



# 南昌大学

NANCHANG UNIVERSITY

■ 格物论坛四十五

## A Self-Consistent-Field Iteration for MAXBET with an Application to Multi-view Feature Extraction



报告人：张雷洪教授（苏州大学）

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线下地点：理生楼 A502

### 报告人简介：

张雷洪于 2008 年博士毕业于香港浸会大学，现为苏州大学数学科学学院特聘教授、博士生导师。长期从事最优化理论与计算、数值线性代数、模式识别、数据挖掘等领域的研究。主持国家自然科学基金青年/面上项目，参与国家自然科学基金重大研究计划。在数值代数、最优化及数据科学相关的研究上，发表近 50 篇 SCI 学术论文。其中有发表于计算数学和机器学习领域权威期刊，如《Mathematics of Computation》、《Numerische Mathematik》、《Journal of Scientific Computing》、《IMA Journal of Numerical Analysis》、《IEEE Transactions on Pattern Analysis and Machine Intelligence》，以及十余篇发表于美国工业与应用数学协会 (Society for Industrial and Applied Mathematics, SIAM) 旗下的期刊等。曾获第四届中国数学会计算数学分会颁发的“应用数值代数奖”、上海财经大学第四届学术奖、2018 和 2019 年两届世界华人数学家联盟最佳论文奖（若琳奖），及 2019 年上海市自然科学三等奖（第一完成人）等。现为学术杂志《Operators and Matrices》(SCI) 和《Cogent Mathematics & Statistics》的编委。

### 内容摘要：

As an extension of the traditional principal component analysis, the multi-view canonical correlation analysis (MCCA) aims at reducing  $m$  high dimensional random variables  $s_i \in R^{n_i}$  ( $i=1,2,\dots,m$ ) by proper projection matrices  $X_i \in R^{n_i \times \ell}$  so that the  $m$  reduced ones  $y_i = X_i^T s_i \in R^\ell$  have the 'maximal correlation'. Various measures of the correlation for  $y_i$  ( $i=1,2,\dots,m$ ) in MCCA have been proposed. One of the earliest criteria is the sum of all traces of pair-wise correlation matrices between  $y_i$  and  $y_j$  subject to the orthogonality constraints on  $X_i$ ,  $i=1,2,\dots,m$ . The resulting problem is to maximize a homogeneous quadratic function over the product of Stiefel manifolds and is referred to as the MAXBET problem. In this talk, the problem is first reformulated as a coupled nonlinear eigenvalue problem with eigenvector dependency (NEPv) and then solved by a novel self-consistent-field (SCF) iteration. Global and local convergence of the SCF iteration are studied and proving computational techniques in the standard eigenvalue problem are incorporated to yield more practical implementations. Besides the preliminary numerical evaluations on various types of synthetic problems, the efficiency of the SCF iteration is also demonstrated in an application to multi-view feature extraction for unsupervised learning.

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