Decisior Implementation in Neural Model Selection by Multi-objective Optimization

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1. Purpose

This work presents a new learning scheme for improving generalization of Multilayer Perceptrons (MLPs). The proposed Multi-objective algorithm (MOBJ) approach minimizes both the sum of squared error and the norm of network weight vectors to obtain the Pareto-optimal solutions [1]. Preliminar results are shown in [3].

Since the Pareto-optimal solutions are not unique, we need a decision phase in order to choose the best one as a final solution by using a validation set. The final solution is expected to balance network variance and bias [2] and, as a result, generates a solution with high generalization capacity, avoiding over and underfitting.

2. Novel aspects of the work

The proposed multi-objective method controls model flexibility independently of the number of network weights, although a minimal number of weights is needed. Also, the training parameters produce minor effects on the final solution and, consequently, tuning the best set of training parameters is an easy task.

3. Methods

The proposed algorithm are based on Multi-objective techniques [1]. The constraint problem P_ϵ [1] is used to approach the learning task. Also, the efficiency of the decision phase “Decisor" is proved.

4. Conclusions

The classification and regression MOBJ solutions are compared with Weight decay, Optimal Brain Damage, Early Stopping, 10-Fold Cross-Validation, Support Vector Machines and Backpropagation. It is concluded that the proposed method is able to generate high generalization solutions and its operation is simple and efficient.

References

[1] V. Chankong and Y. Y. Haimes. *Multiobjective Decision Making: Theory and Methodology*, volume 8. North-Holland (Elsevier), New York, 1983.

[2] S. Geman, E. Bienenstock, and R. Doursat. Neural networks and the bias/variance dilemma. *Neural Computation*, 4(1):1–58, 1992.

[3] R. A. Teixeira, A. P. Braga, R. H. C. Takahashi, and R. R. Saldanha. Improving generalization of mlps with multi-objective optimization. *Neurocomputing*, 35(1–4):189–194, 2000.

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