Multimedia Annotation via Semi-Supervised Shared-Subspace Feature Selection

Zhiqiang Zeng, Xiaodong Wang, Yuming Chen

PII: S1047-3203(17)30037-8
DOI: http://dx.doi.org/10.1016/j.jvcir.2017.01.030
Reference: YJVCI 1950

To appear in: *J. Vis. Commun. Image R.*

Please cite this article as: Z. Zeng, X. Wang, Y. Chen, Multimedia Annotation via Semi-Supervised Shared-Subspace Feature Selection, *J. Vis. Commun. Image R.* (2017), doi: http://dx.doi.org/10.1016/j.jvcir.2017.01.030

Multimedia Annotation via Semi-Supervised Shared-Subspace Feature Selection

Zhiqiang Zeng[a], Xiaodong Wang[a,b,*], Yuming Chen[a]

[a] *College of Computer and Information Engineering, Xiamen University of Technology, Xiamen 361024, China*
[b] *Department of Information Management, Chaoyang University of Technology, Taichung, Taiwan*

Abstract

With the rapid development of social network and computer technologies, we always confront with high-dimensional multimedia data. It is time-consuming and unrealistic to organize such a large amount of data. Most existing methods are not appropriate for large-scale data due to their dependence of laplacian matrix on training data. Normally, a given multimedia sample is usually associated with multiple labels, which are inherently correlated to each other. Although traditional methods could solve this problem by translating it into several single-label problems, they ignore the correlation among different labels. In this paper, we propose a novel semi-supervised feature selection method and apply it to the multimedia annotation. Both labeled and unlabeled samples are sufficiently utilized without the need of graph construction, and the shared information between multiple labels is simultaneously uncovered. We apply the proposed algorithm to both web page and image annotation. Experimental results demonstrate the effectiveness of our method.

Keywords: semi-supervised learning, feature selection, multi-label learning, web page annotation, image annotation

1. Introduction

With the rapid development of computer technology and network technology, we have witnessed the explosive growth of multimedia data, i.e. text, image, and video have brought a great challenge of how to effectively index, retrieval and organize these resources. A common approach to deal with this problem is the automatic annotation which analyzes the knowledge embedded in multimedia data, which is further correlated with the semantic concepts. However, feature vectors of the aforementioned resources are usually very large, which is not suitable to directly access. Meanwhile, previous works[1, 2] have indicated that the most discriminating information is carried only by a subset of features. Under this circumstance, feature selection which aims to select the most representative features may be an efficient tool to solve this problem. Generally speaking, there are two advantages of applying feature selection on multimedia data. On the one hand, feature selection is able to reduce the dimensionality of original data, and thus save the computation. On the other hand, it can remove the redundant features and noise in the feature representation, which in turn improves the performance of subsequent analysis tasks.

In the past decades, lots of feature selection algorithms have been proposed and demonstrated their performance in many applications. For instance, classical feature selection algorithms, such as Fisher Score [3, 4] computes the weights of all features and selects the most discriminative features by ranking them. However, it ignores the inter-dependency between features when multiple features need to be selected simultaneously. Another limitation is that it only uses the labeled training data, which is very expensive to be collected in real-world applications. Meanwhile, it is much easier to obtain unlabeled data [5]. Motivated by this fact, researchers have shown that semi-supervised algorithms are able to potentially boost the learning performance when properly designed [6, 7]. Among most different algorithms, graph-based semi-supervised feature selection has gained increasing interest. Ma et.al [8] have proposed a semi-supervised feature selection framework (SFSS) which takes advantage of sparsity, manifold regularization, and transductive classification

*Corresponding author.
Email address: xdwangjsj@xmut.edu.cn (Xiaodong Wang)