Computing the Best Rank$-(r_1, r_2, r_3)$ Approximation of a Tensor by Optimization on the Grassmann Manifold

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Abstract

We derive a Newton method for computing the best rank-(r_1, r_2, r_3) approximation of a given 3-tensor. The problem is formulated as an approximation problem on a product of Grassmann manifolds. Incorporating the manifold structure into Newton's method ensures that all iterates generated by the algorithm are points on the Grassmann manifolds. We also introduce a consistent notation for matricizing a tensor, for contracted tensor products and some tensor-algebraic manipulations, which simplify the derivation of the Newton equations and enable straightforward algorithmic implementation. Experiments show a quadratic convergence rate for the Newton-Grassmann algorithm.

This is joint work with Berkant Savas.