國 立 中 央 大 學

統 計 研 究 所

學 術 演 講

主 講 人：張中 教授（國立中山大學應用數學系）

講　　題：**Combining p-values with sparse/frequent signals and Fisher ensemble**

時　　間：**112年09月19日（星期二）上午11：00 ～ 12：00**

地　　點：**中央大學鴻經館M429室**

茶　　會：**上午 10：30 ～ 11：00**　　地　點：**鴻經館 510 室**

ABSTRACT

Combining individual p-values to aggregate multiple small effects is a prevalent need in many scientific investigations and is a long-standing statistical topic. Many classical methods were designed to combine independent and frequent signals in a traditional meta-analysis sense using the sum of transformed p-values with the transformation of light-tailed distributions. Since the early 2000, advances in big data have promoted methods to aggregate independent, sparse and weak signals. Recently, Liu and Xie (2020) and Wilson (2019) independently proposed Cauchy and harmonic mean combination tests to robustly combine p-values under an "arbitrary" dependency structure. Motivated by these two tests, we proposed tests that are the transformation of heavy-tailed distributions for improved power with sparse signals. This talk covers how we investigated the regularly varying distribution, which is a rich family of heavy-tailed distribution. We showed that only an equivalent class of Cauchy and harmonic mean tests have sufficient robustness to dependency in a practical sense. In addition, we did simulations and applied to a neuroticism GWAS application. In the second part of this talk I'll revisit the traditional setting (independent and frequent signals) and compare the exact slopes (or Bahadur relative efficiency) to evaluate their asymptotic powers for many famous and/or recently developed p-value combination tests. The comparison concludes Fisher and adaptively weighted Fisher method to have top performance and complementary advantages across different proportions of true signals. Finally, I'll present the ensemble method we proposed, namely Fisher ensemble, to combine the two top-performing Fisher-related methods. We've shown that Fisher ensemble achieves asymptotic Bahadur optimality and integrates the strengths of Fisher and adaptively weighted Fisher methods in simulations.

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