Nonparametric Empirical Bayes Method: An Introduction and Applications in a Clinical Trial

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Abstract

The empirical Bayes method is a combination of frequent and Bayes methods but is much richer than either the classical frequent or the ordinary Bayes model. In this talk, we start with the first major work of empirical Bayes by Robbins (1955) and then introduce empirical Bayes methods in hierarchical models.

Hierarchical models have a variety of applications in clinical trials, including multi-center trials, local estimation of disease rates, longitudinal studies, risk assessment, and meta-analysis. In a hierarchical model, observations are sampled conditional on individual unit-specific parameters and these parameters are sampled from a mixing (prior) distribution.

We propose a nonparametric empirical Bayes method to estimate the mixing distribution, using smoothing by roughening. A bootstrap testing procedure is developed to compare between-group differences. The strength of the method is demonstrated by a clinical trial evaluating a new treatment for stress urinary incontinence.