

Joint estimation of sensitivities and specificities in multi-reader multi-disease diagnostic studies

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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 eyes. This may consequently yield incorrect estimates, especially of the standard errors. The paper is concerned with diagnostic studies wherein several diagnostic tests, or the same test measured on several occasions, are administered to identify one or more diseases. A likelihood-based method of estimating sensitivities and specificities via hierarchical generalized linear models is proposed to meaningfully delineate the various correlations in the data. A pairwise likelihood approach is proposed and the efficiency of the estimates is assessed in a simulation study. Data from a study on diabetic retinopathy are analyzed to illustrate the methodology.

References

- [1] de Leon AR, Guo M, Rudnisky CJ, Singh G (2007) A likelihood approach to estimating sensitivity and specificity for binocular diagnostic data: Application in ophthalmology. *Statistics in Medicine* 26(17):3300-3314.