

SPECIAL ISSUE

RETHINKING PRINCIPAL COMPONENT ANALYSIS (PCA) FOR MODERN DATA SETS: THEORY, ALGORITHMS, AND APPLICATIONS

Edited by N. Vaswani, Y. Chi, and T. Bouwmans

1277 PCA in High Dimensions: An Orientation

By I. M. Johnstone, and D. Paul

|INVITED PAPER| This paper provides a broad overview of the key phenomena associated with high-dimensional PCA, focusing on asymptotic results for the closeness of eigenvalues and eigenvectors of the sample covariance matrices to those of the population covariance matrix.

1293 Streaming PCA and Subspace Tracking: The Missing Data Case

By L. Balzano, Y. Chi, and Y. M. Lu

|INVITED PAPER| This paper reviews both classical and recent algorithms, together with their performance guarantees, for solving the PCA problem in an online fashion under memory and computation constraints.

1311 A Selective Overview of Sparse Principal Component Analysis

By H. Zou and L. Xue

|INVITED PAPER| This paper provides a selective overview of methodological and theoretical developments of sparse PCA that produce principal components that are sparse, i.e., have only a few nonzero entries.

1321 A Review of Distributed Algorithms for Principal Component Analysis

By S. X. Wu, H.-T. Wai, L. Li, and A. Scaglione

|INVITED PAPER| This paper discusses distributed PCA algorithms that are amenable when data are distributively acquired without communicating and accessing the entire data set locally.

1341 Extension of PCA to Higher Order Data Structures: An Introduction to Tensors, Tensor Decompositions, and Tensor PCA

By A. Zare, A. Ozdemir, M. A. Iwen, and S. Aviyente

|INVITED PAPER| This paper reviews the extension of PCA to tensors, which are multiway data that find important applications in many domains.

1359 Static and Dynamic Robust PCA and Matrix Completion: A Review

By N. Vaswani and P. Narayanamurthy

|INVITED PAPER| This paper provides an exhaustive overview of the literature on robust PCA [PCA or subspace recovery in the presence of elementwise (sparse) outliers] and its dynamic extension (robust subspace tracking), and matrix completion, with an emphasis on provably correct methods.

1380 An Overview of Robust Subspace Recovery

By G. Lerman and T. Maunu

|INVITED PAPER| This paper overviews the entire body of work on robust subspace recovery (subspace recovery when an entire data vector is either an “inlier” or an “outlier”), emphasizing the advantages and disadvantages of the various proposed approaches on this topic and discussing unsolved problems in the area.

DEPARTMENTS

1271 POINT OF VIEW

The Twin Arts of Writing and Revising Technical Articles

By G. C. Temes and L. Solymar

1274 SCANNING THE ISSUE

Rethinking Principal Component Analysis (PCA) for Modern Data Sets: Theory, Algorithms, and Applications

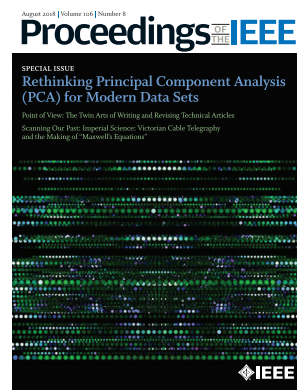
By N. Vaswani, Y. Chi, and T. Bouwmans

1458 SCANNING OUR PAST

Imperial Science: Victorian Cable Telegraphy and the Making of “Maxwell’s Equations”

By B. J. Hunt

1466 FUTURE SPECIAL ISSUE/SPECIAL SECTIONS



On the Cover: Our cover image this month depicts an artist’s rendition of a modern data set. Principal component analysis and its extensions are used broadly in the processing of such modern data sets.

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1411 Efficient Optimization Algorithms for Robust Principal Component Analysis and Its Variants

By S. Ma and N. S. Aybat

|INVITED PAPER| This paper reviews specialized efficient optimization algorithms that have been developed to solve convex relaxations of various optimization programs that can be defined to solve robust PCA and related problems.

1427 On The Applications of Robust PCA in Image and Video Processing

By T. Bouwmans, S. Javed, H. Zhang, Z. Lin, and R. Otazo

|INVITED PAPER| This paper surveys the applications of RPCA in computer vision and biomedical imaging by reviewing representative image processing applications (low-level imaging, biomedical imaging, 3-D computer vision), and video processing applications such as background/foreground separation.

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