
Grey Theory Based Approach for Time Series Forecasting: Application to Rainfall Data in the Ginigathhena Area

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Analysis of time series is an important research direction that attempts to understand the underlying context of the data points to make forecasting future behaviors. The ability of forecasting is a difficult task and represents a major challenge with traditional time series mechanisms, because of the nonlinear data patterns. Therefore, this study proposes a combined model to forecast time series data with high volatility and complex nature. The proposed model is a combination of a Fourier series and Nonlinear Grey Bernoulli model (NGBM), constructed in three stages. In the first stage, NGBM (1,1) model is used to obtain one step ahead forecast. Then residuals are calculated and modified with the Fourier series in the second stage. In the last stage, it combines results of the first and second stages to determine the final forecasting results. The monthly rainfall data in the Ginigathhena area from 2009 to 2015 are used as a case study. The forecasting results of the proposed model are compared to the other three models; Grey (1,1), Back Propagation Neural Network, and Seasonal Auto-Regressive Integrated Moving Average. The results reveal that the proposed Grey theory based combined model outperforms all the other models and is effective for forecasting nonlinear time series data.

Keywords: Back propagation neural network model, Fourier analysis, Nonlinear grey bernoulli model, Seasonal autoregressive integrated moving average model