Modeling rainfall occurrence using neural networks

Seema Narain (1), Pramod Chandra Tiwari (2), and Ashu Jain (3)

(1) PhD Student, Indian Institute of Technology Kanpur, India (seemanv@iitk.ac.in)

(2) M. Tech. Student, Indian Institute of Technology Kanpur, India (pramodct@iitk.ac.in)

(3) Associate Professor, Indian Institute of Technology Kanpur, India (ashujain@iitk.ac.in

/ Fax 91+512+259 7395)

Rainfall forecast models are key inputs to many important water resource projects. The actual magnitude of future rainfall is important in most water resources applications but certain physical systems depend on the occurrence of rainfall rather than its magnitude e.g. short-term municipal water demand process. Many researchers have employed the occurrence of rainfall as a significant input variable rather than the magnitude of rainfall in water demand modeling and management. One can find numerous literatures focusing on the modeling of rainfall magnitude based on the affecting climatic variables; however, in the knowledge of the authors, there has not been any attempt at modeling the occurrence of rainfall. Therefore, it is important to develop mathematical models that can predict the occurrence of rainfall.

This paper presents the results of an investigation aimed at developing an artificial neural network (ANN) models for predicting rainfall occurrence, probably for the first time. Two different types of ANN models are investigated. The first ANN model is a single artificial neuron model that employs the McCulloch and Pitts artificial neuron model and uses Hebbian learning algorithm for its training. The Hebbian learning is a method of automatically identifying the principal components, or clusters, or other such regularities in input patterns to classify them into two or more classes. The second ANN model uses a feed-forward ANN with back-propagation training algorithm. The climatic data derived from Tarrawarra Catchment of Southern Victoria, Australia, were employed in the development of the ANN models for modeling rainfall occurrence. The performance of all the ANN models is evaluated in terms of a classification error statistic called decision error. The preliminary results obtained in this study

demonstrate that a single artificial neuron model may be adequate in capturing the complex dynamics inherent among various climatic variables and the occurrence of rainfall.