Heterogeneous Domain Adaptation and Classification by Exploiting the Correlation Subspace

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Abstract

We present a novel domain adaptation approach for solving cross-domain pattern recognition problems, i.e., the data or features to be processed and recognized are collected from different domains of interest. Inspired by canonical correlation analysis (CCA), we utilize the derived correlation subspace as a joint representation for associating data across different domains, and we advance reduced kernel techniques for kernel CCA (KCCA) if nonlinear correlation subspaces are desirable. Such techniques not only make KCCA computationally more efficient, potential over-fitting problems can be alleviated as well. Instead of directly performing recognition in the derived CCA subspace (as prior CCA-based domain adaptation methods did), we advocate the exploitation of domain transfer ability in this subspace, in which each dimension has a unique capability in associating cross-domain data. In particular, we propose a novel support vector machine (SVM) with a correlation regularizer, named correlation-transfer SVM, which incorporates the domain adaptation ability into classifier design for cross-domain recognition. We show that our proposed domain adaptation and classification approach can be successfully applied to a variety of cross-domain recognition tasks such as cross-view action recognition, handwritten digit recognition with different features, and image-to-text or text-to-image classification. From our empirical results, we verify that our proposed method outperforms state-of-the-art domain adaptation approaches in terms of recognition performance.