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FETAL WEIGHT ESTIMATION AND HEALTH CLASSIFICATION USING MACHINE LEARNING

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ABSTRACT

Estimating the fetal weight and classifying its health are vital for the mother and the developing child.By utilizing machine learning models, healthcare professionals can improve prenatal care and potentially identify issues early, leading to better outcomes for both. Fetal weight estimation and health classification using machine learning represent innovative approaches in prenatal care that leverage computational techniques to enhance the monitoring of fetal development and maternal well-being. These applications aim to provide accurate predictions of weight and classify the health status of the unborn child, offering valuable insights for healthcare professionals. We can estimate fetal weight using maternal characteristics and classify fetal health using CTG parameters. Various machine learning algorithms are explored to achieve precise estimations, specifically classifying fetal health conditions.

Keywords-*Fetal weight, maternal characteristics, fetal health, CTG parameters, machine learning.*

I. INTRODUCTION

Predicting the effects on health in the short- and long-term depends heavily on fetal weight.The Health Organization (WHO) classifies newborns into three birth weight (BW) groups: low birth weight (LBW, BW < 2500g), normal birth weight (NBW, 2500g ≤ BW < 4000 g), and high birth weight (HBW, BW ≥ 4000 g), also referred to as macrosomia. Machine learning can help identify diseases like gestational diabetes or preeclampsia early on, allowing for prompt and focused medical interventions to reduce risks. When LBW infants are identified before birth as opposed to after delivery, there may be a significant reduction in these risks. Therefore, to lower the risk factors for moms and babies by offering the necessary interventions, medical professionals must diagnose LBW infants accurately and promptly.

Traditional approaches such as ultrasound measurements have various drawbacks. Machine learning methods can learn complicated patterns and relationships to create more accurate estimates of fetal weight by integrating many maternal and fetal factors and using ultrasound readings. To find the most accurate algorithm for fetal health classification, we apply a variety of methods. A ground-breaking method of prenatal treatment is the classification of fetal health using machine learning. Medical practitioners can enhance their capacity to assess and manage fetal health and hence improve outcomes for expectant mothers and their unborn offspring by utilizing the power of data-driven models. This study categorizes fetal health into three groups using the chat boost algorithm.

Fetal weight estimation and health classification can now be combined by healthcare professionals thanks to machine learning advancements, which could revolutionize prenatal care. Healthcare providers can recognize and address such difficulties early because of the more precise and customized information these technologies give them. In the end, this method improves outcomes for moms and babies by encouraging a move toward proactive and preventative healthcare practices.

II. LITERATURE REVIEW

According to birth weight (BW), fetal weight is a crucial component in predicting the short- and long-term health implications. Both the fetus and its mother benefit from accurate fetal weight measurement. A machine learning approach to increase the precision of fetal weight estimation and support medical professionals in identifying possible concerns before delivery. Neonatal survival and health are significantly

influenced by birth weight (BW), and prompt decision-making by healthcare professionals can be facilitated by precise BW prediction. Numerous factors, including the mother's diet, close intervals between pregnancies, illnesses, high parity, premature delivery, and socioeconomic circumstances, might contribute to low birth weight in newborns.

Fetal weight is presently determined using heuristic mathematical models based on fetal biometry measurements. Thus, ongoing fetal health monitoring via ICT can lower mortality and morbidity while also enhancing the quality of life for both moms and their unborn children. An infant who is overweight is referred to as having HBW fetal macrosomia. About 9% of children globally weigh more than 4000g, as indicated by the HBW range >4000g, and the risk factor for macrosomia rises as weight surpasses 4500g. Long-term adverse effects including low blood sugar and childhood obesity also exist because the infant is in danger of harm, including heart failure.

Fetal macrosomia may be caused by several risk factors, some of which are controllable and some of which are not. Birth weight is influenced by many variables, such as the baby's gender, head circumference, mother's age, height, and diabetes. To address multidimensional and non-linear interactions between all of these variables and fetal weight, a straightforward classical withdrawal formula is not an effective tool. To get around the issues with conventional retinal detachment, a neural implant network was recently utilized to predict fetal weight. A nonstress test is the most widely used technique for identifying perinatal death and initiating early measures for the health of the mother and fetus.

For prompt intervention and better healthcare outcomes for moms and their unborn children, accurate assessment of fetal health is essential. Conventional prenatal health evaluation techniques rely on subjective interpretations and small sets of characteristics, which can cause variable outcomes and a delay in starting interventions. One of the primary methods for assessing the health of the fetus in the womb is a cardiotocography (CTG), which is typically performed to measure the heartbeat and uterine contractions. The physician then uses the data produced to assess the fetus's health and provide his diagnosis.

