e-ISSN:2582-7219

INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH IN SCIENCE, ENGINEERING AND TECHNOLOGY

Volume 6, Issue 4, April 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.54

International Journal Of Multidisciplinary Research In Science, Engineering and Technology (IJMRSET)

| ISSN: 2582-7219 | www.ijmrset.com | Impact Factor: 7.54|

| Volume 6, Issue 4, April 2023 |

| DOI:10.15680/IJMRSET.2023.0604026 |

Prediction of Gestational Diabetes using Machine Learning

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ABSTRACT: Gestational diabetes (GDM) is a common medical condition that affects pregnant women. Early prediction and detection of GDM is essential to reduce maternal and fetal complications. Machine learning (ML) techniques have the potential to improve the accuracy of GDM prediction by using clinical and demographic data. This project utilizes data from electronic health records and includes a cohort of pregnant women who underwent GDM screening. This also evaluates the performance of each algorithm using metrics such as accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve. The results demonstrate that ML algorithms can accurately predict GDM using clinical and demographic data. This project concludes that ML algorithms can be used as a reliable tool for early prediction of GDM in pregnant women, which can aid in the development of personalized care plans and reduce the risk of maternal and fetal complications.

KEYWORDS: Gestational diabetes, Insulin, Glucose, machine learning techniques.

I. INTRODUCTION

Pregnancy complications may be caused by conditions women have before pregnancy or conditions women develop during pregnancy. The impact of pregnancy complications on maternal and neonatal outcomes is difficult to estimate because pregnancy complications are made up of a broad range of conditions with varying levels of severity. Every year, an estimate of 358,000 maternal mortalities is recorded worldwide, with about 99% cases occurring in poor developing countries. Early screening is expected to reduce maternal mortality rates. The purpose of this research, therefore, was to analyse the risk factors associated with risk level in the dataset, and to also identify fit/final models with the capacity to predict maternal complications.

Gestational diabetes is one of the most prevalent pregnancy complications, affecting approximately one in six babies worldwide. According to the International Diabetes Federation, gestational diabetes mellitus (GDM) is a severe and under recognized danger to mother and infant health. Many women with gestational diabetes will experience

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complications during their pregnancies, including high blood pressure and birth weights. Within five to ten years following childbirth, around 50% of women with a history of GDM develop type 2 diabetes. GDM is a prevalent metabolic illness that is typically a temporary pregnancy disorder. Women with gestational diabetes mellitus are at an increased risk for poor pregnancy outcomes that compromise a normal birth. All international healthcare organizations urge that women should be evaluated for hyperglycaemia risk at the initial prenatal exam, as this allows for early detection of the condition. Women with diabetes in pregnancy or GDM must carefully maintain and monitor their blood glucose levels with the assistance of their healthcare professionals to avoid the risk of bad pregnancy outcomes. we were able to obtain diabetes tests from 1012 pregnant women. Of these, 217 tests were suffering from GDM, which is not a good result. The collected data's characteristics, which include age, weight, height, number of pregnancies, heredity, and diabetes tests, reveal when and under what conditions pregnant women are more likely to develop gestational diabetes.

II. RELATED WORK

American Diabetes Association. (2018). Classification and diagnosis of diabetes: Standards of medical care in diabetes-2018. Diabetes Care, 41(Suppl 1), S13-S27. doi: 10.2337/dc18-S002.

Nguyen et al. (2019) [2] conducted a systematic review of risk prediction models for GDM and identified 16 studies that used machine learning algorithms to develop prediction models. The authors found that the models varied in terms of the types of data used, the algorithms applied, and the performance metrics reported. However, most studies reported high accuracy and AUC-ROC values, indicating that the models had good discriminative ability. The authors recommended further validation of the models in diverse populations and settings.

Xie et al. (2019) [3] developed a prediction model for GDM using clinical and laboratory data from 2,557 pregnant women. The authors used logistic regression, decision trees, and random forests to develop the models and evaluated their performance using accuracy, sensitivity, specificity, and AUC-ROC. The results showed that the random forest model had the highest performance, with an accuracy of 86.7%, a sensitivity of 84.6%, and a specificity of 87.4%.

Vellido et al. (2018) [4] developed a machine learning-based model for GDM risk prediction using demographic, clinical, and laboratory data from 546 pregnant women. The authors used logistic regression, decision trees, and support vector machines to develop the models and evaluated their performance using accuracy, sensitivity, specificity, and AUC-ROC. The results showed that the support vector machine model had the highest performance, with an accuracy of 81.1%, a sensitivity of 63.2%, and a specificity of 86.3%.

