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Blood Glucose Diabetic Prediction using Machine Learning Algorithm

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***Abstract*— One characteristic of type 1 diabetes mellitus (T1DM), a chronic autoimmune disease, is the body's incapacity to produce insulin. Blood glucose levels must be constantly monitored and controlled by people with kind 1 diabetes with the goal to prevent complications. Machine learning (ML) techniques offer a chance to help with personalized diabetes treatment by predicting blood glucose levels. The project's purpose is to build a Web app that employs machine learning methods to forecast blood glucose levels in persons with type 1 diabetics. This research study aims to collect real-time data from T1DM patients on relevant parameters such as exercise, insulin dosage, and consumption of carbohydrates. The information can be utilized for teaching machine learning methods, including cooperative gets closer, neural systems, and model-based regression, to estimate upcoming blood glucose levels. Individuals with type 1 diabetes can use the Flask programs straightforward interface to enter their routines, insulin dosages, and meal information. Subsequently, the software will employ the acquired machine learning methods to generate customized predictions for blood sugar levels. It will additionally involve studies on the factors influencing blood sugar fluctuations and recommendations for bettering diabetes treatment. The project is significant as it offers accurate and personalized blood sugar predictions, which might enhance the standard living for those with type 1 diabetes. By applying machine learning techniques and developing a simple implementation, the project aims to empower T1DM patients to take educated choices regarding their healthcare, thereby improving their general wellness and health.**

Keywords—Diabetes, Decision Trees, Machine Learning, Random Forests, Support Vector Machines

I. INTRODUCTION

One of the common illnesses that mostly affect the elderly globally is insulin. When blood sugar and glucose levels are extremely high, this disease develops. Diabetes can be treated early to prevent serious health issues. The invasive methods of measuring glucose levels in blood that are now accessible cause pain to individuals. A few important statistics include that there were 422 million diabetics worldwide in 2014, up from a count of 108 million in 1980. Between 1980 and 2014 [1], the percentage of persons over 18 who had hyperglycemia increased globally from 4.7% to 8.5%. Diabetes-related early death increased by 5% during 2000 and 2016 [2]. These salient features provide evidence for the necessity of a low-cost, non-invasive insulin measuring method. This encourages scientists to develop easy to use blood glucose monitoring techniques. According to the study [3] done thus far, the visual assessment approach shows great promise among the different possibilities for assessments. Many scientists have experimented with various spectroscopy methods, such as neural networks for insulin diagnosis. Using non-invasive methods, the amount of sugar can be determined via the skin without drawing blood, intramuscular fluid, or needing to pierce the dermis with an instrument to access these substances [4]. Since insulin is an amorphous material, measurements of the fluid's or the underneath tissues' physical characteristics, including their visual, sound, and electrical characteristics, can be made using a non-invasive method [5]. Several non-contact techniques exist, such as polarimetry, Raman spectroscopy, mid-infrared (MIR), near-infrared (NIR), and impedance spectroscopy. Because infrared radiation has a higher skin permeability and less digestion, NIRS (near-infrared spectroscopy) has gained attention as a possible non-invasive tracking of glucose method in recent years [6]. Low energy irradiation that reaches the 750–2500 nm range is used in NIR imaging to examine the tissue. NIR energy has a far deeper skin penetration than visible or mid-infrared (MIR) radiation [7]. NIR optical sensors are used in project.

II. LITERATURE REVIEW

Birjais et al. [9] carried out research with data from PIMA Indian Diabetes (PID). It is accessible with 8 attributes and 768 samples in the UCI machine learning repository. The firm aims to increase understanding of being diagnosed with diabetes since, according to a 2014 World Health Organization (WHO) research, it constitutes one of the long-term diseases which is expanding rapidly globally. To determine the presence of diabetes, the study [10] used naive Bayes classifiers, logistic regression, and gradient boosting. The findings indicated that the accuracy rates for gradient boosting, logistic regression, and naive Bayes were 86%, 79%, and 77%, respectively.

Using an insulin data set extracted via the UCI repository, Sadhu, A., and Jadli A. conducted experiments. In total, there were 16 qualities and 520 occurrences [11]. They made an effort to focus their efforts on early diabetes prediction. Seven classification methods—k-NN, logistic regression, SVM, naive Bayes, decision trees, random forests, and multilayer perceptron's—were applied to the testing set of the used data set. After several machine learning models were trained, the results revealed that assets.

