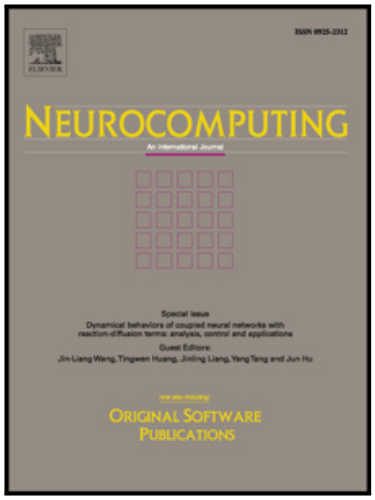
Communicated by Dr. G.-B. Huang

Accepted Manuscript



Feature selection of generalized extreme learning machine for regression problems

Yong-Ping Zhao, Ying-Ting Pan, Fang-Quan Song, Liguo Sun, Ting-Hao Chen

PII: S0925-2312(17)31815-5
DOI: 10.1016/j.neucom.2017.11.056
Reference: NEUCOM 19121

To appear in: *Neurocomputing*

Received date: 21 April 2017
Revised date: 19 September 2017
Accepted date: 26 November 2017

Please cite this article as: Yong-Ping Zhao, Ying-Ting Pan, Fang-Quan Song, Liguo Sun, Ting-Hao Chen, Feature selection of generalized extreme learning machine for regression problems, *Neurocomputing* (2017), doi: 10.1016/j.neucom.2017.11.056

Feature selection of generalized extreme learning machine for regression problems

Yong-Ping Zhao[a], Ying-Ting Pan[a], Fang-Quan Song[a], Liguo Sun[b,†], Ting-Hao Chen[c]

[a]Jiangsu Province Key Laboratory of Aerospace Power Systems

College of Energy and Power Engineering

Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China

[b]School of Aeronautic Science and Engineering, Beihang University, Beijing 100091, China

[c]Guangdong Maritime Safety Administration, Guangzhou 510260, China

Abstract

Recently a generalized single-hidden layer feedforward network was proposed, which is an extension of the original extreme learning machine (ELM). Different from the traditional ELM, this generalized ELM (GELM) utilizes the p-order reduced polynomial functions of complete input features as output weights. According to the empirical results, there may be insignificant or redundant input features to construct the p-order reduced polynomial function as output weights in GELM. However, to date there has not been such work of selecting appropriate input features used for constructing output weights of GELM. Hence, in this paper two greedy learning algorithms, i.e., a forward feature selection algorithm (FFS-GELM) and a backward feature selection algorithm (BFS-GELM), are first proposed to tackle this issue. To reduce the computational complexity, an iterative strategy is used in FFS-GELM, and its convergence is proved. In BFS-GELM, a decreasing iteration is applied to decay this model, and in this process an accelerating scheme was proposed to speed up computation of removing the insignificant or redundant features. To show the effectiveness of the proposed FFS-GELM and BFS-GELM, twelve benchmark data sets are employed to do experiments. From these reports, it is demonstrated that both FFS-GELM and BFS-GELM can select appropriate input features to construct the p-order reduced polynomial function as output weights for GELM. FFS-GELM and BFS-GELM enhance the generalization performance and simultaneously reduce the testing time compared to the original GELM. BFS-GELM works better than FFS-GELM in terms of the sparsity ratio, the testing time and the training time. However, it slightly loses the advantage in the generalization performance over FFS-GELM.

Key words: single hidden layer feedforward network; extreme learning machine; feature selection; greedy learning; iterative updating

† Corresponding author: E-mail: L.G.Sun@buaa.edu.cn