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Toward Faster Nonnegative Tensor Factorization: A New Activeset type Algorithm and Comparisons

A common formulation for nonnegative matrix factorization (NMF) appears as a non-convex optimization problem and various types of algorithms have been devised to solve the problem. The alternating nonnegative least squares (ANLS) framework is a block coordinate descent approach for solving NMF, which was recently shown to be theoretically sound and empirically efficient.

In this talk, we present novel algorithms for NMF and nonnegative tensor factorization (NTR) based on the ANLS framework. Our new algorithm for NMF is built upon the block principal pivoting method for the nonnegativity constrained least squares problem that overcomes some limitations of active set methods. We show that the proposed NMF algorithm can naturally extended to obtain highly efficient NTF in the form of the PARAFAC (PARAllel FACtor) model. Our algorithms inherit the convergence theory of the ANLS framework and can easily be extended to other NMF formulations such as sparse NMF and NTF with L1 norm constraints. Comparisons of algorithms using various data sets show that the proposed new algorithms outperform existing ones in computational speed for computing NMF and NTF.

This is a joint work with Krishnakumar Balabusramanian, Hyunsoo Kim, and Jingu Kim.