Preface

Visual analysis has been prevalent lately since large-scale data are generated every day from advance vision and imaging devices. Low-rank and sparse modelling are emerging mathematical tools dealing with uncertainties of real-world visual data. This book provides a unique view of low-rank and sparse computing, especially approximation, recovery, representation, scaling, coding, embedding, and learning among unconstrained visual data. These techniques will significantly advance existing methodologies of image and video analysis and understanding by taking advantage of low-rank and sparse modeling. Visual analysis under uncertainty stands at the core of numerous real-world applications which bring broad impacts and generate significant academic and industrial values. As a professional reference book and research monograph, this book, through several chapters covers popular research topics from several fields such as Pattern Recognition, Computer Vision, Big Data, Social Media, Image and Video Classification, and Machine Learning. These chapters, contributed by the editor, top experts, and practitioners, complement each other from various perspective and compose a solid overview of the low-rank and sparse modelling techniques for visual analysis. Readers from different backgrounds may all benefit from the well-balanced contents for both theoretical analysis and real-world applications.

The book is composed of ten chapters in a coherent manner. "Nonlinearly Structured Low-Rank Approximation" presents an Adjusted Least-Squares Estimation method for polynomially structured low-rank approximation, which is computationally cheap and statistically consistent; "Latent Low-Rank Representation" presents the formulation of the Latent Low-Rank Representation (LatLRR), which constructs the dictionary using both observed and unobserved, hidden data, and seamlessly integrates subspace clustering and feature extraction into a unified framework; "Scalable Low-Rank Representation" addresses problem of solving nuclear norm regularized optimization problems for Low-Rank Representation under large-scale settings through a transformation, which is achieved by factoring the large-size solution matrix into the product of a small-size orthonormal matrix (active subspace) and another small-size matrix; "Low-Rank and Sparse Dictionary Learning" introduces low-rank and sparse dictionary learning methods, which learn discriminative dictionaries with

low-rank and sparse constraints for modeling; "Low-Rank Transfer Learning" discusses transfer learning in a generalized subspace where each target sample can be represented by some combination of source samples under a low-rank constraint; "Sparse Manifold Subspace Learning" presents a linear dimensionality reduction algorithm called Sparse Manifold Subspace Learning, based on sparse eigendecomposition, by considering the locality of samples and their neighbors; "Low Rank Tensor Manifold Learning" presents a supervised low rank tensor manifold learning model to learn the intrinsic structure and dimensionality of the tensors embedded in a high-dimensional Euclidean space; "Low-Rank and Sparse Multi-task Learning" proposes to correlate multiple tasks using a low-rank representation and formulate multi-task learning approaches as mathematical optimization problems of minimizing the empirical loss regularized by the low-rank structure and a separate sparse structure; "Low-Rank Outlier Detection" presents a low-rank outlier detection approach, which incorporates a low-rank constraint into the support vector data description model; "Low-Rank Online Metric Learning" presents an online metric learning model considering the low-rank constraint to address the online image classification/scene recognition problem via adaptive similarity measurement.

This book aims at broad groups of audience, such as professional researchers, graduate students, university faculties. Specifically, this book can be used by these audiences in the background of computer science/engineering, statistics, and mathematics. Other potential audiences can be attracted from broad fields of science and engineering since this topic is interdisciplinary and the topics covered synergize cross-domain knowledge.

I would like to sincerely thank all the contributors of this book for presenting their most recent research advances in an easily accessible manner. I would also sincerely thank editors Brett Kurzman, Rebecca R. Hytowitz, and Mary James from Springer for support to this book project.

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