



THE CHINESE UNIVERSITY OF HONG KONG
Department of Information Engineering

Seminar

Robust Principal Component Analysis: Exact Recovery of Corrupted Low-Rank Matrices via Convex Optimization

by

Professor Yi Ma

**Department of Electrical and Computer Engineering
University of Illinois at Urbana-Champaign and
Microsoft Research Asia**

Date : 8 January, 2010 (Friday)
Time : 2:30-3:30pm
**Venue : Room 833, Ho Sin Hang Engineering Building
The Chinese University of Hong Kong**

Abstract

Principal component analysis is a fundamental operation in computational data analysis, with myriad applications ranging from web search, to bioinformatics, to dynamical system identification, to computer vision and image analysis. However, its performance and applicability in real scenarios are limited by a lack of robustness to outlying or corrupted observations. In this work, we consider the idealized “robust principal component analysis” problem of recovering a low-rank matrix A from corrupted observations $D = A + E$. Here, the error entries E can be arbitrarily large (modeling grossly corrupted observations common in visual and bioinformatic data), but are assumed to be sparse. We prove that most matrices A can be *efficiently and exactly* recovered from most error sign-and-support patterns, by solving a simple convex program. Our result holds even when the rank of A grows nearly proportionally (up to a logarithmic factor) to the dimensionality of the observation space and the number of errors E grows in proportion to the total number of entries in the matrix. We will also review the rapid development of fast algorithms for solving this problem that, for large matrices, is significantly faster and more scalable than general-purpose solvers. We provide simulations and real-data examples corroborating the theoretical results. The simulation results actually have revealed even more striking phenomena and remarkable pictures that merit future investigation.

This is joint work with Emmanuel Candes, Xiaodong Li, and John Wright.

Biography

Yi Ma is an associate professor at the Electrical & Computer Engineering Department of the University of Illinois at Urbana-Champaign. He is also the research manager of the Visual Computing group at Microsoft Research Asia in Beijing since January 2009. His main research interest is in computer vision, high-dimensional data analysis, and systems theory. He is the first author of the popular vision textbook "An Invitation to 3-D Vision," published by Springer in 2003. Yi Ma received two Bachelors' degree in Automation and Applied Mathematics from Tsinghua University (Beijing, China) in 1995, a Master of Science degree in EECS in 1997, a Master of Arts degree in Mathematics in 2000, and a PhD degree in EECS in 2000, all from the University of California at Berkeley. Yi Ma received the David Marr Best Paper Prize at the International Conference on Computer Vision 1999, the Longuet-Higgins Best Paper Prize at the European Conference on Computer Vision 2004, and the Sang Uk Lee Best Student Paper Award with his students at the Asian Conference on Computer Vision in 2009. He also received the CAREER Award from the National Science Foundation in 2004 and the Young Investigator Award from the Office of Naval Research in 2005. He is an associate editor of IEEE Transactions on Pattern Analysis and Machine Intelligence and has served as the chief guest editor for special issues for the Proceedings of IEEE and the IEEE Signal Processing Magazine. He will also serve as Program Chair for ICCV 2013 in Sydney, Australia. He is a senior member of IEEE and a member of ACM, SIAM, and ASEE.

**** ALL ARE WELCOME ****

Host: Professor Sean X.O. Tang (Tel: 2609-8379, Email: xtang@ie.cuhk.edu.hk)
Enquiries: Information Engineering Dept., CUHK (Tel.: 2609-8385)