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Construction and evaluation of optimal diagnostic tests

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Abstract

Accurate diagnostic tests are essential for effective treatment, screening, and surveillance of diseases. Single biomarkers often lack the sensitivity and specificity required for heterogeneous diseases like cancer, requiring the development of composite diagnostic tests. While binary classification methods like logistic regression are commonly used for this, they can be suboptimal when disease states exhibit differing dependence structures among biomarkers or when biomarker distributions are complex. In this talk, we introduce a novel multivariate model that addresses these challenges by capturing varying biomarker dependence structures while flexibly modeling their marginal distributions. This model can then be used to construct an optimal diagnostic test which combines multiple biomarkers using the likelihood ratio function. The model's parameters translate into computationally simple diagnostic accuracy measures and it can be used even in the presence of missing biomarker data. We demonstrate the model?s application by constructing an optimal diagnostic test for hepatocellular carcinoma, a cancer type lacking a single ideal biomarker. The talk will also feature an R implementation to demonstrate the results of the application.