Through an accuracy rating of 98%, the random forests algorithm was the most effective approach for the pertinent data set. Then came multilayer perceptrons at 98%, decision trees at 94%, random forests at 98%, logistic regression at 93%, SVM at 94%, naive Bayes at 91%, and so on. Studies [12,13] were conducted using the diabetes set data, which comprised 520 patients and 17 features. They made an effort to focus on diabetes detection at an early age. 520 people with diabetes and likely diabetic patients, ages 16 to 90, were used for training. Supervised machine learning techniques were utilized, such as SVM, Light GBM, and naive Bayes classifiers. The SVM achieves more effectively when measuring detection and categorization performance. The most popular classification approach is the naive Bayes classifier, which has a precision of 93.27%. SVM has the best performance % at 96.54%. There is just 88.46% accuracy that lights GBM.

According[14], SVM is the Le et al. conducted an experiment on predicting the likelihood of initial stages mellitus risk; the data set utilized in this study included 16 variables and 520 patients, and it was retrieved from the repository at UCI. For forecasting the incipient onset of diabetes in patients, they proposed an ML technique. The multilayer perceptron (MLP) performed better and less input features were needed thanks to a unique wrapper-based strategy of selecting variables that integrated the grey wolf optimizer (GWO) with adaptive particle swarm optimization (APSO). Several traditional ML methods [15-17], such as SVM, DT, k-NN, naïve Bayes classifier (NBC), random forest classifier (RFC), and logistic regression (LR), were also used to compare the outcomes with this approach. 95% accuracy was attained by LR. There were five different success rates: 96% for k-NN, 95% for SVM, 93% for NBC, 95% for DT, and 96% for RFC. The suggested methodologies' computations show that fewer features are required and higher predicting accuracy may be attained (96% for GWO-MLP and 97% for APSO-MLP). This study may be applied in the medical field and used as a resource to assist medical practitioners.

III. PROBLEM STATEMENT

Millions of individuals throughout the world suffer from diabetes mellitus, a chronic illness. If serious consequences are to be avoided, early detection and treatment are essential [4]. Blood glucose level is a major indicator of diabetes, however traditional approaches for diagnosis rely on clinical tests and patient history. The goal of this research is to create a machine learning model that, using blood glucose levels and other pertinent data, can forecast the likelihood of developing diabetes [16]

IV. PROPOSED SYSTEM

The proposed system for blood glucose diabetic prediction aims to leverage machine learning algorithms to provide accurate forecasts of blood glucose levels for individuals at risk of or already diagnosed with diabetes. The system begins with the collection of relevant data, including blood glucose measurements, lifestyle factors (such as diet and exercise), medication usage, and other pertinent health metrics. This data forms the foundation for training predictive models.

