

TO OBTAIN THE NUMBER OF HIDDEN NODES IN ELM METHODOLOGY

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SUMMARY

The Extreme Learning Machine (ELM) is a recent algorithm for training single-hidden layer feedforward neural networks (SLFN) which has shown promising results when compared with other usual tools. ELM randomly chooses weights and biases of hidden nodes and analytically obtains the output weights and biases. In this work we introduce an ELM algorithm that uses a micro genetic algorithm in order to generate the hidden weights and biases of the SLFN, as well as the ELM methodology for obtaining the output weights. It minimizes simultaneously the approximation error MSE and the number of hidden nodes to conduct the training and it is able to obtain the appropriate number of hidden nodes as well as the associated weights and biases via a new strategy based on regression for which different strategies are tested. The performance of our approaches is compared with the original ELM algorithm and some of its competitors in a wide set of problems usually found in the literature.

Keywords: MLP Neural Networks, Evolutionary Algorithms, Extreme Learning Machine, Multiple Objective Programming, Linear Regression

AMS Classification: 82C32, 90C29, 90C59, 62-07, 92B20

References

- [1] COELLO, C. A., LAMONT, G. B., AND VAN VELDHUIZEN, D. A. (2007). Evolutionary Algorithms for Solving Multi-Objective Problems, 2nd Edition. *Springer*. Berlin.
- [2] HUANG, G. B., ZHU, Q.Y. AND SIEW, C.K. (2006). Extreme learning machine: Theory and applications. *Neurocomputing* **70**(1-3), 489–501.
- [3] LACRUZ, B., LAHOZ, D., AND MATEO, P.M. (2011). A bi-objective micro genetic extreme learning machine. . *IEEE SSCI11 (HIMA), Paris, France*, 68 – 75.

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