ABSTRACT

Rainfall prediction is an active topic recently since people want to make decisions about crop and irrigation cycles to understand weather and climate patterns. Due to need of predicting this natural phenomenon, various research works has been carried out previously with different type of techniques using historical data. In this paper, a hybrid model based on support vector regression (SVR) model and wavelet neural network (WNN) for rainfall prediction is proposed. In hybridized SVR-WNN, optimal kernel and wavelet coefficients are generated using hybrid algorithm. Here, artificial bee colony (ABC) and genetic algorithm (GA) are hybridized and used to this purpose. These optimal kernel functions and wavelet coefficients are supplied to hybrid model to predict the rainfall. In hybrid model, wavelet neural network with ARX modeling and support vector regression (SVR) model is effectively hybridized to time series rainfall prediction. The performance of the hybrid model is analyzed with the help of real datasets taken from Assam, Chhattisgarh, East Rajasthan, Gangetic West Bengal, Gujarath, Haryana, Telangana, Rajalaseema regions. From the results, it can be concluded that proposed rainfall prediction model have shown the MAPE performance of 20, the RMSE performance of 2, MAD performance of 12, but existing model show the MAPE performance of 61, the RMSE performance of 3, MAD performance of 27 for Telangana dataset.

Keywords: GABC, MAD, MAPE, NARX, Rainfall Prediction, RMSE, Support Vector Regression (SVR) Model, Wavelet Neural Network (WNN)

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1. INTRODUCTION

Rainfall time series forecasting has, of late, emerged as one of the most vital challenges in water resources planning and management. Forecasting of rainfall variable is employed for flood and drought prevention, reservoir operation, contract negotiation, in addition to irrigation scheduling (Araghinejad et al., 2011). Rainfall is an intricate atmospheric process, that is generally space and time dependent and it becomes very hard to forecast. In view of the apparent random characteristics of rainfall sequences, they are usually expressed by a stochastic process (Chinchorkar et al.). Conventional techniques like time series regression, exponential smoothing, and autoregressive integrated moving average (ARIMA), have been found extensively offered for stochastic time series analysis. Especially, the ARIMA brand is characteristic of time series models and has been able to attain amazing level of popularity. The conventional time series modeling techniques have extended a helping hand to the scientific community from time immemorial; Nevertheless, they have been able to offer only a rational level of accuracy and have been found to face music from the postulations of stationary and linearity (Brockwell and Davis, 1994; Zhang, 2003). A ruthless rainfall prediction technique with the help of severe rainfall artificial intelligence (SRAI), endowed with the quality of forecasting the time sequence deviation and spatial distribution of harsh rainfall in a basin area, is in the offing. A backdrop which triggers the forecasting tasks for relentless rainfall prediction by means of weather forecaster is the underlying goal of the SRAI (Oishi et al.).

The forecast of atmospheric parameters is a sine-qua-non for many an application. Prominent among them embrace climate monitoring drought detection, planning in power industry, aviation industry and communication pollutions dispersal (Pal et al., 2003) etc.

Rainfall prediction is a difficult job in the climate dynamics and climate prediction hypothesis (Wu, 2011; Wu and Jin, 2009; Hong, 2008). Generally, rainfall forecasting is a very complicated nonlinear pattern, involving constraints such as pressure, temperature, wind speed and its meteorological traits of the precipitation zone and the like. In the good old days, several techniques have been employed for forecasting the rain fall prediction. Certain machine learning techniques utilized to forecast the rainfall (Cristianini et al., 2000) reveal the rainfall prediction by means of support vector machine methods. Many soft computing approaches were used for rainfall forecasting. The ANN forecasts the overall Indian summer monsoon rainfall with diverse Meteorological parameters as brand inputs (Venkatesan et al., 1997). Several investigations have been done for the purpose of quantitative precipitation forecast (QPF) by means of diverse techniques encompassing numerical weather prediction (NWP) brands and remote sensing observations (Davolio et al., 2008), statistical models (Nayagam et al., 2008), non-parametric nearest-neighbors method (Toth et al., 2000), and soft computing based methods including artificial neural networks (ANN), support vector regression (SVR) and fuzzy logic (FL) (Brath et al., 2002).

Of late, support vector regression has established itself as a major classifier in prediction analysis. The SVR has owed its origin to the structural risk minimization theory to evaluate a function by reducing the upper bound of the generalization error (Huang et al., 2005). The erstwhile investigations have revealed that the SVR brand has come out with flying colors in tackling the prediction problem in several domains (Kim, 2003; Pai and Lin, 2005). Anyhow, making appreciable improvement in the forecast accuracy still continues to be a critical challenge in the area of prediction. In SVR brand, the wavelet support vector regression is the recent launch intended for finding a solution to pattern recognition and function estimation problems in line with the wavelet kernel. The wavelet kernel is an important type of multidimensional wavelet function endowed with the merit of approximating arbitrary non-linear functions (Schapire, 1990) and wavelet neural network is also capable of forecasting...
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