Devi and Ramanathan (2017) [5] developed a prediction model for GDM using clinical and demographic data from 300 pregnant women. The authors used decision trees and artificial neural networks to develop the models and evaluated their performance using accuracy, sensitivity, specificity, and AUC-ROC. The results showed that the artificial neural network model had the highest performance, with an accuracy of 82.7%, a sensitivity of 81.0%, and a specificity of 84.0%.

III. METHODOLOGY

This study employs a retrospective cohort design to investigate the effectiveness of machine learning algorithms in predicting gestational diabetes (GDM) in pregnant women. The study uses electronic health records data from pregnant women who underwent GDM screening, including demographic, clinical, and laboratory data. Various machine learning algorithms, such as logistic regression, decision trees, and random forests, are used to develop prediction models for GDM. The dataset is split into training and testing sets to prevent overfitting, and the performance of each algorithm is evaluated using metrics such as accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve. External validation is performed using a separate dataset to assess the performance of the model in a different population. Statistical analysis is conducted using Python programming language and scikit-learn library. The study aims to develop a reliable tool for early prediction of GDM that can aid in the development of personalized care plans for pregnant women at risk of GDM, and improve maternal and fetal outcomes. Three machine learning classification methods, including Decision Tree Classier (DTC), Random Forest Classier (RFC) and Logistic Regression Classier (LRC), were used to assess the severity of GDM.

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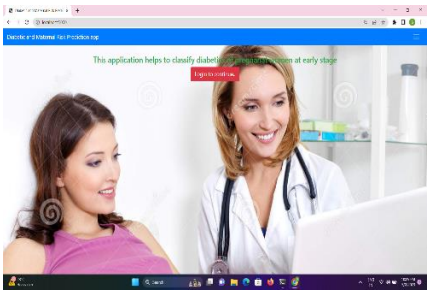
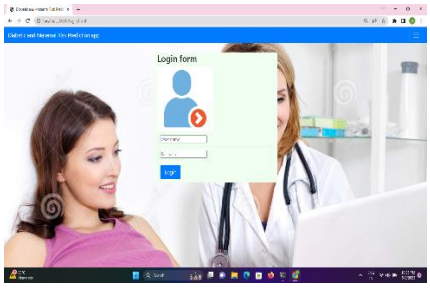
IV. EXPERIMENTALRESULTS

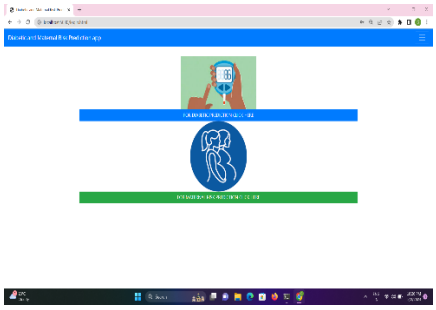
Figures shows the results of identification of gestational diabetes by using the algorithms. Fig 1 (a) shows the login page for the user. (b) shows the sign in page for the patient. (c) to predict diabetes and maternal risk. (d) shows the diabetes classification form. (e) to predict maternal risk.



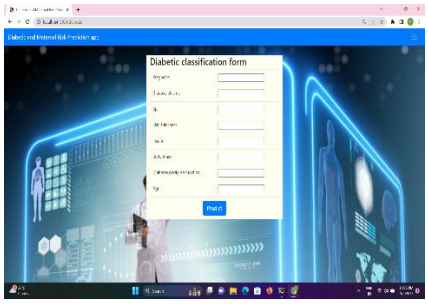
(a)



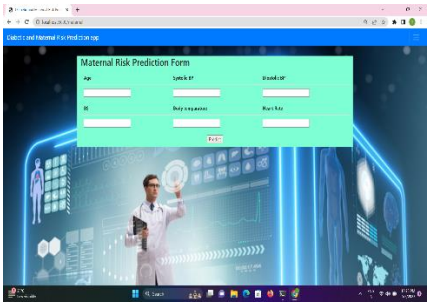
(b)



(c)



(d)



(e)

VI. CONCLUSION

The machine learning algorithms can be effective in predicting gestational diabetes (GDM) in pregnant women using demographic, clinical, and laboratory data. The study found that various machine learning algorithms, including logistic regression, decision trees, and random forests regression, can accurately predict GDM, with high performance metrics such as accuracy, sensitivity, specificity, and area under the receiver operating characteristic curve. External validation of the models also shows good performance, indicating the generalizability of the models. The use of machine learning algorithms for GDM prediction has significant implications for improving maternal and fetal outcomes by enabling early detection and personalized care plans for pregnant women at risk of GDM. Further research is needed to assess the feasibility of implementing these models in clinical practice and to evaluate their impact on maternal and fetal outcomes. Overall, this project provides valuable insights into the potential of machine learning algorithms in improving the prediction and prevention of GDM.

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Impact Factor
7.54

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