ANTENNAS AND PROPAGATION

Modeling, Simulation & Measurements

Edited by

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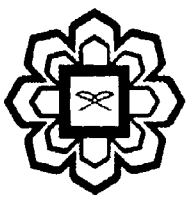

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Chapter 23

Time-Delay Neural Network for Rainfall Forecasting

Kyaw Kyaw Htike[1], Othman O. Khalifa[1] and Md. Rafiqul Islam[1]

23.1 Introduction

Accurate forecasts of the spatial and temporal distribution of rainfall are useful to convert one-minute rain intensity data for designing microwave link and predicting attenuation on microwave propagation. Chapter 22 has elaborated the procedure how to convert the data from annual statistics to one-minute statistics. However, rainfall is one of the most complex and challenging components of the hydrology cycle to comprehend and to forecast due to the various dynamic environmental factors and random variations both spatially and temporally[1]. There are several reasons why Artificial Neural Networks (ANN) are valuable and appropriate for use in such forecasting systems. Firstly, they are data-driven methods which have the ability to model both linear and non-linear systems without needing to make priori assumptions which are implicit in most classical statistical approaches such as the Box–Jenkins or ARIMA which assume that the time series under study are generated from linear processes, which is not the case in most real-world situations [2]. Secondly, they are capable of generalization. After learning the data that have been given to them during the training, they can often correctly estimate the unseen part of a population which is not part of the training data. Finally, they have been shown to be universal functional approximators and can approximate any continuous function to any desired accuracy.

23.2 Related Works

There have been many rainfall forecasting models developed based on the use of ANNs to implement the pattern recognition methodology. However, rainfall forecasting can apply to many time horizons such as short term [3], medium term, and long term periods [4] [5]. Some authors design systems which can forecast yearly data, some try to forecast monthly data [5] whereas some try to forecast daily data [6]. Most of them concentrate on one-step-ahead prediction. If multi-step prediction is then required, many iterations of one-step-ahead can be performed. The accuracy of the forecasts would of course decrease with the number of such iterations.

The traditional techniques for statistical weather forecasting include ARMA models, Box-Jenkins Models and Multivariate Adaptive Regression Splines [7]. When the machine learning became popular, there have been many attempts to build rainfall forecasting

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