Efficient Group Testing Designs for Robust Prevalence Estimation against Uncertain Test Error Mechanisms

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Abstract

In group testing applications, a primary focus is to estimate the prevalence of a trait in the present of testing errors. However, the inclusion of testing error models may introduce substantial bias into prevalence estimation when the models are misspecified, and it inflates variance when the models involve additional parameters. To address this issue, we first introduce a robust estimation method into group testing to mitigate model misspecification bias. Subsequently, we develop efficient design approaches for data collection, aimed at complementing the estimation technique, to further improve the prevalence estimation by reducing variance. Our simulation experiments in a real-world context demonstrate that our approaches usually result in smaller mean squared errors in comparison to conventional techniques. (Joint work with C.-T. Chen and Z.-J. Lin).