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Inexact and incremental bilinear Lanczos components algorithms for high dimensionality reduction and image reconstruction

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Recently, matrix-based methods have gained wide attention in pattern recognition and machine learning communities. The generalized low rank approximations of matrices (GLRAM) and the bilinear Lanczos components algorithm (BLC) are two popular algorithms that treat data as the native two-dimensional matrix pattern. However, these two algorithms often require heavy computation time and memory space in practice, especially for large scale problems. In this talk, we propose inexact and incremental bilinear Lanczos components algorithms for high dimensionality reduction and image reconstruction. We first introduce the thick-restarting strategy to the BLC algorithm, and present a thick-restarted Lanczos components algotithm (TRBLC). In this algorithm, we use the Ritz vectors as approximations to dominant eigenvectors instead of the Lanczos vectors. In our implementation, the iterative matrices are not formed nor stored explicitly, thanks to the characteristic of the Lanczos procedure. Then, we explore the relationship between the reconstruction error and the accuracy of the Ritz vectors, so that the computational complexities of eigenpairs can be reduced significantly. As a result, we propose an inexact thick-restarted Lanczos components algorithm (Inex-TRBLC). Moreover, we investigate the problem of incremental generalized low rank approximations of matrices, and propose an incremental and inexact TRBLC algorithm (Incr-TRBLC). Numerical experiments illustrate the superiority of the new algorithms over the GLRAM algorithm and its variations, as well as the BLC algorithm for some real-world image reconstruction and face recognition problems.

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Flexible detection algorithm for advanced MIMO systems

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One of the most challenging tasks of advanced MIMO signal processing with respect to the computational requirements is data detection at the receiver side. The transmitted data has to be detected with low probability of error. For high rate MIMO transmission schemes using spatial multiplexing, optimum data detection can easily become prohibitively complex, since one has to deal with a very strong spatial interference of the multiple transmitted data streams. These systems require receiver with high probability of detection and high performance in order to estimate the transmitted data streams. We propose a scalable and flexible detection algorithm with higher performance. It is characterized by dividing the total detection problem into sub-problems. Each sub-problem is solved separately to reduce complexity. The proposed detection algorithm consists of 5 stages. The stages are preprocessing, group interference suppression, sub-optimum detection algorithm with low dimension to detect first data streams, interference cancellation and linear detector to detect last data. Each stage can be updated with advanced stage to enhance the performance without affecting other stages. This algorithm is applicable for advanced communication systems that deploy multiple antennas at transmitter and receiver. This paper investigates the performance of the proposed algorithm and compares its performance with other detection algorithms.

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