IMS Medallion Lecturer

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A Nonparametric Test for Multivariate Outcomes and Studies of Comorbidity

From college admissions to job searches to scientific investigations, we make inferences based on multi-dimensional data. For example, in psychiatric and behavioral research, about six out of ten people with a substance use disorder suffer from another form of mental illness as well, making it necessary to consider multiple conditions as we study the etiologies of these conditions. The occurrence of multiple disorders in the same patient is referred to as comorbidity. Identifying the risk factors for comorbidity is an important yet difficult topic in psychiatric research. The effect of studying the genetics for comorbidity can be tracked back a century ago. Thus, for the purposes of both statistical science and clinical investigation, it is important to consider and develop inferential tools for multivariate outcomes, particularly when the outcomes are discrete. There is extensive literature on the statistical analysis of multivariate normal variables as well as on nonparametric tests for a single variable of non-normal distribution. However, few options are available for the inference when we have multiple non-normally distributed variables and potentially a hybrid of continuous and discrete variables. To overcome this challenge, we made use of several useful statistical techniques such as the rank-based U-statistics and the kernel-based weighted statistics to accommodate the mix of continuous and discrete outcomes and the presence of important covariates. We conducted thorough simulation and analytic evaluation to assess the control of the type I error and the power of our proposed test. Both empirical and theoretical results suggest that our proposed test increases the power of testing association when adjusting for covariates. Applications of our test to real data sets also reveal novel insights. This presentation includes a series of joint work with Yuan Jiang, Ching-Ti Liu, Xueqin Wang, and Wensheng Zhu.

Biography
Heping Zhang is Professor of Biostatistics, Child Study, and Statistics, and Director of the Collaborative Center for Statistics in Science at Yale University. He received his doctoral degree in Statistics with a minor in Computer Science from Stanford University in 1991. He has been on the Yale faculty since 1992. Dr. Zhang was the receipt of a FIRST Award from National Institute of Child Health and Human Development and an Independent Scientist Award from National Institute on Drug Abuse. He is an elected fellow of American Statistical Association and the Institute of Mathematical Statistics, and an elected member of the International Statistical Institute. He was named as a Myrto Lefkopoulou Distinguished Lecturer by Harvard School of Public Health. Internationally, he is named as a Chang-Jiang Professor by Chinese Ministry of Education and an Honorary Professor by University of Hong Kong. He serves as the Editor-in-Chief of *Statistics and Its Interface* and also directs the Research Training Program in Mental Health Epidemiology at Yale School of Public Health.