

Integration of IoT and MLA In Prediction of Diabetes : An Overview

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ABSTRACT

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A Healthcare system that employs modern computer techniques is the most investigated area in Research. For many years, researchers in the disciplines of Healthcare have collaborated to improve such systems technologically. A number of Internet-based apps on diabetes management have been proposed as a result of rapid developments in wireless and web technology. According to a recent World Health Organization Survey the number of persons affected with diabetics has increased. Diabetes chronic symptoms are the most common Health Problems. Large volumes of medical data are being created. These patients' health data should be recorded and preserved so that continual monitoring and technology advancements can be used to interpret, learn, and anticipate. Internet of Things (IoT) is used to implement numerous applications. IoT can be used in numerous domains, like the health surveillance system of patients. Various successful machine learning methods can be used to forecast diabetes, allowing people to avoid it and receive treatment as soon as possible. Different machine learning classification algorithms for diabetes are investigated in depth in this work. Machine learning algorithms applied on the diabetes data set include K-Nearest Neighbor (KNN), Random Forest (RF), Decision Tree (DT), Support Vector Machine (SVM), Naive Bayes (NB), and others.

Keywords : Diabetes, K-Nearest Neighbor (KNN), Random Forest (RF), Decision Tree (DT), Support Vector Machine (SVM), Naive Bayes (NB).

I. INTRODUCTION

Diabetes is now one of the world's most life-threatening diseases. Diabetes is growing more frequently in India, with millions of individuals suffering from the disease. Diabetes mellitus is a

serious healthcare problem in India that could reach epidemic levels, and its many complications can cause a slew of problems for patients. The incidence of diabetes has risen dramatically in the last four decades and is anticipated to rise considerably more in the coming decades. The disease currently has no solution,

and if patients are not closely watched and given the appropriate treatment at the appropriate time, it can lead to death. The Internet of Things (IoT) is being hailed as a game-changer in the healthcare business, and the goal of this article is to evaluate and investigate how IoT technology and solutions might improve people's quality of life and assist those living with chronic diseases. Diabetes is a thoughtful health disease that affects persons of all ages and produces a variety of problems. Diabetes is highly visible in all parts of India, and it is mainly affecting India on a huge scale. Many studies are being conducted at various levels to predict diabetes in advance and to decrease the occurrence of diabetes increase in the coming years. [1]Diabetic patient technological solutions, especially when combined with Internet of Things (IoT) devices, play an important role in keeping track of a patient's health. Diabetic patient monitoring systems essentiall yallow people with diabetes to be monitored and data about their blood glucose levels, body temperature, and location to be saved. This technology can do more than just observe patients.

Diabetes is a long-term condition in which blood glucose stages are unusually high due to the absence of insulin, which helps the body control blood sugar levels. Type 1 and Type 2 diabetes are the two maximum common types of diabetes. Type 1 diabetes is a serious illness in which the body's ability to make insulin is impaired. Type 2 diabetes is the maximum common kind of diabetes in the world; it is insulin resistant or insulin deficient. Blood sugar levels are too high can create major, often life-threatening health problems by mutilating the eyes, kidneys, and nerves of patients, as well as causing heart disease and stroke. Type-2 diabetes is more frequent; around 90-95 % of persons with diabetes must type-2 diabetes.

Patients through Type-2 Diabetes Mellitus experience diabetes due to atypical cell responses. This type of diabetes is most common in those with a high BMI or

who lead an inactive lifestyle [2]. Chronic hyperglycemia and the body's inability to manage blood sugar levels are the hallmarks of diabetes type 2, which accounts for 90 percent of all diabetes cases [3]. Diabetic complications can be caused by several causes. Typical urbanization-related behavior is one of the contributing factors. Even physical movement and a fit diet, according to most studies, can help avoid type 2 diabetes. As the symptoms may occur very gradually, it can be more difficult to spot the indicators of type 2 diabetes mellitus. Type 2 diabetes mellitus is more frequent in urban areas than in rural areas [4].

Predicting diabetes earlier will assist to control such a disease and save lives, according to the researchers. It's difficult to forecast diabetes at an initial period using various machine learning algorithms, which is why a lot of research is being done in this field. Predictive models are created by combining the data sets from several diagnostic centers to create these algorithms. As a result of this study, the Pima Indian Diabetes data set was used to review the many types of diabetes patient prediction algorithms and approaches [3]. Health monitoring system basedon the Internet of Things (IoT) as well as a diagnostic forecasting tool for diabetic patients. This system gives you real-time blood sugar measurements as well as data about your blood sugar levels. It checks blood sugar levels on a routine basis. Rising blood sugar and significant glucose fluctuations are avoided[5]Diabetes is one of the world's most prevalent health issues. We believe that early diabetes detection helps to improve diagnosis and treatment for this purpose, we want to develop an automatic blood glucose measuring system (SMS), which can be transmitted to the doctor via a short message service [6].

