Online Transductive Support Vector Machine

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ABSTRACT

The support vector machine (SVM) is one kind of machine learning methods based on the Statistical Learning Theory. The SVM is designed to construct a separating hyperplane between two classes of points, such that the margin between the hyperplane and the points closest to it becomes maximal. However, there are some disadvantages in applying the SVM in pattern classification problems. Firstly, the SVM is usually trained by supervised learning. Thus, the SVM model needs to be retrained from scratch whenever a new sample arrives. Secondly, the SVM trained with only a few labeled data can lead to construct very well performing classification systems, but its generalization ability highly depends on which samples are chosen for training. On the other hand, the labeled data is scarce and expensive to generate while the unlabeled data is often readily available in real world application. To overcome the aforementioned problems, an online trandusctive SVM (OTSVM) is proposed to train the SVM model incrementally with new unlabeled data. The OTSVM is developed to combine the trandusctive SVM model with online learning for classification. Unlike supervised SVM learning, in which no learning occurs when labeling unlabeled samples, the OTSVM can learn from labeled and unlabeled samples progressively. Besides, the OTSVM increases the classification accuracy while keeping the memory requirements and computation complexity at a manageable level. In order to investigate the efficiency and effectiveness of the proposed OTSVM method, examples of linearly/non-linearly separable data and terrain classification of SAR images are carried out to compare with supervised SVM learning, TSVM, PTSVM, and unsupervised learning. From simulation results, we conclude that the OTSVM can maintain acceptable classification accuracy with limited labeled data and large quantity of unlabeled data.

Keywords : support vector machine ; Statistical Learning Theory ; online learning ; transductive support vector machine ; labeled and unlabeled data

Table of Contents

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