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Predicting Low Birth Weight Using Machine Learning: A Study on 53,637 Ethiopian Birth Data

Authors : Kehabtimer Shiferaw Kotiso, Getachew Hailemariam, Abiy Seifu Estifanos

Abstract : Introduction: Despite the highest share of low birth weight (LBW) for neonatal mortality and morbidity, predicting births with LBW for better intervention preparation is challenging. This study aims to predict LBW using a dataset encompassing 53,637 birth cohorts collected from 36 primary hospitals across seven regions in Ethiopia from February 2022 to June 2024. Methods: We identified ten explanatory variables related to maternal and neonatal characteristics, including maternal education, age, residence, history of miscarriage or abortion, history of preterm birth, type of pregnancy, number of livebirths, number of stillbirths, antenatal care frequency, and sex of the fetus to predict LBW. Using WEKA 3.8.2, we developed and compared seven machine learning algorithms. Data preprocessing included handling missing values, outlier detection, and ensuring data integrity in birth weight records. Model performance was evaluated through metrics such as accuracy, precision, recall, F1-score, and area under the Receiver Operating Characteristic curve (ROC AUC) using 10-fold cross-validation. Results: The results demonstrated that the decision tree, J48, logistic regression, and gradient boosted trees model achieved the highest accuracy (94.5% to 94.6%) with a precision of 93.1% to 93.3%, F1-score of 92.7% to 93.1%, and ROC AUC of 71.8% to 76.6%. Conclusion: This study demonstrates the effectiveness of machine learning models in predicting LBW. The high accuracy and recall rates achieved indicate that these models can serve as valuable tools for healthcare policymakers and providers in identifying at-risk newborns and implementing timely interventions to achieve the sustainable developmental goal (SDG) related to neonatal mortality.

Keywords : low birth weight, machine learning, classification, neonatal mortality, Ethiopia
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