Comparative Study of Artificial Neural Networks in Water Reservoirs Storage Analysis – Case Study

Erfan Goharian[1], Hassan Tavakol Davani[1], Donya Goharian[2]

1- Graduate student, School of Civil Engineering, University of Tehran, Enqelab Sq., Tehran, Iran
2- Ph.D. Candidate, Faculty of Computer Science and Information Technology, University Putra, Malaysia
e.goharian@ut.ac.ir
h_tavakol@ut.ac.ir
goharian.donya@gmail.com

Abstract

In the recent years, there have been lots of improvements in the artificial intelligence areas which artificial neural networks is one of those. It works based on the past events empirical relations which they have been occurred. Nowadays using this network become more common among scientists and engineers due to its predictions ability and there are different type of these networks which they have typical usages. On the other hand, much attention has been considered today for the optimal management of water resources forecasting system components (WRFSC). Due to importance of WRFSC, we have developed a statistical model which it predicts the volume stored in reservoirs by using different type of networks such as artificial neural networks, recursive neural networks, dynamic neural networks and other neural networks; the result of the examination of models have been illustrate and the best fitted model had been selected. We have chosen the Lar dam which it is located 35 kilometers far from Rude Hen to examine our model. Lar dam has an important role for water supply needs in Tehran. To design a model which helps for estimating of scientific and engineering situations, we have studied and compared different models. The results of our modeling indicate a functional model simulation as a tool in water management scenarios of dam reservoirs.

Keywords: Reservoirs Storage, Artificial Neural Networks, WRFSC, Water Supply.

1. INTRODUCTION

Nowadays, artificial neural networks in all fields of engineering are in modelling the water systems. Most basic concepts about neural computations by McCulloch and Pitts were developed in 1943 [1]. Artificial neural networks techniques act as a perceptual brain system and also as a tool for extracting the existing rules in information. Disadvantage of artificial neural network is the "Black Box" attitude, because the internal structure of model shouldn't be matched with physical process of it and must be established through a Trial and Error process. However, this model has a high flexibility to accept lots of parameters and taking hydrological process which will cause attractiveness of hydrological modelling [2]. The major advantage of artificial neural network approach to traditional methods is that the artificial neural network doesn't needs to explain the explicit nature of this complex mathematical process [3].

Garcia and Shigidi (2005) used the neural network model to estimate groundwater system parameters. The result of this study certified the ability of neural networks model in estimation of hydraulic conductivity factor of aquifer. Results of this research indicate the ability of neural network to use in this prediction [4]. Sarangi and Bhattacharya (2005) compared the regression methods and neural network models to predict sedimentation and erosion [5]. Cigizogl (2003) studied a daily discharge and sediment and statistics related to two areas in England then they concluded relation between suspended sediment estimation methods include rating curve and artificial neural network, the sediment rating curve less precipitation than usual, The neural network results is estimated close to reality [6].

2. STUDIED AREA

Lar dam was built in a distance of 35 km of Roude Hen and 75 km northeast of Tehran and near the Plour, the confluence of two rivers, Lar and Delichaie in Damavand mountain. Lar dam is one of the embankments that are located near Tehran and supplies needed drinking water and agricultural irrigation water of the region. This kind of embankment with a volume of 21 million cubic meters of soil operations has crown length and height of 2500 meters, 105 meters respectively. The water stored in the dam reservoir transfer by