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Negative correlation in incremental learning.

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Summary: Negative Correlation Learning (NCL) has been successfully applied to construct neural network ensembles. It encourages the neural networks that compose the ensemble to be different from each other and, at the same time, accurate. The difference among the neural networks that compose an ensemble is a desirable feature to perform incremental learning, for some of the neural networks can be able to adapt faster and better to new data than the others. So, NCL is a potentially powerful approach to incremental learning. With this in mind, this paper presents an analysis of NCL, aiming at determining its weak and strong points to incremental learning. The analysis shows that it is possible to use NCL to overcome catastrophic forgetting, an important problem related to incremental learning. However, when catastrophic forgetting is very low, no advantage of using more than one neural network of the ensemble to learn new data is taken and the test error is high. When all the neural networks are used to learn new data, some of them can indeed adapt better than the others, but a higher catastrophic forgetting is obtained. In this way, it is important to find a trade-off between overcoming catastrophic forgetting and using an entire ensemble to learn new data. The NCL results are comparable with other approaches which were specifically designed to incremental learning. Thus, the study presented in this work reveals encouraging results with negative correlation in incremental learning, showing that NCL is a promising approach to incremental learning.

Keywords: neural network ensembles; incremental learning; negative correlation learning; multi-layer perceptrons; self-generating neural tree; self-organising neural grove; classification
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