PLEASE NOTE UNUSUAL TIME AND PLACE
Seminar Notice

Statistical Laboratory
Iowa State University

DATE AND TIME: Thursday, March 9, 2006, 4:10 p.m.

PLACE: 1126 Sweeney

SPEAKER: Peng Liu
Department of Biological Statistics
and Computational Biology
Cornell University
Ithaca, NY

TITLE: Empirical Bayes Test with Application to Microarray Data

ABSTRACT

(joint work with J. T. Gene Hwang)

The measured variables (gene expressions) in microarray experiments have dimensions in thousands or even more, while the replicate number of arrays is typically small. As a consequence of "small n and large p", hypothesis tests based on individual genes often result in low average power. There are several proposed tests that attempt to improve power. Among which, Fs-test developed by Cui, Hwang, Qiu, Blades and Churchill (2005) using the concept of James-Stein shrinkage to estimate the variance, showed a striking average power improvement. Wright and Simon (2003) has parallel results.

In this talk, we first study the asymptotic power of Fs-test. The asymptotic here refers to a large p (the number of genes) and a fixed n (the number of replicates). The asymptotic calculation reveals interesting connections between Fs-test and two other commonly applied methods: the classical F-test and Fold Change. To further study Fs-test and search for more powerful tests, we develop a empirical Bayes framework. The idea is to benefit from the dimensionality by assuming a class of prior distributions. We derive the Fs-test as an empirical Bayes likelihood ratio test within the framework. The shrinkage of variance is natural within this setup. Up to this point, only tests shrinking the variances are derived. Should we shrink the means too? Modifying the prior distributions leads to a new empirical Bayes likelihood ratio test which is called F_{MAP} test (where MAP stands for Maximum Average Power). Also, an approximation to F_{MAP}, F_{SS}, is derived which was seen to shrink both the means and the variances and which has a numerically identical average power as F_{MAP}. Simulation studies show that, the proposed test uniformly improves the other tests in the literature including Fs, the test of Wright and Simon (2003), modified t-test (Smyth, 2004) and SAM (Tusher, Tibshirani and Chu, 2001).

COFFEE: 3:45 p.m., 104 Snedecor Hall