Abstract

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The Risk of Re-intervention after Endovascular Aortic Aneurysm Repair

This thesis studies survival analysis techniques dealing with censoring to produce predictive tools that predict the risk of endovascular aortic aneurysm repair (EVAR) reintervention. Censoring indicates that some patients do not continue follow up, so their outcome class is unknown. Methods dealing with censoring have drawbacks and cannot handle the high censoring of the two EVAR datasets collected. Therefore, this thesis presents a new solution to high censoring by modifying an approach that was incapable of differentiating between risks groups of aortic complications. Feature Selection (FS) becomes complicated with censoring. Most survival FS methods depends on Cox's model, however machine learning classifiers (MLC) are preferred. Few methods adopted MLC to perform survival FS, but they cannot be used with high censoring. This thesis proposes two FS methods which use MLC to evaluate features. The two FS methods use the new solution to deal with censoring. They combine factor analysis with greedy stepwise FS search which allows eliminated features to enter the FS process. The first FS method searches for the best neural networks' configuration and subset of features. The second approach combines support vector machines, neural networks, and K nearest neighbor classifiers using simple and weighted majority voting to construct a multiple classifier system (MCS) for improving the performance of individual classifiers. It presents a new hybrid FS process by using MCS as a wrapper method and merging it with the iterated feature ranking filter method to further reduce the features. The proposed techniques outperformed FS methods based on Cox's model such as Akaike and Bayesian information criteria, and least absolute shrinkage and Selector operator in the log-rank test's p-values, sensitivity, and concordance. This proves that the proposed techniques are more powerful in correctly predicting the risk of reintervention. Consequently, they enable doctors to set patients' appropriate future observation plan.