Review of *Controlling the False Discovery Rate: a Practical and Powerful Approach to Multiple Testing*

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The paper this week introduces using methods to control for False Discovery Rate (FDR) errors in multiple testing scenarios. The probability of committing any type I error in multiple comparisons together is called familywise error rate (FWER) and we need to control it for inflated false positive rate in the experimental designs. Traditionally, we have Bonferroni-type procedures to control FWER, which use the observed individual p-values for FWER control. Controlling FDR is new, comparing with the Bonferroni-type procedures, as it is a method to control the expected proportion of errors among the rejected hypotheses. The authors give some proofs to show that it could weakly control FWER while gain more power. They also give examples about its detailed procedures and use simulations to compare with the Bonferroni-type procedures.

This paper is well-written and easy for me to understand the general rationale of controlling FDR procedures. This article refreshes my memory about the difference between Bonferroni-type and Benjamini-Hochberg (BH) procedures. These two methods are different and are great to control for multiple comparison errors. However, when the number of multiple comparisons is large, the power of using Bonferroni-type procedures to detect the true difference is small and FDR control may be the better one. For example, when doing differential gene expression analysis, we usually need to control for FDR instead of FWER to gain more power. In contrast, if our goal is to control FWER, like in a clinical trial, we should use Bonferroni-type procedures for analysis.

Question:

1. I have some difficulty understanding the simulation setting part about the “non-zero expectations were divided into 4 groups and placed at L/4, L/2, 3L/4 and L in the 3 ways”.
2. I am wondering is there any disadvantages when controlling for FDR compared with controlling for FWER?