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Chebyshev Polynomial Functions based Locally Recurrent Neuro-Fuzzy Information System for Prediction of Financial and Energy Market Data

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Abstract:

In this paper Chebyshev Polynomial Functions based locally recurrent neuro-fuzzy information system is presented for the prediction and analysis of financial and electrical energy market data. The normally used TSK-type feedforward fuzzy neural network is unable to take the full advantage of the use of the linear fuzzy rule base in accurate input-output mapping and hence the consequent part of the rule base is made nonlinear using polynomial or arithmetic basis functions. Further the Chebyshev polynomial functions provide an expanded nonlinear transformation to the input space thereby increasing its dimension for capturing the nonlinearities and chaotic variations in financial or energy market data streams. Also the locally recurrent neuro-fuzzy information system (LRNFIS) includes feedback loops both at the firing strength layer and the output layer to allow signal flow both in forward and backward directions, thereby making the LRNFIS mimic a dynamic system that provides fast convergence and accuracy in predicting time series fluctuations. Instead of using forward and backward least mean square (FBLMS) learning algorithm, an improved firefly-harmony search (IFFHS) learning algorithm is used to estimate the parameters of the consequent part and feedback loop parameters for better stability and convergence. Several real world financial and energy market time series databases are used for performance validation of the proposed LRNFIS model.