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A NOVEL NEURAL NETWORK MODEL FOR PREDICTION OF A LORENZ CHAOTIC TIME SERIES

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Abstract

This paper investigates the prediction of a Lorenz chaotic attractor, which have relatively high values of Lypunov's exponents. The characteristic of this time series is its rich chaotic behaviour. In this paper the authors compared the performance of four neural network models namely Self Organised Feature Map network (SOFM), Multilayer Perceptron (MLP), feed forward network, and the Jordan Elman network on the performance measures like Mean Square Error (MSE), Normalised Mean Square Error (NMSE), and Correlation Coefficient (r) on the testing data set for the short step (1,5,10) ahead prediction and long step (20,50) ahead prediction. In addition to this it is observed that the output of the proposed neural network model closely follows the desired output for all the step ahead predictions. The major contribution of this paper is that various parameters like number of hidden layers, number of processing elements, step size, various learning rule, momentum value in hidden layer, in output layer the various transfer functions like tanh, sigmoid, linear-tanh and linear sigmoid, different error norms L_1, L_2 to Lp and $L\infty$ are exhaustively experimented for obtaining the optimal model. The results are compared and accordingly optimal model is proposed. Finally the number of Epochs are varied in the proposed model for observing the effect of epochs variation on results. Also the Lorenz chaotic time series is embedded with a dimension and the proposed optimal neural network model is experimented and the performance measures are compared for embedded and without embedded Lorenz time series for all the steps.

Keywords: - Chaotic, Multi step, Prediction, Cross validation, Embedded.