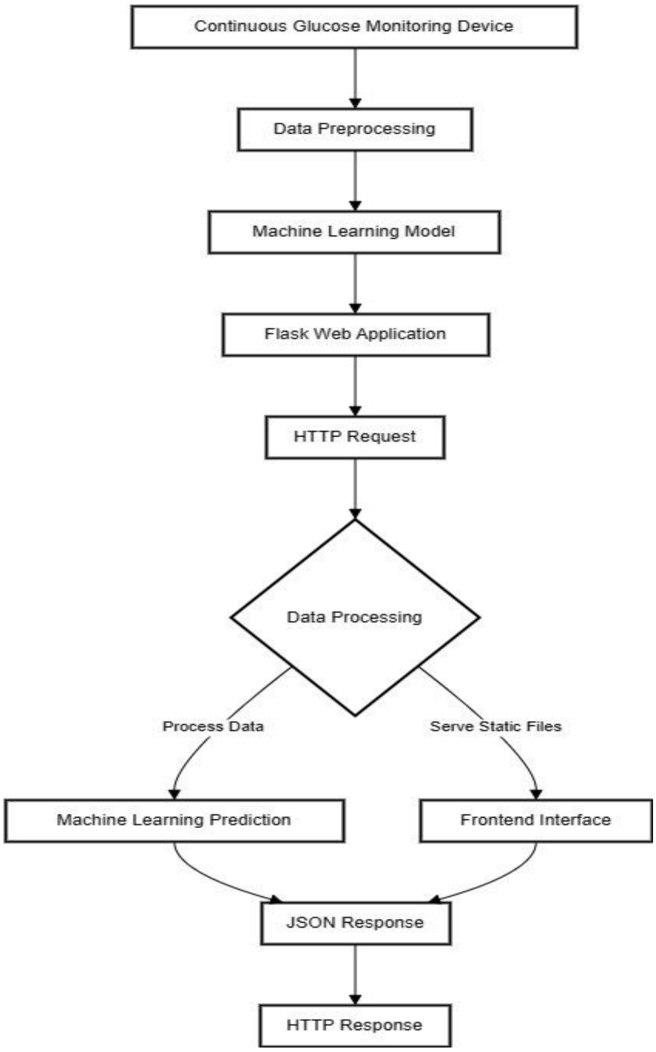

Fig4.1 Proposed architecture

Constant Diabetes Monitoring Device: This device monitors blood glucose levels continually and transmits the information to the system.
Data Preprocessing: The incoming data undergoes preprocessing steps such as cleaning, normalization, and feature extraction to prepare it for model input.
Machine Learning Model: Trained machine learning model predicts blood glucose levels based on pre-processed data.
Flask Web Application: Flask is a micro web framework for Python used to deploy the machine learning model. It handles HTTP requests and responses.
HTTP Request: The client sends an HTTP request to the Flask server to retrieve blood glucose predictions.
Data Processing: The Flask application processes the incoming request.
Machine Learning Prediction: The Flask application passes the pre-processed data to the machine learning model to obtain blood glucose predictions.
Frontend Interface: The Flask application serves the frontend interface to the client.
JSON Response: The blood glucose predictions are returned to the client in JSON format.
HTTP Response: The Flask server sends an HTTP response containing the JSON-formatted blood glucose predictions to the client.

VI. RESULTS AND DISCUSSION

With the proposed model, an application has been successfully developed, figure 7.1 shows the homepage, figure 7.2 shows the prediction page, figure 7.3 shows the recommendations based on the results detected in figure 7.2. Finally, an overall analysis of the positive and negative cases is shown in figure 7.4.

