An Efficient Approach for Identifying Important Biomarkers for Biomedical Diagnosis

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Abstract

In this talk, we explore the challenges associated with biomarker identification for diagnosis purpose in biomedical experiments, and propose a novel approach to handle the above challenging scenario via the generalization of the Dantzig selector. To improve the efficiency of the regularization method, we introduce a transformation from an inherent nonlinear programming due to its nonlinear link function into a linear programming framework under a reasonable assumption on the logistic probability range. We illustrate the use of our method on an experiment with binary response, showing superior performance on biomarker identification studies when compared to their conventional analysis. Our proposed method does not merely serve as a variable / biomarker selection tool, its ranking of variable importance provides valuable reference information for practitioners to reach informed decision regarding the prioritization of factors for further investigations.

Keywords：
Factor Screening, Regularization Methods, Dantzig Selector, Linear Programming, Binary Responses, Biomarker Identification.

Bio

Dr. Frederick Kin Hing Phoa is a Research Fellow at the Institute of Statistical Science, Academia Sinica (ISSAS), where he has served since 2018 following appointments as Assistant Research Fellow (2009–2013) and Associate Research Fellow (2013–2018). He earned dual B.S. degrees in Physical Chemistry (2001) and Applied Mathematics (2002), as well as an M.S. (2006) and Ph.D. (2009) in Statistics from the University of California, Los Angeles. Dr. Phoa's research excellence has been recognized through numerous prestigious awards, including the Academia Sinica Career Development Award (2014), the Ta-You Wu Memorial Award (2014), the Ministry of Science and Technology Outstanding Research Award (2017), the Outstanding Scholar Award from the Foundation for the Advancement of Outstanding Scholarship (2020), and the Academia Sinica Investigator Award (2023). He also received the Best Paper Award at the 2015 World Congress of Engineering.
He has led multiple large-scale research projects, such as two Excellent Young Researcher projects (2013–2016, 2022–2024), an International Cost-Share Exchange Scheme with the Royal Society UK (2016–2018), an Interdisciplinary Intelligence Agriculture Project (2018–2021), the Academia Sinica Thematic Project (2020–2022), the ISSAS Tukey Project (2021–2023), and the Academia Sinica Investigator Project (2023–2027). From 2009 to 2026, Dr. Phoa has published 93 peer-reviewed papers and delivered more than 190 invited talks at international conferences and 130 seminars worldwide. His research spans theoretical and applied statistics, advancing interdisciplinary collaborations and demonstrating sustained international impact.

Research Areas

Design and Analysis of Experiments, Variable Selection, Network Analysis, Nature-Inspired Metaheuristic Optimization, Big Data Analytics, Scientometrics and Bibliographic Research, Missing Data Problem, Environmental Statistics and Data Analysis.