



Separable Dictionary Learning

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Many techniques in computer vision, machine learning, and statistics rely on the fact that a signal of interest admits a sparse representation over some dictionary. Dictionaries are either available analytically, or can be learned from a suitable training set. While analytic dictionaries permit to capture the global structure of a signal and allow a fast implementation, learned dictionaries often perform better in applications as they are more adapted to the considered class of signals. In imagery, unfortunately, the numerical burden for (i) learning a dictionary and for (ii) employing the dictionary for reconstruction tasks only allows to deal with relatively small image patches that only capture local image information. The approach presented in this paper aims at overcoming these drawbacks by allowing a separable structure on the dictionary throughout the learning process. On the one hand, this permits larger patch-sizes for the learning phase, on the other hand, the dictionary is applied efficiently in reconstruction tasks. The learning procedure is based on optimizing over a product of spheres which updates the dictionary as a whole, thus enforces basic dictionary properties such as mutual coherence explicitly during the learning procedure. In the special case where no separable structure is enforced, our method competes with state-of-the-art dictionary learning methods like K-SVD.

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