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Article

Optimizing the bounds of neural networks using a novel simulated annealing method

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Abstract

Artificial neural networks are reliable machine learning models that have been applied to a multitude of practical and scientific applications in recent decades. Among these applications there are examples from the areas of physics, chemistry, medicine, etc. For their effective application to these problems, it is necessary to adapt their parameters using optimization techniques. However, in order to be effective, optimization techniques must know the range of values for the parameters of the artificial neural network, so that they can adequately train the artificial neural network. In most cases, this is not possible, as these ranges are also significantly affected by the inputs to the artificial neural network from the objective problem it is called upon to solve. This situation usually results in artificial neural networks becoming trapped in local minima of the error function or, even worse, in the phenomenon of overfitting, where although the training error achieves low values, the artificial neural network exhibits low performance in the corresponding test set. The present work proposes the introduction of an additional stage in the training of artificial neural networks before the application of the optimization method, in which stage a method based on simulated annealing is used to effectively identify the optimal value interval for the parameters of the artificial neural network. Subsequently, the optimization method will adjust the parameters of the artificial neural network within the optimal value interval of the first stage. The proposed method has been successfully applied to a wide range of classification and regression problems and comparative results are presented in detail in the present work.

Keywords: Neural networks; Simulated Annealing; Optimization methods

Received:
Revised:
Accepted:
Published:

Author Contributions: V.C. and I.G.T. conducted the experiments, employing several datasets and provided the comparative experiments. D.T. and V.C. performed the statistical analysis and prepared the manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This research has been financed by the European Union : Next Generation EU through the Program Greece 2.0 National Recovery and Resilience Plan , under the call RESEARCH – CREATE – INNOVATE, project name “iCREW: Intelligent small craft simulator for advanced crew training using Virtual Reality techniques" (project code:TAEDK-06195).

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

References

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