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A NOVEL ELMAN RECURRENT NEURAL NETWORK MODEL FOR SHORT-TERM ELECTRICAL POWER LOAD PREDICTION IN MAHARASHTRA

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Abstract

In this paper an Elman recurrent neural network model is developed to predict Maharashtra's total real time electrical power load one day in advance on seasonal load series (rainy). Small size datasets has been chosen intentionally, because learning from small-sized data set is even difficult & challenging for neural networks (NNs). This paper compares the performance of two NNs configurations namely a well-known multilayer perceptron neural network, and the proposed Elman NN. Various learning paradigm have been tested on two models. A best of standard backpropagation with momentum term has been used for the two models. Optimal NN model is designed with a view to minimize mean absolute percentage error (MAPE), mean absolute deviation (MAD), mean square error (MSE), normalized mean square error (NMSE), and the training time elapsed/epoch/ exemplar.

Different data partitioning schemes have been implemented on the data sets to ensure that proposed NN is unbiased and does not depend on any specific partitioning scheme of data for obtaining excellent results. The proposed NN model runs over different number of epochs and its effect on the performance is investigated. In addition, the proposed NN runs several times to gauge the performance. Prediction performance as a function of error criterion norm is investigated. Visual inspection in addition to quantitative comparison of desired outputs and NN outputs of the two models are examined closely. Visual inspection is very important than analytical values of various performance measures.

Data are clustered due to the differences in their characteristics. National days are extracted from the normal training sets. In this way, solution is provided for working days and weekends. A well-known MLPNN is constructed as a benchmark. It is shown that the proposed Elman NN clearly outperforms the well-known MLPNN in various performance metrics such as MSE, NMSE, MAD, MAPE, and correlation coefficient (r) on working days and weekends for testing datasets.

Result shows that the proposed Elman recurrent NN model gives prediction error for the period of 18 August to 30 September 2006 as 3.76% on weekday's model and 5.52% on weekend (Sundays) model.

Keyword : Short-term electric load prediction, neural networks, Small-sized data, Data partitioning, Error norm, Variation of epochs and runs, optimal network structure, visual inspection.