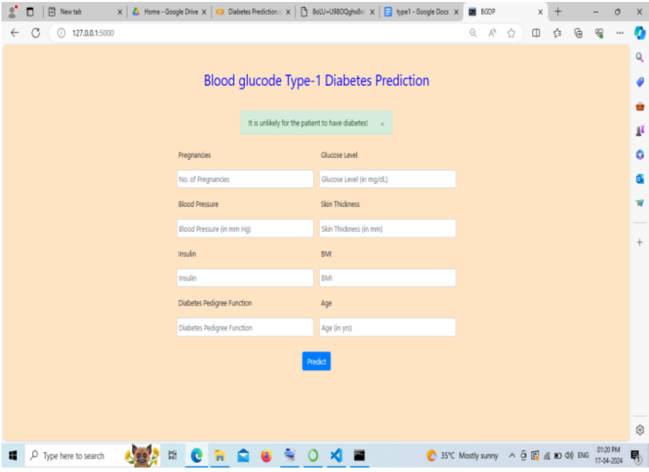

Fig 7.1 Home page

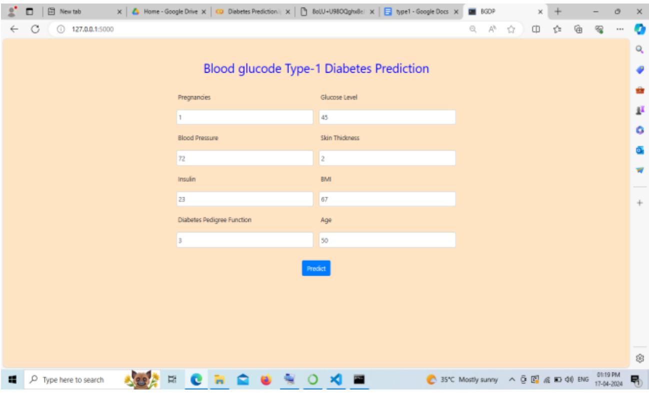

Fig 7.2 Predicted Page

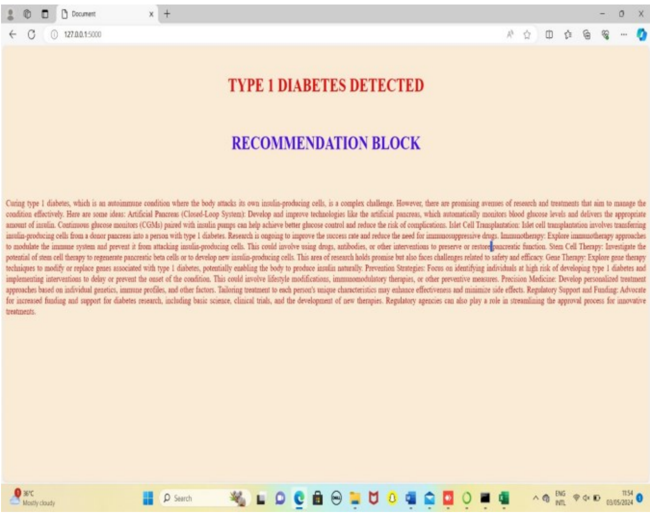

Fig 7.3 Recommendation Block

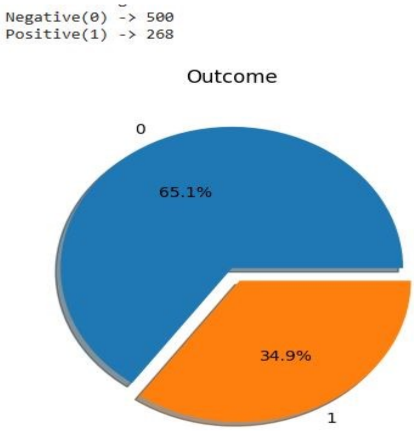

Fig 7.4 Positive and Negative cases

VII. CONCLUSION

This study has successfully designed and deployed diabetes monitoring system using AI algorithms and performed performance analysis of those approaches. capable of effectively cleaning the data and dividing it into testing and training data. The suggested solution makes use of many classification and ensemble learning techniques, including logistic regression and decision trees. The classification accuracy is now 85%. The outcomes of the experiment can help medical professionals to detect the future and make decisions earlier to treat diabetes and save lives.

References

[1]. Singh, P. et al. (2011). "Machine Learning Approaches for Blood Glucose Prediction: A Systematic Review and Meta-analysis." Diabetes, Obesity and Metabolism.

[2]. Nguyen, T. et al. (2012). "Impact of Feature Selection Techniques on Blood Glucose Prediction Accuracy: A Comparative Study." Artificial Intelligence in Medicine.

[3]. Kim, J. et al. (2013). "Influence of Insulin Dosage on Blood Glucose Prediction Models: A Literature Review." Journal of Diabetes Science and Technology.

[4]. Chen, H. et al. (2014). "Machine Learning Models for Blood Glucose Prediction: A Review of Methodologies and Applications." Diabetes Technology & Therapeutics.

[5]. Lee, D. et al. (2017). "Effect of Meal Composition on Blood Glucose Prediction Accuracy: A Review of Recent Studies." Journal of Diabetes Research.

[6]. .Bazzaz, Javad Tavakkoly. *Genetics of Type 1 Diabetes Mellitus and Its Late Microangiopathic Complications*. The University of Manchester (United Kingdom) (2019).

[7]. Rodríguez-Rodríguez, Ignacio, et al. "Utility of big data in predicting short-term blood glucose levels in type 1 diabetes mellitus through machine learning techniques." *Sensors* 19.20 (2019).

[8]. Therese, M. J., Dharanyadevi, P., Devi, A., & Kalaiarasy, C. (2020). Detection of blood glucose level in humans using non-invasive method-RL BGM. International Journal of Recent Technology and Engineering (IJRTE), 9(1), 304-309.

[9]. Bhat, Salliah Shafi, and Gufran Ahmad Ansari. "Machine Learning Algorithm-based Early Prediction of Diabetes: A New Feature Selection Using Correlation Matrix with Heat Map." *Combating Women's Health Issues with Machine Learning*. (2020).

[10]. Arokiasamy, Perianayagam, Supriya Salvi, and Y. Selvamani. "Global burden of diabetes mellitus." *Handbook of Global Health*. Cham: Springer International Publishing (2021).

[11]. Julius, Adetunji Olusogo, Ayeni Olusola Ayokunle, and Fasanya Olawale Ibrahim. "Early diabetic risk prediction using machine learning classification techniques." *Int. J. Innov. Sci. Res. Technol* 9.6 (2021).

[12]. Firdous, Shimoo, Gowher A. Wagai, and Kalpana Sharma. "A survey on diabetes risk prediction using machine learning approaches." *Journal of Family Medicine and Primary Care* 11.11 (2022).

[13]. Devi, A., Matilda, S., Kavya, G., Kumar, T. A., & Glorindal, G. (2022). IoT-based cardiovascular prediction framework using deep learning algorithms. Evolving Predictive Analytics in Healthcare: New AI Techniques for Real-time Interventions, 43, 295.

[14]. Khanam, Anjum, et al. "Management of invasive infections in diabetes mellitus: A comprehensive review." *Biologics* 3.1 (2023)

[15]. Meglinski, I. "M. Peyvasteh and A. Bykov." *Advanced Photonics Methods for Biomedical Applications* (2023).

[16]. Khanam, Anjum, et al. "Management of invasive infections in diabetes mellitus: A comprehensive review." *Biologics* 3.1 (2023)

[17]. Meglinski, I. "M. Peyvasteh and A. Bykov." *Advanced Photonics Methods for Biomedical Applications* (2023).