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Tensor Clustering and Error Bounds

We show that widely used tensor decompositions such as HOSVD and ParaFac have clustering capabilities. More precisely, we prove that HOSVD/ParaFac objective functions are equivalent to relaxed K-means clustering, in the same framework that nonnegative matrix factors and PCA relate to K-means clustering. Error analysis provides insights to tensor decompositions. We derive tight error bounds for both HOSVD and ParaFac, generalizing Eckart-Young Theorem for SVD to these tensor decompositions. We present experiments on several real-life datasets to demonstrate the usefulness of these new theoretical results.