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Transfer active learning by querying committee

基于专家问询系统的主动迁移学习

Key words: Active learning, Transfer learning, Classification

关键词： 主动学习， 迁移学习， 分类

Motivation

- **Disadvantages of existing methods:** **1.** Most methods assume that the distributions between the source and the target domains are related. **2.** *Negative transfer* will occur due to the few labeled instances in the initial stage. **3.** There is no effective strategy to avoid selecting uninformative instances.
- **Our method:** **1.** Use source tasks as committee members, to directly make use of the useful information. **2.** All members are assigned with different weights, to decrease the negative effect of irrelevant members during the iteration. **3.** Adaptively eliminate unimportant instances and members.

Framework of our method

The most informative instance:

$$x^* = \arg \max_x \sum_{i=1}^{K+1} w_i KL(P_{\theta_i}(Y|x) || P_C(Y|x))$$

where

Class distribution of a committee member

“consensus” probability that is y_j the correct label

$$KL(P_{\theta_i}(Y|x) || P_C(Y|x)) = \sum_j P_{\theta_i}(y_j|x) \log \frac{P_{\theta_i}(y_j|x)}{P_C(y_j|x)}$$

$$P_C(y_j|x) = \frac{\sum_{i=1}^{K+1} w_i P_{\theta_i}(y_j|x)}{\sum_{i=1}^{K+1} w_i}$$

The one with the maximum divergence to the weighted “consensus” probability will be chosen to query

$$w_i = \exp \left[-K(P_{\theta_i}(Y|X_L) || P^*(Y|X_L)) \right]$$

Summary

- **Motivation:** Design a transfer active learning method for classification to achieve a high accuracy with fewer queries.
- **Methodology:** We extend the QBC framework, propose a divergence based method to evaluate the relevance between models, and adaptively eliminate unnecessary instances and models.
- **Performance:** Experiments conducted on both synthetic and real data sets show the effectiveness of our ALTL algorithm.