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Optimization Approaches for Solving Tensor Decompositions Models and Tensor Eigenvalue Problems

Tensor decompositions (e.g., higher-order analogues of matrix decompositions) are powerful
tools for data analysis, especially as the size and complexity of data grow. Thus far, the most popular methods for fitting tensor decompositions rely on alternating optimization – typically alternating least squares (ALS). This can be thought of as a nonlinear generalization of block Gauss-Seidel because the idea is to solve for one block of variables at a time while holding all the others fixed. My team has been studying optimization approaches that solve for all variables simultaneously. Although this leads to a complex nonlinear optimization problem, our initial results indicate that all-at-once optimization for fitting CANDECOMP/PARAFAC is competitive with ALS. Others have achieved promising results for Tucker; see, e.g., Eldén and Savas (2007). I propose to discuss optimization approaches and their implications to the domain of tensor decompositions. *Joint work with Evrim Acar and Daniel Dunlavy, Sandia National Laboratories.*