAME	YEAR	TECHNOLOGY USED	DESCRIPTION
Cheng-Hsiung Weng et.al.	2016	neural network classifiers	Investigated the performance of different classifiers is the major purpose of this study, in a solo classifiers and ensemble classifier the individual classifiers is involved. Moreover, with real-life datasets to examine the performance of these classifiers the various evaluations is used in this paper. In performance among the three classifiers to evaluate the significance of the difference, the statistical testing is used, finally. Within an ensemble, an ensemble classifier performs better than an individual classifier by statistical testing. However, as compared to the ensemble classifier built the solo classifier does not perform worse with the same size training dataset.
Rian Budi Lukmanto et. al.	2015	Fuzzy Hierarchical Model	to perform early detection against DM by using fuzzy hierarchical model an application of computational intelligence is proposed in this paper. Based on how a medical doctor concluded related to an indication that someone has the potential against DM the architecture of the proposed method is designed. With the data obtained from the authorities in the laboratory, the model has been adjusted. With the medical doctor decision, they did a comparison of the data they have obtained from this method. The 311 relevant data result is 87.46% that is equal to the medical statement.
J. Pradeep Kandhasamy et.al.	2015	classifier models	To predict diabetes using data mining techniques the comparison of algorithms is used. With diabetes mellitus to classify patients, it compared the machine learning classifiers (J48 Decision Tree, K-Nearest Neighbors, and Random Forest, Support Vector Machines). From UCI machine learning data repository with data samples downloaded these approaches have been tested. The exhibitions of the calculations have been measured in both the cases i.e dataset with boisterous information (before pre-handling) and dataset set without uproarious information (after pre-preparing) and thought about as far as Accuracy, Sensitivity, and Specificity.

Klaus Donsa et.al.	2015	computerized decision support and machine learning	To personalize diabetes therapy the relevant parameters are covered in this paper, it explains the role of machine learning and how CDSS can support the therapy process in the context. Furthermore, with focus on machine learning technology and decision support system for the personalization of diabetes therapy, it identified open problems and challenges.
Kamadi V.S.R.P. Varma et.al.	2014	A computational intelligence approach	To predict the occurrence of diabetes disease this paper aims at developing a decision tree model. With crisp boundaries, the traditional decision tree algorithms have a problem. With the use of the fuzzy decision boundaries from these clinical data sets the much better decision rules can be identified. In the construction of a decision tree, the key step is the identification of split points and using the Gini index the best split points are identified in this paper. By identifying false split points to minimize the calculation of Gini indices a method is proposed and Gaussian fuzzy function is used because the clinical data sets are not crisp.
Bum Ju Lee et.al.	2014	anthropometric measures	By a combination of various measures among Korean adults the fasting plasma glucose (FPG) status is predicted and that is used in the diagnosis of type 2 diabetes. In this study, a total of 4870 subjects (1915 males and 2955 females) participate. Using two machine-learning algorithms the predictions of FPG status using individual versus combined is compared, based on the 37 anthropometric measures.
Longfei Han et.al.	2015	ensemble learning approach	to screen diabetes the support vector machines are utilized in this paper and added the ensemble learning module, which is useful for solving imbalance problem and turn the "black box" of SVM decisions into comprehensible and transparent rules. With weighted average precision 94.2% and weighted average recall, 93.9% for all classes the CHNS data show that the proposed ensemble learning method generates rule sets. Moreover, for diagnosis of diabetes and it supports a second opinion for lay users a tool is provided by the hybrid system.
Phyo Phyo San et.al.	2014	Evolvable rough-block-based neural network	Using rough sets concepts and neural computing for decision and classification purposes this paper focused on the hybridization technology. To partition the inconsistent (random) part and input signal to a consistent (predictable) part the lower region and boundary region are defined, based on the rough set properties. To deal with the boundary region the neural network is designed. The different characteristics of the neural network (NN) applications owe, the optimal solution is not given by the same structure of conventional NN.
Arpneek Kaur et.al.	2014	Artificial Intelligence	Artificial intelligence techniques are ending up noticeably extremely famous in medicinal applications because of high unwavering quality and ease. From the previous decades, Artificial Intelligence systems, for example, Artificial Neural Networks, Fuzzy Expert Systems, Mechanical autonomy and so on have found an expanded utilization in ailment determination, persistent observing, ailment chance assessment, foreseeing the impact of new medications and automated treatment of surgeries.
Ross KK Leung et.al.	2013	a multi-staged strategy	In a forthcoming companion of sort 2 diabetic patients, it chose 119 subjects with DKD and 554 without DKD at enrolment and after a middle follow-up time of 7.8 years for model preparing, testing and approval utilizing seven

			machine learning techniques (incomplete slightest square relapse, the grouping and relapse tree, the C5.0 choice tree, irregular backwoods, guileless Bayes grouping, neural system and bolster vector machine). It utilized 17 clinical traits and 70 single nucleotide polymorphisms (SNPs) of 54 competitor qualities to fabricate distinctive models. The top properties chosen by the best-performing models were then used to manufacture models with execution practically identical to those utilizing the whole dataset.

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