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**Self-Taught Low-Rank Coding for Visual Learning**

**Abstract**

The lack of labeled data presents a common challenge in many computer vision and machine learning tasks. Semisupervised learning and transfer learning methods have been developed to tackle this challenge by utilizing auxiliary samples from the same domain or from a different domain, respectively. Self-taught learning, which is a special type of transfer learning, has fewer restrictions on the choice of auxiliary data. It has shown promising performance in visual learning. However, existing self-taught learning methods usually ignore the structure information in data. In this paper, we focus on building a self-taught coding framework, which can effectively utilize the rich low-level pattern information abstracted from the auxiliary domain, in order to characterize the high-level structural information in the target domain. By leveraging a high quality dictionary learned across auxiliary and target domains, the proposed approach learns expressive codings for the samples in the target domain. Since many types of visual data have been proven to contain subspace structures, a low-rank constraint is introduced into the coding objective to better characterize the structure of the given target set. The proposed representation learning framework is called self-taught low-rank (S-Low) coding, which can be formulated as a nonconvex rank-minimization and dictionary learning problem. We devise an efficient majorization-minimization augmented Lagrange multiplier algorithm to solve it. Based on the proposed S-Low coding mechanism, both unsupervised and supervised visual learning algorithms are derived. Extensive experiments on five benchmark data sets demonstrate the effectiveness of our approach.