Joint estimation of disease-specific specificities and sensitivities in reader-based multi-disease diagnostic studies of paired organs

N.N.P. Withanage

Department of Economics and Statistics, Faculty of Social sciences and language, Sabaragamuwa University of Sri Lanka, P.O. Box 02, Belihuloya, Sri Lanka.
niroshan@sab.ac.lk

Abstract

Binocular data typically arise in ophthalmology where pairs of eyes are evaluated, through some diagnostic procedure, for the presence of certain diseases or pathologies. Treating eyes as independent and adopting the usual approach in estimating the sensitivity and specificity of a diagnostic test ignores the correlation between fellow eyes. This may consequently yield incorrect estimates, especially of the standard errors. This research is concerned with diagnostic studies wherein several diagnostic tests, or the same test read by several readers, are administered to identify one or more diseases. A likelihood-based method of estimating disease-specific sensitivities and specificities via hierarchical generalized linear mixed models (HGLMMs) is proposed to meaningfully delineate the various correlations in the data. The efficiency of the estimates is assessed in a simulation study. Data from a study on diabetic retinopathy are analyzed to illustrate the methodology.

Keywords: *binocular data; correlated binary outcomes; pairwise likelihood; generalized linear mixed model; latent variable models.*