Resolving Unclassifiable Regions in Multilabel Classification by Fuzzy Support Vector Machines

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In multilabel classification, a data sample is classified into one class or plural classes [1]. One of the widely used classification methods uses one-against-all classification, in which for an n-class problem, n decision functions are determined, with each decision function putting one class on the positive side and the remaining classes on the negative side. In classification, a data sample is classified into a single-label or multilabel class associated with positive decision functions. By this method, a data sample is unclassifiable if there is no positive decision function, and a data sample may be classified into a multilabel that is not included in the multilabels contained in the training set.

To solve this problem, in this paper, we propose one-against-all fuzzy support vector machines (FSVMs) for multilabel classification [2]. For each multilabel in the training data set, we define a new multilabel class. And for each single label or multilabel class, we define a fuzzy region using the decision functions determined by one-against-all classification. The degree of membership of a data sample to the fuzzy region is determined by the decision hyperplane that is nearest to the data sample. And the data sample is classified into the class with the highest degree of membership.

This classification strategy is simplified for an unclassifiable region. If no decision function is positive for a data sample, it is classified into a class with the maximum degree of membership. This is the same as the fuzzy SVM for single-class classification.

We compare the accuracies and subset accuracies of the proposed FSVMs with the conventional one-against-all, one-against-one, and the best accuracies in [1] using several benchmark data sets that are used in [1].

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References

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