Modelling the dependence between two diagnostic tests via copula functions

Jorge Alberto Achcar[1], José Rafael Tovar Cuevas[2]

[1]Department of Social Medicine FMRP, University of São Paulo, Riberão Preto, SP, Brazil

[2]Department of Statistics, IMECC, State University of Campinas, Campinas, SP, Brazil

Abstract

In medical diagnostic testing, it is common the use of more than one diagnostic test applied to the same individual. Usually these tests are assumed to be independents and important performance measures are estimated as the sensitivities and specificities of the tests, in the presence or not of a reference test usually known as "gold standard". These tests could be dependent since they are applied to the same individual and this assumption could modify the estimation of the performance measures. Considering two diagnostic tests, we could assume a bivariate Bernoully distribution. Alternatively, we propose the use of different copula functions to model the association between tests. Under the Bayesian paradigm, the posterior summaries of interest are obtained using MCMC (Markov Chain Monte Carlo) methods. A detailed discussion on the elicitation of prior distributions on the test performance and copula parameter is considered in this study.We illustrate the proposed methodology considering two medical data sets introduced in the literature.

Keywords:dependent diagnostic tests, Bayesian analysis, copula functions, gold standard.