Call for Papers

IEEE Journal of Selected Topics in Signal Processing (J-STSP)

Special issue on Data Science: "**Robust Subspace Learning and Tracking: Theory, Algorithms, and Applications**"

Principal Component Analysis (PCA) and subspace learning is a problem that has existed for over a century.

1) Robust PCA refers to the problem of PCA in the presence of outliers. While PCA for relatively clean data is easily accomplished via singular value decomposition (SVD), robust PCA is a much harder and ill-posed problem. There have been many attempts to make it well-posed, with the recent work of Candès, Wright, Li and Ma, being the most popular model. This attempts to model outliers as sparse corruptions and poses robust PCA as a problem of sparse plus low-rank matrix recovery. To make the problem well-posed this and later work impose conditions that ensure that the sparse matrix is not low-rank and vice versa. Besides the sparse plus low-rank model, the other common model for robust PCA is to assume that an entire data vector is either an inlier or an outlier. Robust PCA is needed in a wide variety of applications such as video analytics and computer vision (e.g., background and foreground separation, motion saliency detection), speech enhancement, anomaly detection in seismic waves, anomaly detection in networks, survey data analysis, region-of-interest detection in dynamic MRI, and much more. The first provably correct solution for robust PCA, Principal components' pursuit was a convex program. This was very slow and memory intensive. In later work there have been many nice attempts to develop non-convex solutions that are significantly faster.
2) Robust subspace tracking (or dynamic robust PCA) refers to the time-varying extension of robust PCA. This assumes that the true (uncorrupted) data lies in a low-dimensional subspace that can change with time, albeit slowly. The goal is to track this changing subspace over time in the presence of sparse outliers. This is a more appropriate model for long data sequences, e.g., long surveillance videos, or long dynamic social network connectivity data sequences. A natural solution to the dynamic robust PCA problem is a recursive (online) one and this is what most of the proposed solutions have focused on. A different, but related, task is one of developing online / recursive or streaming algorithms for the original (static) robust PCA problem. While the two tasks are different in theory, in practice, they are not. An online algorithm for static robust PCA is also able to track a changing subspace. On the other hand, a natural solution to dynamic robust PCA is an online or recursive one.
3) Subspace clustering, robust subspace clustering and their dynamic extensions are related problems that also fit well within the scope of this special issue. These involve modeling data as a union of subspaces plus outliers (instead of a single subspace plus outliers in case of robust PCA).
4) Low-rank matrix completion or PCA with missing data as well as robust matrix completion and their dynamic extensions are other related topics of interest. Missing data is a different (and often easier) form of corruption than outliers.

Papers are solicited on algorithms, theory, and applications, of all of the above topics as well as on other related topics in robust subspace learning and tracking. A partial list of topics of interest is given below

- Robust subspace learning, Robust Principal Component Analysis (RPCA), robust matrix completion,
- Robust Subspace Tracking, Dynamic Robust PCA, Online, Incremental, Streaming algorithms for Robust PCA
- Robust subspace clustering
- Non-convex solutions
- Fast solvers (ALM, ADM, etc…) for convex programs,
- Tensor data versions of all above problems
- Matrix and Tensor Factorization
- Real time implementation on GPU, embedded implementation
- Incorporating structured sparsity, dynamic group sparsity etc in the robust PCA solutions
- Applications in video analysis, computer vision, anomaly detection in networks, etc.

Prospective authors should follow the instructions given on the IEEE JSTSP webpages: https://signalprocessingsociety.org/publications-resources/ieee-journal-selected-topics-signal-processing and submit their manuscript with the web submission system at: https://mc.manuscriptcentral.com/jstsp-ieee

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