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Introducing a parallel Particle Swarm Method for neural network training

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Abstract

Artificial neural networks constitute a machine learning tool that has been used across a wide range of scientific as well as commercial applications over the past decades, delivering excellent results in most cases. For the effective training of the parameters of these machine learning models, optimization techniques are employed; however, in most cases these techniques tend to require significant computational time, which is also determined by the complexity and the size of the data to which the artificial neural network is applied. In the present work, a computational method is presented that exploits modern parallel computing architectures and is based on a distributed variant of the Particle Swarm Optimization technique. This method also employs distributed initialization of the artificial neural network parameters to enable more effective exploration of the parameter value space of the machine learning model. Furthermore, experimental results indicate that the proposed method becomes more effective as the number of parallel computational units increases, thereby enhancing the overall efficiency of the technique.In this study, the technique was applied to a large dataset originating from various scientific domains, and the experimental results were more than promising.

Keywords: Neural networks; machine learning; particle swarm optimization; parallel programming

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