On the Distribution of Roy's Largest Root Test in Manova, Signal Detection in Noise and Canonical Correlation Analysis

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Roy's largest root is one of the four most common tests in multivariate analysis of

variance (MANOVA), with applications in many other problems, including signal detection in

noise, and canonical correlation analysis. The other three popular tests, namely Wilks Lambda, Hotelling-Lawley trace and Pillai-Bartlett trace, have been thoroughly studied, and accurate F-type approximations to their distributions have been derived. In contrast,

accurate and tractable approximations to the distribution of Roy's largest root test

have so far resisted such analysis and remained an open problem for several decades.

In this talk, I'll derive a simple yet accurate approximation for the distribution of Roy's largest root test, in the extreme case of a rank-one alternative, also known as concentrated non-centrality, where the signal or difference between groups is concentrated in a

single direction. Our results allow power calculations for Roy's test, and provide a lower bound on the minimal number of samples required to detect a given group difference, both of which are important quantities in hypothesis-driven research.

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