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Newton-type Methods for Non-negative Tensor Approximation

Nonnegative Tensor Approximation is a decomposition technique that is useful in a wide variety of applications ranging from document analysis and image processing to bioinformatics.
There are existing algorithms for nonnegative tensor approximation (NNTA), for example, Lee & Seung's multiplicative updates, alternating least squares, and certain gradient-descent based procedures. However, most existing procedures suffer from slow convergence or numerical instability. In this talk, I will present improved Newton-type algorithms for the NNTA problem,
which overcome many computational deficiencies of existing methods. In particular, our methods use non-diagonal gradient scaling for faster convergence. These methods provide numerical results that are superior to both Lee & Seung's method as well to the alternating
least squares (ALS) heuristic, which is known to work well in some situations but has no theoretical guarantees. I will present experimental results on both synthetic and real-world datasets to demonstrate the effectiveness of the new methods.

This is joint work with Dongmin Kim and Suvrit Sra.