CONDITIONAL ROC CURVE ESTIMATION

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The ROC curve is a fundamental technique in the characterisation of the accuracy of diagnostic systems. The performance of a diagnostic marker itself may be greatly dependent on the values of one or more covariates. We propose a new nonparametric estimator of the ROC curve conditional on a covariate vector. This estimator represents an extension to the conditional case of the ROC curve estimator proposed by Peng and Zhou (2004). The new estimator is based on local linear smoothing of the ROC curve, but requires additional kernel smoothing for the estimation of the conditional empirical distribution functions. The performance of this conditional ROC curve estimator is illustrated in the context of a computer-aided diagnostic (CAD) system dedicated to the early detection of clustered microcalcifications, a primary sign of breast cancer. The marker considered is the ratio of the cluster size to mean distance between the microcalcifications of each cluster detected on digital mammograms. The covariate vector consists of the ratio of average grey level of the cluster to that of the image, and the tissue type. The use of conditional ROC curve estimator yielded an increase in sensitivity, while reducing the number of false detections achieved by the CAD system. In this way, the outputs of the computerized scheme would not confuse the radiologist by indicating normal areas as suspicious regions, and this would not increment the number of biopsies to be performed.