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III. SYSTEMOVERVIEW

The proposed system for estimating fetal weight and classifying its health status using machinelearning presents a comprehensive approach to improving prenatal care. It starts with the collection of diverse and representative datasets that include maternal characteristics and CTG parameters. The proposed system emphasizes feature engineering and preprocessing to optimize data quality.

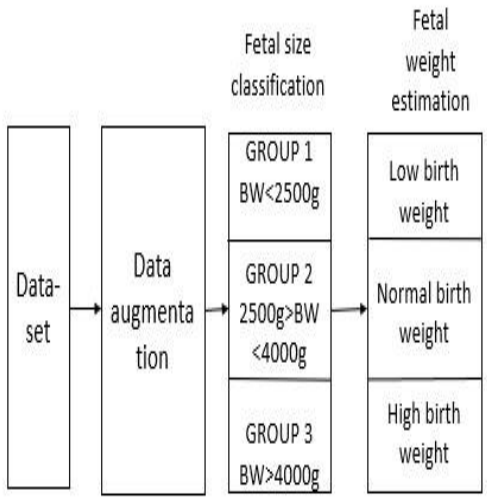

Fig. 1: System design of Fetal Weight Estimation

According to fetal weight estimation, a birth weight of less than 2500g is considered low, and a birth weight of more than 2500g but less than 4000g is considered normal. A high birth weight is indicated by a weight of more than 4000g.

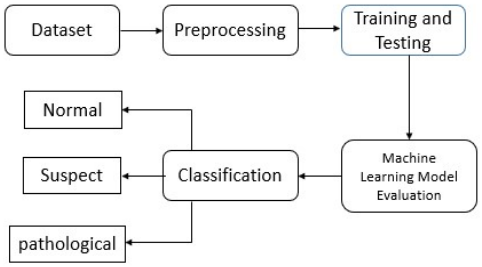

Fig. 2: System design of Fetal Health Classification

We use several algorithms, including Logistic Regression, AdaBoost, Decision Trees, and CatBoost, to classify fetal health accurately. Among these algorithms, CatBoost provides the most accurate results. Three groups—normal, suspect, and pathological—are created by our project to represent the various states of fetal health.

IV. METHODOLOGY

The process of estimating fetal weight using machine learning involves a structured approach to developing a predictive model.

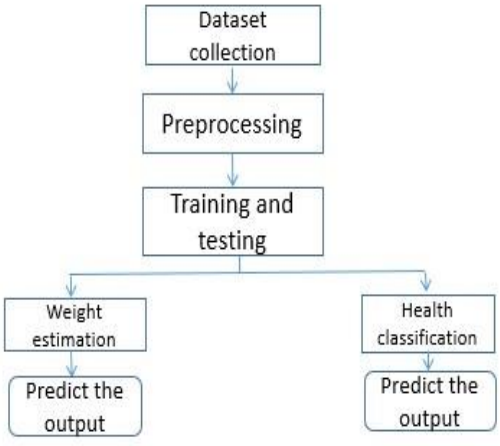

Fig.3: workflow of methods

First, a dataset comprising crucial elements such as ultrasound measurements, prenatal history, and maternal characteristics is gathered. Preprocessing is used in the dataset to encode categorical variables, normalize numerical features, and manage missing values. Next, training and testing sets are created from the dataset.It is predicted by the weight estimation method if an infant will be born low, normal, or high in weight. The method of classifying an infant's health indicates if they are abnormal, suspect, or normal.

V. RESULT

Fetal weight estimation and health classification can be revolutionized by using machine learning. Accurate fetal weight estimation helps to track fetal growth and development, providing timely insights to healthcare providers.This makes it possible for them to act proactively to reduce risks and enhance results. Health classification models analyze fetal biometry and maternal characteristics to identify health risks and create personalized care plans for pregnant individuals. These models provide decision-making support tools to healthcare professionals, enhancing diagnostic accuracy, treatment planning, and patient management strategies.

VI. Conclusion

Our project aims to develop a web-based application powered by machine learningmodels that can detect fetal weight and health issues early. We will use key maternal characteristics and CTG parameters to estimate fetal weight and classify fetal health accurately. This approach will enable proactive intervention, allowing expecting mothers and healthcare providers to address potential complications promptly. It represents a significant advancement in improving prenatal care, reducing maternal and fetal health risks, and addressing a critical healthcare concern in today's society. Furthermore, our model is user-friendly, as it can be used by clinical and non-clinical individuals.

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