Hong Kong Institute for
Data Science

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# CENTRE FOR SYSTEMS INFORMATICS ENGINEERING SEMINAR

## Partial Least Squares for Big and Small Data: As a Statistical and an Optimization Program

### Prof S. Joe QIN

Chair Professor & Dean, School of Data Science
Director, Hong Kong Institute for Data Science
City University of Hong Kong

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## Abstract

Partial Least Squares (PLS) has been around for five decades with accelerated adoptions and applications in many fields, including engineering, social science, finance, analytic chemistry, bioinformatics, and brain-computer interface. There are two common purposes for PLS modeling. One is to interpret the latent scores and loadings to explain variations in the input data X. The other is to predict output data Y using the X latent variables, which is known as PLS regression (PLSR). While PLS provides a viable approach to the regression problem where OLS is ill-conditioned, it has a unique latent variable structure that models both output data variations and the output-relevant input data variations.

In this talk I give the motivation for PLS, the popular NIPLS algorithm, its interpretations and properties, its connection with the conjugate gradient, and its difference from other regularized methods such as the Lasso and ridge regression. A few simulated and real application examples are given for the cases of collinear data and small data to appreciate the uniqueness of PLS.

## Biography

Dr. S. Joe Qin is currently Chair Professor, Dean of the School of Data Science, and Director of Hong Kong Institute for Data Science at City University of Hong Kong. In his prior career he was the Fluor Professor at the Viterbi School of Engineering of the University of Southern California, Endowed Professor at the University of Texas at Austin, and Principal Engineer at Emerson Process Management. He was Cheung Kong Visiting Professor with Tsinghua University from 2006 to 2009.

Dr. Qin is a Fellow of the U.S. National Academy of Inventors, the International Federation of Automatic Control (IFAC), AIChE, and IEEE. He is a recipient of the U.S. National Science Foundation CAREER Award, the 2011 Northrop Grumman Best Teaching award at USC Viterbi School of Engineering, the DuPont Young Professor Award, Halliburton/Brown & Root Young Faculty Excellence Award, NSF-China Outstanding Young Investigator Award, and IFAC Best Paper Prize for a model predictive control paper published in Control Engineering Practice. He has served as Senior Editor of Journal of Process Control, Editor of Control Engineering Practice, Member of the Editorial Board for Journal of Chemometrics, and Associate Editor for several journals. He has published over 400 international journal papers, book chapters, conference papers and/or presentations. He received over 35,000 Google Scholar citations with an h-index of 80. Dr. Qin's research interests include data analytics, machine learning, process monitoring, fault diagnosis, model predictive control, system identification, smart manufacturing, and predictive maintenance.

Enquiry: hkids@cityu.edu.hk