

Title: Development of an Explainable-AI Enabled Decision Support System for Improved Risk Assessment of Atrial Fibrillation in Cardiac Patients during Hospital Stay

Authors:

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Abstract

Cardiovascular disease (CVD) is the primary cause of mortality worldwide. Within CVDs, Coronary Heart Disease (CHD) and its complications account for one of the highest impacts on the healthcare system. Among patients hospitalized for acute myocardial infarction (AMI), the occurrence of atrial fibrillation (AF) is common. This study aims to develop and cross-nationally validate an explainable artificial intelligence decision support system to predict the risk of in-hospital AF post-AMI.

Two independent retrospective datasets comprising post-AMI patients from Italy (n=2440) and Finland (n=4083) were analyzed to develop and evaluate a classification pipeline. The pipeline includes data preprocessing, feature selection, feature extraction, model training, model validation, and explainability analysis. Different models were evaluated via nested-cross validation on the Italian training cohort and Explainable AI (XAI) techniques such as SHAP and MDI were employed to provide interpretable insights. A user-friendly software framework was implemented to visualize the results and was tailored to support the clinical decision-making process. Balanced accuracy (BA) was selected as the target metric and, among all the methods, logistic regression (LR), combined with mutual-information based feature selection, and random forest (RF) reached the best performances (BA: 0.692 LR, 0.678 RF). The explainability analysis conducted through model-specific and post-hoc XAI techniques provided valuable insights into the key predictors of postoperative AF. Moreover, the two datasets were statistically compared and none of the independent predictors for AF has significant distribution differences and the models, trained with the Italian dataset, are in the process of being cross-validated with the Finnish one.

NB It is possible that by October I will be allowed to show results about the cross-validation within the two dataset.