Biometrics-2013

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference and Exhibition on
Biometrics & Biostatistics

June 10-12, 2013 Hilton Chicago/Northbrook, USA

Instrumental variables estimators to address measurement errors in proteomics

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Abstract

Recent advances in genomics and proteomics open new venues for biomedical investigations focused on the identification of molecular biomarkers, which can yield to the development of minimally-invasive and time-effective diagnostic tools improving patients' care and decreasing costs in health system. To date, the number and the quality of the technical resources available for biomarker studies and the rapid expansion of genomic and proteomic datasets are well recognized. However, the development of tailored statistical methods to address the challenges that have arisen in the field has lagged behind, dramatically reducing the pace, quality and precision of biomarker studies.

This talk will outline the key steps required to analyze the rich proteomic data generated by these technologies. Using a case study of cardiac transplantation we describe some of the challenges that the statistical proteomics community is facing today. Particular attention will be given to the problem of measurement errors in mass spectrometry proteomic quantitation, which may affect the identification of protein biomarkers in a discovery study. Robust instrumental variables estimators, which are consistent and highly resistant to outlying observations, will be proposed as a solution to this problem. In the context of biomarkers discoveries, related genomic data will be used as the instrumental variables and thus, integrated to increase the signal strength of sometimes weak, but real and biologically relevant proteomics signatures. The proposed methodology exploits, in an intuitive way, the plausible mechanisms from existing biological knowledge that relate genes, proteins, and diseases and takes advantage of this knowledge to increase the signal strength of sometimes weak, but real and biologically relevant –omics signatures.

Biography

Gabriela Cohen Freue has completed her Ph.D in Mathematical Statistics from the University of Maryland at Collage Park and postdoctoral studies in Biostatistics through her participation in the Biomarkers in Transplantation (BiT) initiative, hosted by the University of British Columbia in Vancouver. She then joined PROOF Centre of Excellence where she led the statistical analysis of proteomics data. She is now an Assistant Professor in the Department of Statistics at the University of British Columbia and a Canada Research Chair-II in Statistical Genomics. Her research interests are in robust estimation and extensions of linear models with applications to Statistical Genomics and Proteomics.