II. DIAGNOSING DIABETES TYPES

Diabetes is a term used to describe a class of metabolic illnesses considered by high blood sugar levels. In the

human body, high blood sugar levels are caused by two factors: the pancreas does not crop sufficient insulin and the cells do not respond to it. Therefore, this is a disorder that occurs in the human body due to insufficient insulin [7]. Diabetes mellitus occurs in many methods, with diabetes insipidus, which is an infrequent form of the disease. Diabetes occurs when the pancreas does not crop sufficient insulin, or when the cells of the body do not respond effectively to the insulin that is provided. Diabetic Mellitus can be categorized into three types.

Type1: Diabetes mellitus (DM) is a kind of diabetes that was previously known as "insulin-dependent diabetes mellitus" (IDDM). Diabetes is produced by the failure of the pancreas, which is unable to create the necessary insulin. Type 1 diabetes has no recognized causes. Type 1 diabetes mainly affects kids and youths below the 20th age. The major impacts of type 1 diabetes are to impair the body's pancreatic cells' ability to function. In type-1 diabetes, the body crops no insulin, causing the patient to suffer throughout their lives and rely on insulin injections. Type 1 diabetes patients can preserve their health by exercising regularly and consumption a healthy food [8].

Type2: It is a disease in which diabetics oppose the occurrence of insulin in the body, or when cells fail to recognize insulin as appropriate. Insulin making in the body reductions as the illness grows. Previously, this condition was mentioned to as "non-insulin-dependent diabetes mellitus" (NIDDM) or "adult-onset diabetes." Excessive body weight is a major cause of this disease, hence the regular exercise is essential [9].

Gestational diabetes: It is the third type, and it happens when a expectant woman has high blood sugar levels without a history of diabetes. According to research, approximately 18 % of pregnant women suffer from this form of the disease. Gestational diabetes develops when a pregnancy is conceived at an older age.

III. TYPE 2 DIABETICS IN DATA MINING

Type 2 Diabetes, also recognized as Non-Insulin Dependent Diabetes Mellitus (NIDDM) or Adult-Onset Diabetes Mellitus, is a chronic condition. The patient produces enough insulin, but it is unable to be utilized by the body due to the cells' lack of insulin sensitivity. Type II disorder affects the majority of people over the 40th age. The diabetic base has devastating consequences for chronic diabetics, as it causes a variety of issues. Diabetes patients frequently have a loss of sensation in their feet, and even a minor injury can result in an infection that is problematic to treat. Due to nerve damage and restricted blood flow, 15 percent of diabetic patients develop foot ulcers. Diabetes impairs a person's ability to see, as well as causing common blindness and cataracts in diabetics. In India, more than 50,000 leg amputations are performed each year owing to diabetes. [10].

IV. RELATED WORK

Many studies in the domain of diabetic prediction have been performed using various classification algorithms and the available medical data set. By choosing currently published papers from many electronic databases, this research aims to review various classification techniques for predicting diabetes.

FardinAbdali-Mohammadi[2020][11] proposed a new Cloud and IoT-based healthcare plan to track the severity of serious diseases and diagnose them quickly. Here's a working framework. . A semantic method for disease diagnosis is presented in this context. Diabetes is one of these disorders, as is medical information related to the University Library of the United States. A new classification technique based on fuzzy neural networks is also provided for those with severe diabetes. The results propose that the proposed method is extra effective than current diabetes diagnosis methods and systems.

When Pau Herrero [2019][12] presented the BiAP, it was a hybrid adaptive closed-loop switch scheme that was directly implemented in hardware to deliver an entrenched low-power solution within a dedicated handheld device proposed the Bio-inspired Artificial Pancreas (BiAP), a cross adaptive closed-loop switch mechanism built on beta-cell working and applied directly in hardware to deliver an embedded low-power solution in a dedicated portable device. The BiAP system has a unique adaptive bolus calculator that works in tandem with the closed-loop switch to improve postprandial glycemic control. This learning focuses on the most recent advancements in the BiAP system and its use in the home.

Samira Akhbarifar [2020][13] presents a remote health checking strategy that advantages secure IoT data management for early diagnosis of hypercholesterolemia, hypertension, and heart disease using data mining algorithms. For ten-fold cross-validation, experimental results demonstrate that the K-star classification approach, with 95 percent accuracy, 94.5 percent precision, 93.5 percent recall, and 93.99 percent f-score, produces the best results between Rural Family Medicine Locum Program RFMLP, SVM, and J48 classifiers. To stop high blood sugar and important glucose variations.

Amine Rghioui [2019][14] proposed. The system generates an exact outcome. To predict glucose levels in diabetic patients, the collected and stored data will be classified using multiple classification methods. The key benefit of this approach is that the blood glucose level is reported promptly and can be changed.

Munish Bhatia [2020] [15] describes a comprehensive approach for detecting and predicting urine-based diabetes at home (Ubd). The four levels of the suggested system are the Diabetic Data Classification (DDC) layer, Diabetic Data Acquisition (DDA) layer, Diabetic Mining and Extraction (DME) layer, and

Diabetic Prediction and Decision Making (DPDM) layer. Based on the temporal properties of Ubd parameters, a Recurrent Neural Network has been constructed for efficient prediction analysis (DIM).

