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FORECASTING RESERVOIR WATER LEVEL OF BHADAR-1 USING ARTIFICIAL NEURAL NETWORK- A REVIEW

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ABSTRACT- Reservoir is a physical structure like pond or lake developed to impound and regulate the water. Reservoir dam is one of the defense mechanism for both flood and drought disasters. Reservoir water level depends on the rainfall, inflow and outflow. Rainfall is main parameter influencing change in the reservoir water level. So the forecasting of the reservoir level is very useful for the flood management. The aim of this research work is to forecast the BHADAR-1 reservoir water level using Artificial Neural Network. In this work, to develop different Artificial Neural Network (ANN) model and compare with actual data.

KEYWORDS: BHADR-1, reservoir level, forecasting, Artificial Neural Network

I. INTRODUCTION

Water is one of the most significant stuff on earth. All plants and animals must have water to exist. If there was no water there would be no life on the Earth. Rainfall is the only source of fresh water. The water is available as (i) soil moisture (ii) stored water surface storage like reservoirs, ponds, and in open wells (iii) ground water in sub-surface (iv) ocean salt water (v) waste water like sewage and effluent. Reservoir is a physical structure like pond or lake developed to enclosure and controls the water. Especially Reservoir dam is one of the defense mechanism for both flood and drought disasters [2]. Reservoir water level depends on the rainfall, inflow and outflow. Rainfall is mainly influence on the increases and decreases of the reservoir water level and inflow.

The inflow quantity strictly depends on cross section area of river, bed slope, type of soil and soil characteristics, vegetation area and its characteristics in proximity environmental and rainfall characteristics, groundwater-table situation and aspects, etc. The water level of reservoir is depending on to the inflow of reservoir. Thus, for any reservoir operation and safety procedure, the timely water level as well as management and mitigation of water level during the high-flood time has demanded greater concentration to avoid any disaster or calamity in the downstream region which tends to importance of water level forecasting, as timely forecasting of water level sometimes save society from disasters or calamity.

Due to Advanced technology solutions, lot of data can be handled and data analysis become easier and faster. Artificial Neural Networks (ANNs) were introduced as an efficient tools of modeling and forecasting since two decades. [1] Artificial neural networks are a kind of black box; this means we do not know its structure but just regard its behavior in practice [2].The artificial neural networks are wide spread and highly flexible function approximates, used in the fields of cognitive science and engineering. Neural networks are ideally suited for such problems because like their biological counterparts, an artificial neural network can learn, and therefore can be trained to find solutions, recognize patterns, classify data, and forecast future events [3]. A neural network consists of a large number of simple processing elements that are variously called neurons or nodes. Each neuron is connected to other neurons by means of direct communication links, each with an

associated weight. The weights represent information being used by the net to solve a problem. An ANN consists of input, hidden and output layers and each layer includes an array of processing elements [4]. In this study, forecasting of reservoir water level using ANN and compare with actual data.

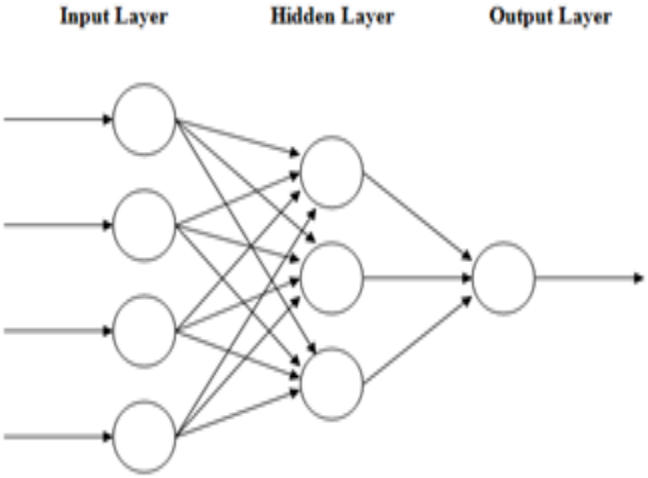

Figure1 A Simple Artificial Neural Network

II. LITERATURE REVIEW

Forecasting reservoir water levels using ANN have been carried out by different researchers.

