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Statistical Modeling of Weekly Rainfall Data for Better Planning

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Abstract

Prediction in short-term rainfall and other forms of precipitation is one of the most critical factors determining the overall impact of climate change. Thus, in this study an attempt is made to predict weekly rainfall. The chaotic nature of weekly rainfall in South Asian countries indicates a necessity for methods which go beyond the conventional context. Alternatively, time series approach and artificial neural network (ANN) approach are employed to predict the weekly rainfall which exhibits the blend features of the linear and non-linear phenomenon. The rainfall data from 1990 to 2017 in Colombo city were obtained from the Department of Meteorology, Sri Lanka (DMSL). The correlation structure of the series confirmed seasonal length of 52 and it was found that there is no cyclic pattern. Seasonality of the series was removed by an additive decomposition method and then AR (1)-GARCH (1,1) for deseasonalized series was identified as the best fitted model to describe the pattern of weekly rainfall. ANN approach facilitates mapping the non-linear relationship between input and output using mathematical model without having proper prior knowledge of the considered phenomenon. The feed forward Multi-Layer Perceptron (MLP) neural network and three recurrent neural network architectures: Simple Recurrent Neural Networks (SRNN), Long Short-Term Memory (LSTM) and Gated Recurrent Unit (GRU) were utilized to find the best one. The forecasting performance of the two approaches were assessed using root mean square error, absolute error, mean absolute error and coefficient of correlation measures. The models were trained using data from 1990 to 2014 and were validated using data from 2015 to 2017. Both approaches performed well and provided encouraging forecasting result. However, based on the forecasting degree, GRU model outperformed the time series model to forecast weekly rainfall series in Colombo city. The developed model can be used for better short-term planning in rainfall.

Keywords: ANN, Deseasonalized, GARCH, Recurrent neural, Weekly rainfall[Suggested Citation >](#)[Hide Contact Information v](#)[Silva H.P.T.N \(Contact Author\) \(https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=4633597\)](https://papers.ssrn.com/sol3/cf_dev/AbsByAuth.cfm?per_id=4633597)**University of Sri Jayawardenepura**Nugegoda
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