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Title : MODIFIED ARTIFICIAL NEURALNETWORK (ANN) MODELS FOR MALAYSIAN CONSTRUCTION COSTS INDICES (MCCI) DATA

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Artificial neural network (ANN) is one of the most prominent universal approximators, and has been implemented tremendously in forecasting arena. The aforementioned neural network forecasting models are feedforward (nonlinear autoregressive) and recurrent (nonlinear autoregressive moving average). Theoretically, the most common algorithm to train the network is the backpropagation (BP) algorithm which is based on the minimization of the ordinary least squares (LS) estimator in terms of mean squared error (MSE). However, this algorithm is not totally robust in the presence of outliers that usually exist in the routine time series data, and this may cause false prediction of future values. Therefore, the main objective of this research is to modify the backpropagation algorithm of nonlinear autoregressive (NAR) and autoregressive moving average (NARMA) models using Tukey-bisquare estimator and a proposed hybrid firefly algorithm on the least median of squares (FFA-LMedS), in order to manage outlying data efficiently, hence produce more accurate forecasted values. The proposed neural network models are named as modified NAR and NARMA models, which able to handle various degrees of outliers problem in time series data. The performance of the fitted neural network models are examined on both real and simulated datasets. The error measures to assess the performance are Root Mean Square Errors (RMSE), Mean Square Prediction Error (MSPE), Mean Absolute Percentage Error (MAPE), Mean Absolute Deviation (MAD) and Geometric Root Mean Square Error (GRMSE). It is found that Tukey-bisquare estimator performs best in handling data with outliers less than 20 percent. On the other hand, the proposed FFA-LMedS performs best when handling outlying data greater than 20 percent. Nevertheless, it is discovered that combinations of input lags, error lags and hidden nodes are vital to affirm the optimal performance of neural network forecasting models. In general, the modified NARMA model outperforms the modified NAR in most cases. It is found that the best model for Aggregate data is modified NARMA using Tukey-bisquare with configurations 15-15-20, while the best model for Sand data is modified NARMA using FFA-LMedS with configurations 10-10-20. Finally, the best model for Roof Materials data is modified NARMA using Tukey-bisquare with configurations 15-15-15. In order to further validate the findings, a bootstrap technique is proposed namely odd-even block bootstrap technique. The proposed bootstrap technique is constructed for easier block length determination, plus remaining the time dependency, as compared to the existing ones. At the same time, the performance of the alternative bootstrap technique is compared to the ordinary and moving block bootstrap techniques to further validate the proposed one. The proposed technique is found to be superior as compared to the existing ones. As a conclusion, the proposed models are efficient to be implemented in a wide range forecasting purposes, especially on any time series data with various degress of outliers problem.