Prediction of short-term success of electrical cardioversion

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Abstract

Electrical cardioversion is a medical technique that uses synchronized electrical shocks as a means of restoring normal heart rhythm in people with persistent arrhythmia that is usually associated with atrial fibrillation (AF). Most cardioversions are initially successful; unfortunately, the recurrence rate of AF after a month or a year is exceptionally high.

The aim of this paper was to create a classification model that accurately predicts whether the procedure will be successful in the short term (immediate outcome), based on data on the clinical picture, other indications, and drug therapy prescribed to patients undergoing it. Dataset, consisting of 147 unique instances, was distributed as part of the master course on data mining in bioinformatics at the Faculty of Mathematics, University of Belgrade.

The focus was put on Bayesian networks, a well-known probabilistic graphical model. Other methods of classification, that is, machine learning, such as decision trees and Support Vector Machine (SVM), have also been applied in order to compare the fitted models – e.g. their accuracy, sensitivity (recall), specificity, and other relevant metrics. Extra attention was given to data preprocessing and exploratory analysis, as well as predictor (feature) importance.

Obtained results include several Bayesian network structures with fair predictive values and some other similarly successful models. They also give insight into predictor importance, such as that extracted from Random Forest Classifier and the other one in the form of a dendrogram, generated by hierarchical clustering on attribute correlations. Patient age, heart rate, and total duration of the indicated heart disease were marked as the most significant.

Keywords: cardioversion, atrial fibrillation (AF), classification, Bayesian network