Identification of the Type of the Respiratory Failure by Analyzing the ABG Test Results Using Machine Learning

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Arterial blood gas (ABG) analysis is crucial for determining oxygenation and blood acid levels. It is essential for identifying the clinical status and contributes to healthcare strategy plans that are both cost-effective and efficient. ABG is most commonly used in emergency care units (ECU) and intensive care units (ICU). Most of the time, doctors and nurses face difficulties diagnosing the type of respiratory failure using ABG test results. So, in this research study, supervised machine learning approaches such as Extreme Gradient Boosting (XGBoost), Adaptive Boosting (AdaBoost), Catboost, Random Forest, Naive Bayes, Support Vector Machine (SVM), LightGBM, K-Nearest Neighbors (KNN), Neural Network (NN), and Decision Tree were applied to determine the type of the respiratory failure. Since it is a multi-class classification problem, the target variable consists of three classes: No respiratory failure, Type-1, and Type-2. The results of 700 patients from a Sri Lankan public hospital were collected for this study. XGBoost outperformed all other approaches in diagnosing the type of respiratory failure, yielding the highest accuracy of 98.65 percent and the lowest error rate of 1.35 percent. The dataset was also subjected to K-fold cross-validation using five folds to see if the XGBoost outperformed against varying training and testing data percentages. The cross-validation method yields findings with an accuracy of 98.45 percent and an error rate of 1.55 percent. Finally, XGBoost was used in the development of the prediction model. The findings of this study provide important insights for a future researcher who wants to employ hybrid and deep learning approaches to figure out what causes respiratory failure and how to anticipate the type of respiratory failure.

Keywords: Arterial Blood Gas (ABG), Supervised Machine Learning, Respiratory Failure