

3-level Confidence Voting Strategy for Dynamic Fusion-Selection of Classifier Ensembles

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Abstract

There are two different stages to consider when constructing *multiple classifier systems*: The *Meta-Classifier Stage* that is responsible for the combination logic and basically treats the ensemble members as black boxes, and the *Classifier Stage* where the functionality of members is in focus. Furthermore, on the upper stage - also called voting strategy stage - the method of combining members can be done by fusion and selection of classifiers. In this paper, we propose a novel procedure for building the meta-classifier stage of MCSs, using an *oracle* of three-level voting strategy. This is a dynamic, half fusion-half selection type method for ensemble member combination, which is midway between the extremes of fusion and selection. The MCS members are weighted and combined with the help of the oracle, which is founded on a voting strategy of three levels: (1) The Local Implicit Confidence (LIC), (2) The Global Explicit Confidence (GEC), and (3) The Local Explicit Confidence (LEC). The first confidence segment is dependent of classifier construction, via the implicit knowledge gathered simultaneously with training. Since this strongly depends on the internal operation of the classifier, it can not always be obtained, for example, when using some particularly complex classification methods. We used several, known classifier algorithms (Decision Trees, Neural Networks, Logistic Regression, SVM) where it is possible to extract this information. The second goodness index is calculated on the validation partition of the labeled train data. It is used to obtain the general accuracy of a single classifier using a data set independent of the training partition. And finally, the third part of the confidence triplet depends also on the unlabeled objects yet to be classified. Due to this, it can only be calculated in classification time.

Keywords: multiple classifier systems, supervised learning, classifier ensembles, voting strategies, confidence based voting, two-staged ensemble

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