Fetal birth weight estimation in high-risk pregnancy through Machine Learning

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Abstract- One of the most serious issues in pregnancy care is the newborn being born underweight, which can harm the infant's health and even result in its death in more extreme circumstances. Because of this illness, The number of infants deaths remains unacceptably high everywhere. Artificial intelligence techniques, especially those based on machine learning (ML), can predict problems with the unborn baby's health early on during the entire gestation, including at birth. As a result, our initiative suggests analyzing several ML approaches that can determine if a fetus would be delivered with less weight than expected for the length of its gestation. The potential for a longer gestation period due to prompt intervention underpins the significance of early detection of issues with fetal development. With such an intervention, it would be possible to increase fetal weight at delivery, which would lead to a reduction in newborn morbidity and death. Therefore, we will anticipate fetal weight at birth in this experiment at an early stage and classify them as low birth weight if they weigh less than 2.5 kg and normal birth weight if they weigh between 2.5 kg and 4.5 kg and above 4.5 kg overweight. To estimate the fetal birth weight, we employed machine learning approaches and algorithms including Linear Regression and Random Forest Regressor, with Random Forest Regressor predicting more correctly than Linear Regression.

Keywords*: Fetal Birth Weight Estimation, Machine Learning, Linear Regression, Random Forest Regressor*

1.Introduction

Today, The birth rate is going up with low birth weights than ever before. Due to an illness known as intrauterine growth restriction (IUGR), the fetus has a lesser height than other embryos of the same gestational age. The baby's physique and organ development are constrained by this condition. Babies with IUGR may experience delivery complications such as hypoglycemia, low oxygen levels, poor Apgar scores, or breathing issues brought on by meconium aspiration. Severe instances may result in fetal mortality or issues with long-term growth. Although it is still very difficult to distinguish between the many kinds of maternal hypertension during the pregnancy-puerperal cycle, this condition is mostly caused by maternal hypertension. In this way, the most severe fetal development abnormalities are caused by chronic arterial hypertension, regardless of its etiology. The healthcare sector is among the fields that has been positively impacted by the application of machine learning methods. A Machine learning , a subset of artificial intelligence, utilizes large volumes of data to spot patterns and trends that human observers would be unable to spot. Incorporating fresh data and learning from experience in this way enables a system to automatically fix settings while improving its capacity to see patterns and make behavioral predictions.

The database's size determines how powerful such systems learning capabilities are. This paradigm enables AI systems to learn, for instance, hundreds of diagnoses and treatment recommendations for the widest range of ailments. Clinicians can enter case characteristics to produce the most likely diagnosis hypotheses when assessing their patients. Through this approach, A machine learning algorithm has the potential to enhance the precision of recommendation outputs for tests and treatments by limiting the number of potential diagnoses in more complicated instances. As a result, ML-based algorithms are an effective tool for guiding the decision-making of the healthcare professional. Using cutting-edge ML techniques, it is feasible to analyse a sizable quantity of data from expectant mothers and give obstetricians and gynaecologists more in-depth knowledge of intra uterine health both during and after pregnancy. Early detection of a low birth weight-related higher risk of problems can support treatment planning as well as can be tailored to each patient's unique needs and risk profiles. Additionally, the healthcare industry tends to stick closely to the Internet of Things (IoT) paradigms for tracking patients using a variety of devices that may communicate information about the clinical state of the patient that requires ongoing tracking. Cloud computing also makes it simple to store data and retrieve it remotely. Therefore, ongoing fetal health monitoring through information and communication technologies can lower mortality and morbidity rates, improving both mother and baby's quality of life.. Predicting the short- and long-term health effects of pregnancy depends on fetal weight. The World Health Organization categorises new-borns into three groups based on their birth weight , including those with low birth weight (LBW, BW 2500g), normal birth weight (NBW, 2500g BW 4000g), and overweight (above 4500g). additionally known as macrosomia. Low birth weight is linked to fetal and neonatal death, stunted development, and long-term disorders in children, such as mental retardation and learning difficulties. Additionally,

macrosomia increases the risk of caesarean section, protracted labour, abnormal haemorrhage, and perineal trauma for mothers. It can also result in infant hypoxia and death. Yonghong Peng served as the assistant editor who oversaw the assessment of this submission and gave final approval for publication. a rise. Long-term risks for macrosomia include obesity, diabetes, and heart disease. It is important to accurately assess fetal weight throughout pregnancy and recognise low birth weight fetuses or macrosomia. Once the risk has been identified, it is possible to decrease maternal or newborn morbidity and death by making the right clinical choices and adopting the necessary safety measures. Therefore, we will anticipate the Newborn weight in the present analysis at an early stage and classify them as low birth weight, normal birth weight, and overweight.

To estimate the fetal birth weight in this case, we employed machine learning approaches and algorithms including Linear Regression and Random Forest Regressor, with Random Forest Regressor predicting more accurately than Linear Regression.

2. Materials and method

This suggests a new technique using the following building components to assist in obtaining a precise and effective working model.

