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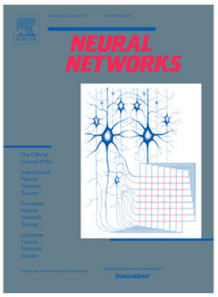

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Low-Rank Representation with Adaptive Graph Regularization

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Abstract

Low-rank representation (LRR) has aroused much attention in the community of data mining. However, it has the following two problems which greatly limit its applications: 1) it cannot discover the intrinsic structure of data owing to the neglect of the local structure of data; 2) the obtained graph is not the optimal graph for clustering. To solve the above problems and improve the clustering performance, we propose a novel graph learning method named low-rank representation with adaptive graph regularization (LRR_AGR) in this paper. Firstly, a distance regularization term and a non-negative constraint are jointly integrated into the framework of LRR, which enables the method to simultaneously exploit the global and local information of data for graph learning. Secondly, a novel rank constraint is further introduced to the model, which encourages the learned graph to have very clear clustering structures, *i.e.*, exactly c connected components for the data with c clusters. These two approaches are meaningful and beneficial to learn the optimal graph that discovers the intrinsic structure of data. Finally, an efficient iterative algorithm is provided to optimize the model. Experimental results on synthetic and real datasets show that the proposed method can significantly improve the clustering performance.

Keywords: Low-rank representation, graph regularization, data clustering, rank constraint

1. Introduction

In the fields of machine learning and pattern recognition, data analysis technologies can be generally divided into three groups in view of whether use the label information during model training, *i.e.*, supervised learning, unsupervised learning, and semi-supervised learning [13, 51, 43, 50, 45, 30, 55]. With the development of computer devices and internet, unsupervised learning arouses more and more attention since data are usually very large and their labels are difficult to be obtained. For example, there are more than 5 billion photos in Flickr and 13.7 PB photos in Google photo albums. How to automatically manage these large amounts of photos into different

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