Constructing Birth Weight Prediction Model Based on Maternal Determinate in Ethiopia Using Ensemble Machine Learning Algorithm

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Introduction

- Birth weight is the primary weight of the newborn infant.
- The chance of the infant to outlive, healthy growth, and advancement was highly decided by birth weight.
- It is an important health indicator of the maternal and infant that affects the infant and indicates the past and present health status of the mothers.
- It is classified into three groups. Low birth weight < 2.5 kg, normal birth weight ≥2.5 kg < 4.0 kg, and macrosomia ≥ 4.0 kg.
- LBW and macrosomia are named abnormal birth weight and important predictors of a child’s development and neonatal short and long-term health consequences.
- A child born with less than 2.5 kg needs extra hospital care, and there are standard alerts and instability over the future well-being results of infants.
- A child born with < 4 kg is associated with negative maternal and neonatal outcomes.
- It is associated with complex deliveries, and obesity epidemics, with related problems during childhood, adolescence, and adulthood and abnormality during delivery.
- ABW may cause the current and future burden of chronic diseases for infants, Negatively affecting individuals, families, healthcare systems, and societies.
- There is a variation in the prevalence of ABW across countries, regions, and low and middle-income countries.
- The prevalence of LBW across the world covers 15.5 percent of infants and high birth weight influences 3-15 percent of all pregnancies.
- Over 20 million infants in the world are born per year with low birth weights 17 percent in the developing and 6 percent in the developed world.
- The prevalence of LBW in sub-Saharan countries estimates to be 13 to 15 percent.
- In the developed world the prevalence of HBW is ranging from 5 to 20 percent of all births.
- In Ethiopia, there’s a difference within the prevalence of ABW in several geographical areas with a variety from 12 to 17 percent (LBW) and 7 to 19.1 percent (macrosomia).
- It is a growing problem in most developing countries, like Ethiopia and it directly or indirectly contributes to psychological disorders, morbidity, mortality, and disability.
- It leads to the economic and social burden.
- In order to come up with feasible intervention strategies machine learning play a vital role.
- In this study, we explore the potential applicability of homogenous ensemble learning techniques, python-based framework (flask), and Heroku-based cloud computing platform.

Related Work

- A study conducted by [22][23], is targeted to find risk factors for abnormal birth weight (macrosomia), maternal and neonatal complications of fetal macrosomia, and its risk factor.
- The researcher undertook a case-control based on maternal and neonatal wards and the researcher include demographic and clinical detail in Tanzania with a cross-sectional analytical-based study in a health facility to assess the risk factor of abnormal birth weight and data was analyzed using statistical tools.
- The data were analyzed using multinomial logistic regression and a frequency, was used to relative risk ratio, and a 95 percent confidence interval was used to identify independent predictors of the abnormal weight of neonatal.
- Underestimate and/or overestimate the prevalence of abnormal weight.
- Most of the previous studies used local clinical data that covered limited geographical areas like a single city or town only with a small data set.
- These studies did not include features, such as history of birth, history of abortion, history of place of delivery, and history of malaria.
- The factors that contribute to the presence of abnormal birth weight weren't thoroughly studied.
- A study done by [1][24][24] aimed to apply one of the machine learning techniques and logistic regression with data mining techniques to spot important predictor variables to classify and predict abnormal weight.
- The researchers in [24] conduct the prediction of the birth weight of newborns using tensor flow end-to-end machine learning techniques using a deep neural network model in a Google cloud environment.
- The researcher in [15] conducted the application of ensemble learning to improve the prediction of fetal abnormal birth weight (macrosomia) and large for gestational age from prenatal ultrasound imaging measurements.
- The research conducted by [15][14] aimed to develop new predictive models that supported the medical records of pregnant women in Japan's urban hospitals.
- Furthermore, [14][15] and [16] aimed to construct a predictive model, but they did not identify the possible risk factors that result in abnormal birth weight, and extract rules which are important to make evidence-based strategies, policies, and interventions towards preventing and/or reducing the presence of abnormal birth weight in Ethiopia.
- This study, hence, is motivated to fill these gaps by constructing a multi-class predictive model, identifying risk factors, extracting useful rules, designing an innovative artifact, and deploying the predictive model for potential users using Heroku-based cloud computing platform.

Material and Methods

- A study done by [24], aimed to identify the possible risk factors that result in abnormal birth weight, and extract rules which are important to make evidence-based strategies, policies, and interventions towards preventing and/or reducing the presence of abnormal birth weight in Ethiopia.
- Identifying risk factors, extracting useful rules, designing an innovative artifact, and deploying the model predict birth weight.
- What are the determinants that influence the presence of abnormal birth weight in Ethiopia?
- Which homogenous ensemble machine learning technique is more appropriate to construct a model to predict birth weight?
- What are the useful rules generated from the multi-class predictive model based on the best-performed homogenous ensemble machine learning model?
- To what extent does the design artifact and deployed model predict birth weight?

Experiment, Result, and Discussion

- Determinant risk factors
- Generated rules
- Related Work
- Conclusion
- Recommendation