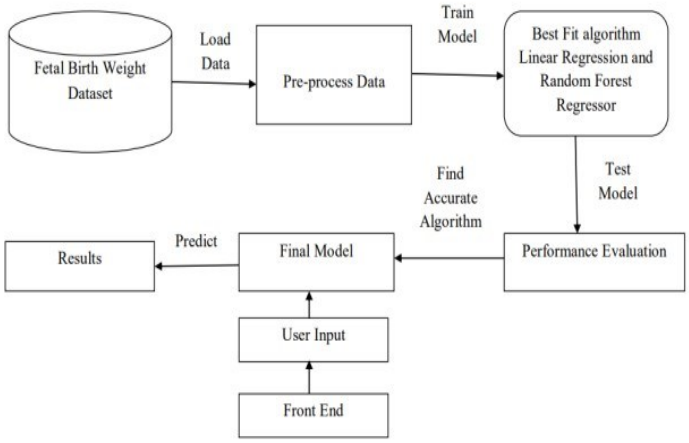


Fig 2.1: System architecture for Fetal Birth Weight Estimation

The dataset containing the birth weight of newborns has been imported. To enhance precision, the data undergoes preprocessing to handle missing values, eliminate redundant records, and perform other necessary cleaning steps. A model for prediction is created using machine learning methods including Linear Regression and Random Forest Regressor. The model is trained using the processed dataset. Using different ML methods, the model's performance is measured and its accuracy is evaluated. The most precise algorithm is then selected and utilized to forecast fetal birth weight for users who submit new input data.

3. Components

3.1 PYTHON

Python is a high-level, interpreted, object-oriented programming language with dynamic semantics. Due to its advanced built-in data types, flexible typing, and dynamic linking, It is a highly appealing choice for fast application development and also functions effectively as a scripting language. Python's clear and simple syntax enhances readability and makes it easy to pick up, which helps reduce the cost of software upkeep. Its support for modules and packages encourages code modularity and reusability within applications. Both the extensive standard library and the Python interpreter are open source and freely available. Python is broadly acknowledged as one of the top-performing programming language for teaching and learning Machine Learning .

3.2 HTML

The code that structures the content of a web page is referred to as HTML (Hypertext Markup Language). Information can be arranged using paragraphs, bulleted lists, images, data tables, and various other elements. HTML is a markup system that defines the organization of your content. It includes a range of components that can be used to surround or contain specific parts of your content to modify their look or behavior.. These surrounding tags can italicize text, adjust font size, create hyperlinks from text or images, and much more.

3.3 Python IDLE

A software development programme is known as an IDE (Integrated Development Environment). IDEs incorporate a number of tools created especially for software development. These tools often consist of: An editor made specifically for handling code (with features like syntax highlighting and autocompletion, for example Tools for building, running, and debugging. Source control of some kind. IDLE is likewise installed by default when Python is set up. A minimal integrated debugger, auto-completion, syntax highlighting, smart indentation, and the Python shell window (an interactive interpreter) are some of its key features. Version 3.6.8 of Python was utilized by us.

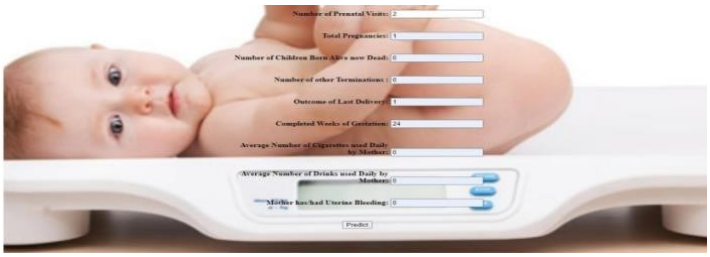
4. Results and Discussion

(i). Login Page

Typically, logging in is done to access a particular webpage, website, or programme that is off-limits to visitors. The login

token can be used to keep track of the user's activities once they have signed in to the website.

(ii). Prediction page



Which predicts the value correctly, so it helps the user to predict the value easily and it even consumes the time. predict the value accurately.

(iii). Final result

The final result shows whether the weight of the baby is low birth weight, normal birth weight or overweight. So, if any issues occur this helps to overcome the problem.

5. Conclusion

In as much as 15% of fetuses, be incorrectly classified as SGA using current ultrasonography criteria for fetal growth evaluation. Growth restriction is a symptom of serious health issues, frequently as a consequence of the fetus not getting the uterus has adequate nourishment or oxygen. Many facts about fetal development and the pathophysiology of its limitation are still poorly understood. A number of models for ultrasonic procedures have been proposed as clinical ideas. But a precise disease detection method, The exact cause remains unidentified. There is broad consensus that the severity increases with the degree of the initial growth limitation.ML approaches are a crucial tool for professionals to use in the early identification of this issue. We introduce a technique for highly precise estimation of fetal birth weight utilizing approaches for machine learning and algorithms. Thus, our project's early predictions of fetal birth weight are classed as low birth weight if the baby weighs less than 2.5 kg and normal birth weight if the baby weighs between 2.5 kg and 4.5 kg. Overweight if the baby's weight is above 4.5kg. To estimate the fetal birth weight, we employed machine learning approaches and algorithms like Linear Regression and Random Forest Regressor. Random Forest Regressor predicts more correctly than Linear Regression.

6. References

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