V. DIABETES PREDICTION USING MACHINE LEARNING

A. SVM Classifier

SVM Classifier is a supervised learning algorithm for linear and non-linear data. In order to create a function that may be used to display new data, you must first examine the data. Two classes of data are separated using a hyperplane in SVM.

Ayman Mir [2018] [16] used WEKA to test four classifiers based on machine learning methods: Naive Bayes, Support Vector Machine, Random Forest, and Simple CART. Associated with other methods, SVM gave an accuracy of 79.13 percent in diabetes prediction.

D. Jeevanandhini [2018] [17] Uses KNN, SVM, J48, and Random Forest for diabetes prediction. SVM method has the highest accuracy of 77.9% among several data mining methods, according to experimental results.

Harwinder Kaur [2019] [18] investigates the feasibility of developing a diabetes disease prediction system. The use of an SVM Classifier to predict diabetes was proposed in this paper, and the experimental results showed 75.3 percent accuracy.

Hasan T Abbas [2019] [19] used non-linear SVM to create a model to predict type 2 diabetes, with variables derived from the OGTT. Using an SVM classifier, it was able to predict Type 2 diabetes with an accuracy of 96.80%. The work that is being proposed by

AbdulahkimSalum Hassan [2020] [20] demonstrates a study employing the Pima Indian Diabetic Data Set to predict diabetes using classification approaches such as Decision Tree, KNN, and SVM. The experimental result showed a 90.23 percent accuracy in diabetes prediction, which is better than the additional two approaches.

FaranakKazerouni [2020] [21] Proposed a model for predicting type 2 diabetes by several datamining approaches, as well as comparing the performance of these algorithms. The SVM system had a 95% accuracy rate in calculating Type 2 diabetes mellitus.

B. KNN Classifier

As a supervised classification technique, K-Nearest Neighbor categorizes fresh data or cases based on a comparison metric. Data points are identified and classified, and a fresh sample's categorization is predicted. The proposed work Madhuri Panwar [2016] [22] utilized the K-Nearest Neighbor classifier to diagnose diabetes and attained 100% accuracy by reducing features in D3.

Sreeja Vishaly Ma [2017] [23] displays a study on predicting type 2 diabetes using the weighted KNN algorithm, and the experimental results are compared to other methodologies, with the weighted KNN technique achieving an accuracy of 80.12%.

Sara [2019] [24] compared the effectiveness of seven classification algorithms in predicting diabetes mellitus and found that KNN had a higher accuracy of 99.0 percent than the other algorithms.

C. Random Forest

Random Forest is a tree classifier made out of a variety of decision trees of various sizes. It determines the dependent variable class based on a huge number of trees. When developing a tree, it takes a random sample of train data and then selects a decision based on the results of the majority of the decision trees.

Debadri Dutta [2018] [25] Developed a perfect to predict diabetes using three classifiers: LR, SVM, and RF, with the Random Forest algorithm being the best at predicting diabetes with an accuracy of 84 %. Quan Zou [2018] [26] employed three classifiers, DT, RF, and NN, to predict diabetes mellitus using PCA and mRMR, and all experiments reveal that utilizing mRMR offers better results than PCA, with Random Forest classifier achieving 80.80% accuracy in predicting diabetes. Sofia Benbelkacem [2019] [27] uses a random forest model to predict the accuracy of diabetes diagnosis using Pima Indian data, and the results reveal that a Random Forest classifier is additional efficient than other machine learning techniques. The study on Random Forest algorithm in Diabetes Prediction is related to the work on Random Forest algorithms in Diabetes Calculation. VijiyaKumar [2019] [28] Using the RF algorithm, developed a high-accuracy early diabetes prediction system for patients. Amani Yahyaoui [2019] [3] used machine learning and deep learning algorithms to predict diabetes at work, and the overall results suggest that Random forest has an accuracy of 83.76 percent in predicting diabetes.

D. ANN Classifier

A systematic info dispensation system is an Artificial Neural Network. It works in the same way as the human brain works. ANN is a directed link that connects the assembly of nodes with their structure. Each connection link has weights connected with it that include info around the input.

Srivastava, Suyash [2018][29] Using multiple classification algorithms, proposed a web-based strategy for predicting diabetes disease. On the Pima Indian diabetes data set, ANN achieved 82.35 percent accuracy using the min-max scaling strategy.

Kumar Protab Saha [2019] [30] A model based on Artificial Neural Networks was proposed, and this

model is suitable for predicting diabetes with a 92% accuracy.

Nitesh Pradhan [2020] [31] Proposed a model based on three algorithms, with the result that ANN surpasses the other techniques with a 75.7 percent accuracy.

E. Naive Bayes Classifier

The classification process of NB algorithm is based on probability. It utilizes Bayes' theorem to predict the occurrence of any given event. K.Priyadarshini [2018] [32] calculating diabetes mellitus was proposed using three classification methods: RF, NB, and NB-Tree. When compared to other methodologies, it was discovered that Naive Bayes had a high accuracy of 76.3 percent. Krish Shah [2020][33] created a perfect for predicting diabetes early on utilizing three classification methods: SVM, Decision Tree, and Naive Bayes, with the Naive Bayes classification achieving 76.3 percent accuracy when compared to other algorithms.

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