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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.

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# Framework of our method

The most informative instance:

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

where

Class distribution of a committee member

"consensus" probability that $y_j$ is the correct label

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

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

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

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

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# 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.

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