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W TORUNIU
Collegium Medicum
im. Ludwika Rydygiera w Bydgoszczy

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STRESZCZENIE ROZPRAWY DOKTORSKIEJ

Dyscyplina naukowa: nauki farmaceutyczne

Tytuł rozprawy doktorskiej:

Implementacja metod sztucznej inteligencji dla ułatwienia podejmowania decyzji klinicznych w kardiologii

Implementation of artificial intelligence to facilitate clinical decision-making in cardiology

Streszczenie rozprawy doktorskiej:

Modern medicine faces the challenge of managing vast and exponentially growing amounts of data. Traditional analytical methods are becoming insufficient; therefore, advanced analytical tools such as artificial intelligence (AI), machine learning, and large language models are playing an increasingly important role. AI enables the analysis of complex data, identification of patterns, and supports the personalization of clinical decision-making. This study presents the implementation of machine learning methods for mortality prediction in two groups of cardiology patients: those with atrial fibrillation (AF) treated with non-vitamin K antagonist oral anticoagulants, and those with pulmonary arterial hypertension (PAH). In both cases, the focus was on identifying and assessing the importance of selected clinical parameters in predicting mortality risk, utilizing state-of-the-art AI algorithms.

The analysis was conducted on two large databases: MIMIC-IV (6,431 patients with AF) and BNP-PL (1,755 patients with PAH). Feature selection was performed using LASSO regression. Classification models were constructed based on gradient boosting algorithms, and their performance was evaluated on separate test sets. The SHAP method was used to interpret the results and assess feature importance.

The best LightGBM model for AF patients achieved an AUC of 0.886, accuracy of 0.862, sensitivity of 0.913, and specificity of 0.859. For PAH, the XGBoost model obtained an AUC of 0.767, accuracy of 0.738, sensitivity of 0.800, and specificity of 0.733. In both analyses, the SHAP method enabled the identification of key risk factors, such as length of hospitalization, duration of stay in the intensive care unit, and presence of comorbidities for AF patients, as well as distance in 6-minute walk test, plasma NT-proBNP concentration, TAPSE/sPAP ratio,

and age for PAH patients. The models also allowed for individualized risk assessment for each patient, indicating the contribution of each feature to the prediction.

The conducted research confirms that machine learning models effectively support mortality prediction in selected groups of cardiology patients, providing tools for more personalized care. Model interpretability increases their clinical utility by enabling the identification of the most important risk factors and supporting the decision-making process. The proposed approach constitutes a valuable complement to traditional risk assessment methods.

Keywords: pulmonary arterial hypertension, atrial fibrillation, machine learning, artificial intelligence, cardiology

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