算法研究

基于高维空间典型样本Steiner最小树覆盖模型的一类分类算法

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摘要：

最小生成树数据描述方法在刻画高维空间样本点分布时，将所有图形的边作为新增虚拟样本以提供同类样本分布描述，这种描述存在分支多覆盖模型复杂，且局部覆盖不够合理的问题。针对该问题，依据特征空间中同类样本分布的连续性规律，提出基于高维空间典型样本Steiner最小树覆盖模型的一类分类算法，该算法首先对目标类训练集进行样本修剪，去除冗余信息和噪声信息，选择最具代表性的样本作为训练集，然后对保留的典型样本构建Steiner最小树覆盖模型。算法分析和仿真实验结果表明，相比最小生成树数据描述，文中提出的方法能在较低覆盖模型复杂度的前提下更合理的描述目标类样本空间分布，构建更合理的覆盖模型，在分类正确率和适用样本规模上都表现出一定的优越性。

关键词： 一类分类器； 高维空间； 最小生成树；Steiner最小树

A One-class Classification Algorithm Based on Steiner Minimal Tree of Typical Samples Covering Model in High-dimensional Space

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Abstract:

Minimum Spanning Tree Class Descriptor (MSTCD) describes the target class with the assumption that all the edges of the graph are also basic elements of the classifier which offers additional virtual training data for better description of sample distribution in high dimensional space. However, this descriptive model has too many branches, which makes the model more complicated, and its local coverage is not so reasonable. In this case, according to the continuity law of the feature space of similar samples, a one-class classification algorithm based on Steiner minimal tree of typical samples covering model is presented in this paper. The method first prunes the training set, eliminates redundant information and noise information and selects the most representative samples as a new training set; then it builds Steiner minimal tree covering model on the retained typical samples. Theoretical analysis and simulation experimental results show that the presented method can describe the distribution of target class more reasonably, construct more reasonable covering model without increasing the model complexity. It performs better than MSTCD in accuracy of classification and applicable sample size.

Keywords: One class classifier　High dimensional space　Minimum spanning tree (MST)　Steiner minimal tree (SMT)

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