p-Laplacian Regularization for Scene Recognition

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Abstract

The explosive growth of multimedia data on the Internet makes it essential to develop innovative machine learning algorithms for practical applications especially where only a small number of labeled samples are available. Manifold regularized semi-supervised learning (MRSSL) thus received intensive attention recently because it successfully exploits the local structure of data distribution including both labeled and unlabeled samples to leverage the generalization ability of a learning model. Although there are many representative works in MRSSL, including Laplacian regularization (LapR) and Hessian regularization, how to explore and exploit the local geometry of data manifold is still a challenging problem. In this paper, we introduce a fully efficient approximation algorithm of graph p-Laplacian, which significantly saving the computing cost. And then we propose p-LapR (pLapR) to preserve the local geometry. Specifically, p-Laplacian is a natural generalization of the standard graph Laplacian and provides convincing theoretical evidence to better preserve the local structure. We apply pLapR to support vector machines and kernel least squares and conduct the implementations for scene recognition. Extensive experiments on the Scene 67 dataset, Scene 15 dataset, and UC-Merced dataset validate the effectiveness of pLapR in comparison to the conventional manifold regularization methods.

Keywords

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