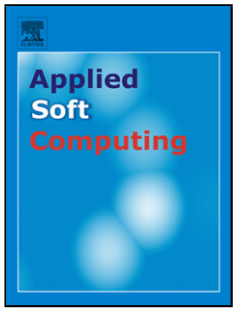

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Cost-Sensitive Back-Propagation Neural Networks with Binarization Techniques in Addressing Multi-class Problems and Non-competent Classifiers

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Highlights

- We handle the multi-class cost-sensitive classification problems by using cost-sensitive back-propagation neural networks with binarization techniques.
- We carry out a comparison of the well-known combination methods in the scenario of multi-class cost-sensitive problems.
- It is proved that the strategy of the management of non-competent classifier can significantly improve the behavior of our methodology in dealing with multi-class cost-sensitive problems.
- We investigate the effectiveness of our methodology on three different kinds of cost matrices.
- In this study, 25 real-world applications, from KEEL dataset repository, are selected for the experimental study.

Abstract: Multi-class classification problems can be addressed by using decomposition strategy. One of the most popular decomposition techniques is the One-vs-One (OVO) strategy, which consists of dividing multi-class classification problems into as many as possible pairs of easier-to-solve binary sub-problems. To discuss the presence of classes with different cost, in this paper, we examine the behavior of an ensemble of Cost-Sensitive Back-Propagation Neural Networks (CSBPNN) with OVO binarization techniques for multi-class problems. To implement this, the original multi-class cost-sensitive problem is decomposed into as many sub-problems as possible pairs of classes and each sub-problem is learnt in an independent manner using CSBPNN. Then a combination method is used to aggregate the binary cost-sensitive classifiers. To verify the synergy of the binarization technique and CSBPNN for multi-class cost-sensitive problems, we carry out a thorough experimental study. Specifically, we first develop the study to check the effectiveness of the OVO strategy for multi-class cost-sensitive learning problems. Then, we develop a comparison of several well-known aggregation strategies in our scenario. Finally, we explore whether further improvement can be achieved by using the management of non-competent classifiers. The experimental study is performed with three types of cost matrices and proper statistical analysis is