Multiclass Classification With Fuzzy-Feature Observations: Theory and Algorithms

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Abstract: The theoretical analysis of multiclass classification has proved that the existing multiclass classification methods can train a classifier with high classification accuracy on the test set, when the instances are precise in the training and test sets with same distribution and enough instances can be collected in the training set. However, one limitation with multiclass classification has not been solved: how to improve the classification accuracy of multiclass classification problems when only imprecise observations are available. Hence, in this article, we propose a novel framework to address a new realistic problem called multiclass classification with imprecise observations (MCIMO), where we need to train a classifier with fuzzy-feature observations. First, we give the theoretical analysis of the MCIMO problem based on fuzzy Rademacher complexity. Then, two practical algorithms based on support vector machine and neural networks are constructed to solve the proposed new problem. The experiments on both synthetic and real-world datasets verify the rationality of our theoretical analysis and the efficacy of the proposed algorithms.

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