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Embracing Evidence, Envisioning Eminence



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DATA-DRIVEN TRIAGE: EXPLORING AI MODELS FOR PREDICTING EMERGENCY DEPARTMENT OUTCOMES

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Introduction: Machine learning has become a significant trend in the healthcare sector recently, and its capabilities appear promising. This study aims to develop and validate four machine learning models in predicting triage outcomes in emergency departments.

Methodology: A retrospective cohort study utilising electronic health records in the emergency department of a teaching hospital, with four machine learning models to be evaluated: Random Forest (RF), Gradient Boosted Decision Tree (GBDT), K-Nearest Neighbors (KNN), and XGBoost.

Results: A total of 312 emergency patient records were acquired. The scores for accuracy, precision, recall, and F1-score were 100% for RF, GBDT, and XGBoost. The models are also able to predict a few classes accurately, potentially improving the triage process. Respiratory rate has a high impact on the decision in triaging to actual_class_5, which is the red zone (resuscitation), with an R-value of 0.36. Diastolic blood pressure and systolic blood pressure have a high correlation, as evidenced by the R-value, 0.61. Respiratory rate has a negative impact on oxygen saturation and a positive impact on body temperature, with R-values -0.49 and 0.32, respectively.

Discussion: On the performance tests of accuracy, precision, recall, and F1-score, the models (RF, GBDT and XGBoost) scored 100% for each of the tests, indicating a perfect classifier. This result indicates the overall ability of the model to improve triage by classifying accurately, as supported by Aljubran et al.'s (2023) statement that machine learning is a promising tool for improving triage decision-making. According to Elhaj, Achour, Tania, & Aciksari, (2023), in these performance tests, the models (KNN and RF) achieved the highest score overall from 9 models trained by the researchers with an accuracy of 89.1% and 88.5%, precision of 89.0% and 88.7%, recall of 89.1% and 88.7%, and F1-score of 89.0% and 88.6%, while the CatBoost model (accuracy = 0.930, recall = 0.915, precision = 0.930, F1-score = 0.930) is clinically excellent to be developed as suggested by Aljubran et al., (2023).

Conclusion: Machine learning models can accurately triage patients when properly trained, covering the possible variations of variables presented during triage. A prospective study is needed to evaluate the models' ability further.

Keywords: Machine learning; ensemble learning; triage; emergency department