

DECISION CURVES, A METHOD TO COMPARE PREDICTIVE MODELS

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The use of predictive models is very common in medical research. Logistic regression is one of the most commonly used methods to predict a disease or to detect effective prognostic factors. The goodness of a predictive model can be measured several different ways. The classical measures are the sensitivity, specificity, Youden index. The ROC (receiver operating characteristics) analysis is very commonly used method to evaluate the performance of a binary classification. Although the ROC method is effective it has the limitation that it does not describe the clinical utility of the predictive model.

Vickers introduced [1] a new method to evaluate the performance of a classification method: the net benefit describes the clinical utility of the decision. Plotting net benefit against threshold probability yields the decision curve. Decision curves can be effectively used to compare different predictive models in function of the threshold probability.

The decision curve method is based on predicted probabilities. For a predictive model yielding non probability outcome (e.g.: scores) our idea was to transform the predicted values into probabilities. The shape of the decision curve may depend on the chosen transformation function. Some possible functions are empirical CDF, inverse logit link, probit function or logistic regression predicted probabilities.

A simulation was applied to show how the shape of the decision curve depends on the chosen transformation. Several distributions were simulated. We found that the shape of the curve depends on the chosen transformation especially for skewed distributions. We prefer the use of the empirical CDF or the inverse probit function.

Decision curves have several applications in medicine. We show a comparison of eight prediction models for nonsentinel node metastases.

- [1] A. J. VICKERS, E. B. ELKIN, Decision Curve Analysis: A Novel Method for Evaluating Prediction, *Medical Decision Making* **26** (2006), 565–569.