

A General Framework for Comparing the Power of Mean Effects and Variance Component Linear Models for Quantitative Group Comparisons

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Abstract:

There are a number of ways one can test for the effect of certain groupings on a quantitative outcome. Standard ANOVA designs test the equality of the mean outcomes across the groups. An alternative test procedure involves explicitly determining whether or not some fraction of the total variation in the outcome can be explained by the grouping factor. This alternative test procedure can be constructed as a one degree-of-freedom test of a variance component in a random effects linear model. In genetics contexts, the mean effects model captures the essence of association mapping, whereas the variance component model possess all the elements at the foundation of most linkage analysis techniques. We consider and compare the power and sample size requirements for this variance component testing approach as well as direct, ANOVA-like tests of the equality of means using standard asymptotic theory for multivariate normal linear models. In general, we find that ANOVA-like tests are uniformly more powerful than the variance component tests. We also consider a fundamentally misunderstood conceptual issue associated with standard power calculations.