

Article

Combining constructed artificial neural networks with parameter constraint techniques to achieve better generalization properties

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Abstract: A machine learning technology that has been used in a wide range of everyday problems is the recently proposed technique of constructing artificial neural networks with the assistance of Grammatical Evolution. This technique was utilized in problems from the fields of physics, chemistry, medicine, etc., in which it had excellent performance compared to other machine learning models. A key feature of these machine learning models is that they can both construct the structure of an artificial neural network efficiently and identify optimal values of the parameters of this network at the same time. However, in many cases the optimization process can become trapped in local minima of the error function, resulting in the construction of the artificial neural network not being able to be completed satisfactorily, which will lead to poor results in terms of test error. In this work, the combination of the artificial neural network construction method with an adapted genetic algorithm is proposed, which preserves the structure of the neural network that has been constructed and, in addition, appropriately adapts the parameters of the artificial neural network in order to avoid overfitting problems. The proposed method was applied on a wide series of datasets from real world problems that include classification and regression problems and it was compared against traditional machine learning models and the results are reported.

Keywords: Grammatical Evolution; Genetic Programming; Neural networks; Local Optimization

Citation: Tsoulos, I.G.; Charilogis, V.; Combining constructed artificial neural networks with parameter constraint techniques to achieve better generalization properties. *Journal Not Specified* **2024**, *1*, 0. <https://doi.org/>

Received:

Revised:

Accepted:

Published:

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Author Contributions: I.G.T. conceptualized the idea and methodology, supervised the technical aspects related to the software, and contributed to manuscript preparation. Also, I.G.T conducted the experiments using various datasets and V.C. performed statistical analysis. I.G.T and V.C prepared the manuscript for publication. All authors have reviewed and endorsed the conclusive version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Institutional Review Board Statement: Not applicable.

Institutional Review Board Statement: Not applicable.

Acknowledgments: 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).

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

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