Robust K-SVD: A Novel Approach for Dictionary Learning

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Abstract

A novel criterion to the well-known dictionary learning technique, K-SVD, is proposed. The approach exploits the L1-norm as the cost function for the dictionary update stage of K-SVD in order to provide robustness against impulsive noise and outlier input samples. The optimization algorithm successfully retrieves the first principal component of the input samples via greedy search methods and a parameterfree implementation. The final product is Robust K-SVD, a fast, reliable and intuitive algorithm. The results thoroughly detail how, under a wide range of noisy scenarios, the proposed technique outperforms KSVD in terms of dictionary estimation and processing time. Recovery of Discrete Cosine Transform (DCT) bases and estimation of intrinsic dictionaries from noisy grayscale patches highlight the enhanced performance of Robust K-SVD and illustrate the circumvention of a misplaced assumption in sparse modeling problems: the availability of untampered, noiseless, and outlier-free input samples for training.

Keywords: *Dictionary learning, K-SVD, Robust estimation*