Research Highlight: Max-norm optimization for robust matrix recovery

Work of
Dr Ethan FANG, Pennsylvania State University,
Dr HAN Liu, Princeton University
Professor TOH Kim Chuan (NUS) and
Dr ZHOU Wen-Xin (University of California, San Diego)

This paper studies the matrix completion problem under arbitrary sampling schemes. We propose a new estimator incorporating both max-norm and nuclear-norm regularization, based on which we can conduct efficient low-rank matrix recovery using a random subset of entries observed with additive noise under general non-uniform and unknown sampling distributions.

This method significantly relaxes the uniform sampling assumption imposed for the widely used nuclear-norm penalized approach, and makes low-rank matrix recovery feasible in more practical settings. Theoretically, we prove that the proposed estimator achieves fast rates of convergence under different settings. Computationally, we propose an alternating direction method of multipliers algorithm to efficiently compute the estimator, which bridges a gap between theory and practice of machine learning methods with max-norm regularization. Further, we provide thorough numerical studies to evaluate the proposed method using both simulated and real datasets.

Reference:

E.X. Fang, H. Liu, K.C. Toh, W.X. Zhou, "Max-norm optimization for robust matrix recovery". Mathematical Programming, 167, No. 1 (2018): 5-35.