- Shie-Yui Liong et al. (2000) the researchers have demonstrated ANN application on the forecast of daily river stage at Dhaka, Bangladesh for the rainy season. The two sensitivity tests are carried out to determine the relative significance of each of the input neurons. This work demonstrate that the suitability of an NN for flow prediction with high accuracy at a fraction of the computational time required by the conventional rainfall- runoff models [3].
- S.Ondimu & H.Murase(2006) used NN tool to forecast the monthly water level of lake Naivasha in Kenya. In this paper Six features like water levels, rainfall, evaporation rate, discharges for rivers and one pair of time harmonics were used to develop neural network models. Through the training and testing Total Mean Square Error (TMSE) of the six models. The training TMSE was highest in Model NN1 and lowest in model NN6. From the researchers it is conclude that timely forecasting can also help in disaster monitoring, response and control in areas prone to floods [5].
- Abdusselam Altunkaynak(2007) used application of ANN for modelling to forecast the temporal change water level of lake van. In this study ancient water level and rainfall taken as an input and one month ahead forecasting water level. In this study ANN and autoregressive moving average with exogenous input (ARMAX) Model used. It is concluded that ANN models outperform (ARMAX) models. It is recommended that for more acceptable ANN models among hydrologists, some more applications should be forthcoming [4].
- Shilpi Rani et al.(2014) presents an Artificial Neural Network (ANN) approach for forecasting of reservoir water level using ten daily data of inflow, water level and release. The developed models are trained and validated on the collected data of Sukhi Reservoir project, located in Gujarat State, India. Based on these results, it can be concluded that amongst the three methods used for this study, ANN using Feed Forward Back propagation is an appropriate predictor for real-time Water Level forecasting of Sukhi Reservoir Project [1].

- Fatih Unes et al (2015) researchers' daily reservoir level for Millers Ferry Dam, which on the Alabama River in USA were predicted using ANN. Bayesian regulation back-propagation training algorithm is employed for optimization of the networks data sample consists of 6 years of daily reservoir level records. From the result, ANN singles out as having very small MSE (Mean Square Error,) MAE (Mean Absolute Error) and high R values for the same input combination. The presented ANN model provides better estimates of the reservoir level fluctuations than the conventional models [6].
- Chih-Chieh Young et al.(2015) the authors had used four model approaches to predict water levels in the Yuan-Yang Lake (YYL) in Taiwan: a three-dimensional hydrodynamic model, an artificial neural network (ANN) model (BPNN), a time series forecasting (ARMAX) model, and a combined hydrodynamic and ANN model. Three statistical indicators (mean absolute error, root mean square error, and coefficient of correlation) were adopted to evaluate model performances. Overall, the results demonstrate that the hydrodynamic model can satisfactorily predict hourly water level changes during the calibration stage but not for the validation stage. The results from an ANN model are superior to those by the ARMAX model in both training and validation phases [7].
- Ghatfan Abdalkareem et al. (2017) have worked on forecasting water level in the 16th Dam reservoir on the North Kebir River in Syria, using artificial neural networks (ANNs). The results of this study showed that feed forward back propagation Artificial Neural Networks (FFBP-ANNs) estimated successfully the water level in the dam reservoir, with low values RMSE, and high values of correlation coefficients (R). Thus, this research has shown the high reliability of artificial neural networks in estimation of water level in 16thTishreen dam reservoir where the feed forward neural network provides a high predictability of water levels dam of the next day, especially during the rainy months [2].
- S. K. Jain et al. (1999) successfully used ANNs for reservoir Indravati in the state of Orissa, India, inflow prediction and operation. An autoregressive integrated moving average time-series model and an ANN-based model were fitted to the monthly inflow data series and their performances were compared. The results of intercomparison indicate that the ANN is a powerful tool for input-output mapping and can be effectively used for reservoir inflow forecasting and operation [8].

III. CONCLUSION

- During the literature review it was observed that different researchers use different parameters and tools for forecasting reservoir water level.
- Most of the researcher used feed forward back propagation network in ANN.
- ARMAX and other model used and compare with ANN.ANN is proved as a good tool for forecasting reservoir water level.

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