Franz Kiraly, UCL

Title:

Matrices, matroids and marginals - a tutorial to the algebra, combinatorics, and statistics of low-rank matrix completion

Abstract:

Low-rank matrix completion is the task of filling in missing entries in a matrix of known, low rank. It has enjoyed recent popularity in statistics and machine learning, where filling in entries can correspond to imputation or prediction, e.g. of a product rating.

The problem lies in the intersection of algebra, combinatorics, and statistics: low-rankness is an algebraic condition, the pattern of observed entries is combinatorial, and the task to make a prediction in the presence of observational uncertainty is statistical. This relation becomes especially crucial (and interesting) when one wants to fill in single missing entries.

The talk presents the necessary theoretical, and practical, machinery to make a prediction for a single entry with confidence, including an appropriate selection of tools from algebraic geometry, matroid theory, and statistical inference; prior knowledge in all three topics is not required (and probably very rare).

This talk is the second in a series of self-contained talks related to the topic of local matrix completion which are optimally enjoyed together, including:

Local Low-Rank Matrix Completion – an introduction to matrix completion; motivation, concepts, applications
Speaker: Franz Király
Apr 20, 12:15-12:45, Large Structures Monday

Prediction and quantification of individual athletic performance (with

local matrix completion)
Speaker: Duncan Blythe
May 11, 12:15-13:15, Large Structures Monday

References:

Király FJ, Theran L, Tomioka R. *The algebraic combinatorial approach for low-rank matrix completion*. Preprint, 42 pages, arXiv 1211.4116. Accepted for publication in the Journal of Machine Learning Research, 2015.
http://arxiv.org/abs/1211.4116

Király FJ, Theran L. *Obtaining error-minimizing estimates and universal entry-wise error bounds for low-rank matrix completion*. Neural Information Processing Systems 2013. Preprint version available as arXiv 1302.5337, 14 pages. 2013.
http://arxiv.org/abs/1302.5337

Király FJ, Rosen Z, Theran L. *Algebraic matroids with graph symmetry*. Preprint, 70 pages, arXiv 1312.3777. 2013.
http://arxiv.org/abs/1312.3777