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Prediction of Rainfall Runoff by Using Matlab Software

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ABSTRACT: The main advantage of Artificial Neural Network over Traditional models is that they are highly non-linear universal approximator. In addition, the form of model is not to be chosen at the start of the modelling process but it is to be chosen to provide the best feed to the available data. The Artificial Neural Network consisting of multilayer perceptron have been already used for prediction of water resources, hydrological processes, waste water treatment processes and environmental variables. A Feed Forward Neural Network Model have been presented to determine velocity in the flow direction. The use of ANN technique for modelling provides lower interpolation errors as compared to other classical methods, usually learned models can be developed quickly then first principles models obtaining high quality approximation. In the present research, the possibility of predicting average rainfall over Pune district has been analyzed through artificial neural network models. In formulating artificial neural network based predictive models three layered networks have been constructed. The models under study are different in the number of hidden neurons.

KEYWORDS: Monsoon rainfall, Pune, prediction, artificial neural network, back propagation algorithm, multilayer artificial neural network.

I. INTRODUCTION

The development of ANN began approximately 50 years ago by McCulloch and Pitts in 1943, inspired by a desire to understand the human brain and emulate its functioning. Although the idea of ANN was proposed by McCulloch and Pitts over fifty years ago, the development of ANN technique has experienced a renaissance only in the last decade due to Hopfield's (1982) effort, because the current algorithms overcome the limitations of early network.

Weather forecasting is one of the most imperative and demanding operational responsibilities carried out by meteorological services all over the world.

It is complicated procedure that includes numerous specialized fields of knowhow. The task is complicated because in the field of meteorology all decisions are to be taken in the visage of uncertainty. Different scientists over the globe have developed stochastic weather models which are based on random number of generators whose output resembles the weather data to which they have been fit. The reason is that ANN (Artificial Neural Network) model is based on 'prediction' by smartly 'analyzing' the trend from an already existing voluminous historical set of data.

1.1 Objective-

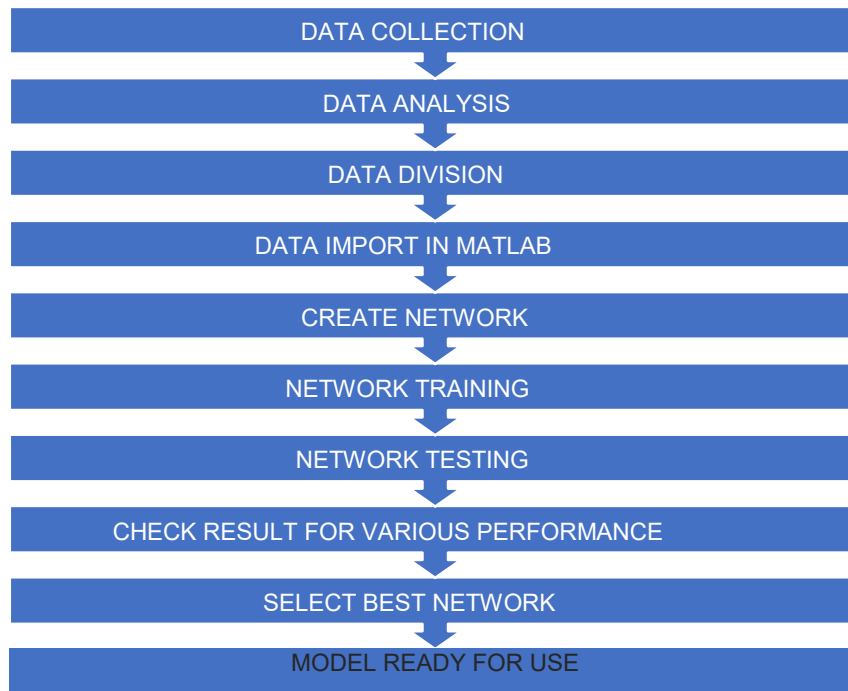
- ❖ To study rainfall-runoff relationship in brief.
- ❖ To discuss various categories of rainfall runoff models, recent development and challenges of rainfall runoff models in flood prediction in the modern era.
- ❖ To discuss forecasted runoff can be used for hydrologic and hydraulic engineering design, water availability, water supply, flood control, drainage, power generation and planning and management of water resource.



1.2 Scope of the Project Work-

- The number of researchers are worked on PREDICTION OF RAINFALL RUNOFF BY USING MATLAB.
- The focus is on rainfall runoff modelling and how the transformation of rainfall into runoff can be simulated with different mathematical tools describing runoff generations process.
- Based on a personal and professional experiences, the use of hydrological model, their advantages and challenges are described.

II. METHODOLOGY



2.1 Data Collection:

Data collection is the process of gathering and measuring information from countless different sources. It most probably include the information about site of study like dam and its technical details, topographic details of the catchment area, geological details of site, rainfall pattern, rainfall intensity, runoff.

2.2 Data Analysis:

Data analysis is the science of examining a set of data to draw conclusions about the information to be able to make decisions or simply to expand the knowledge on various subjects.

Basically here we all information only related to the runoff like rainfall intensity, characteristics of watershed area and catchment area.

2.3 Data Division:

For the modelling of the ANN the data can either be divided in three or two set of input and output/target data, it can be divided as testing set or validation set or training set depending upon need.

2.4 Data Import In Matlab:

In the present study we were used MATLAB 2020 software for the development of Artificial Neural Network model. It is a well known high performance language for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. MATLAB stands for MATrixLABoratory, which includes Matrix-based data structures, its own internal data types, an extensive catalog of functions, an environment in which to develop your own functions and scripts, the ability



to import and export to many types of data files, object oriented programming capabilities, and interfaces to external technologies. In this work, MATLAB neural network toolbox was used.

2.5 CREATE NETWORK:

After import of data now,

STEP-1: Enter “nntool” in the command window then the NN tool tab opens.

STEP-2: Various ANN networks are created using Cascade Feedforward Backpropagation. Also by changing number of hidden layers, number of neurons, transfer function, etc.

STEP-3 Train The Network

The prepared ANN models are trained one by one. To train ANN model select the network which you want to train and then click on the train function in the appeared window which is shown below. The predicted outputs and errors will be saved in MATLAB workshop.

STEP-4 Testing Of Network

After training the network, testing data is selected and network is simulated for testing and validation

STEP-5 Prediction Of Results

1) The obtained outputs are dragged into excel sheet and plot is to be drawn in between observed values and predicted values. 2) Also observed values and ANN predicted values are to be compared with time and draw a comparative graph. 3) Then make error analysis and draw graph between ANN obtained errors with time.

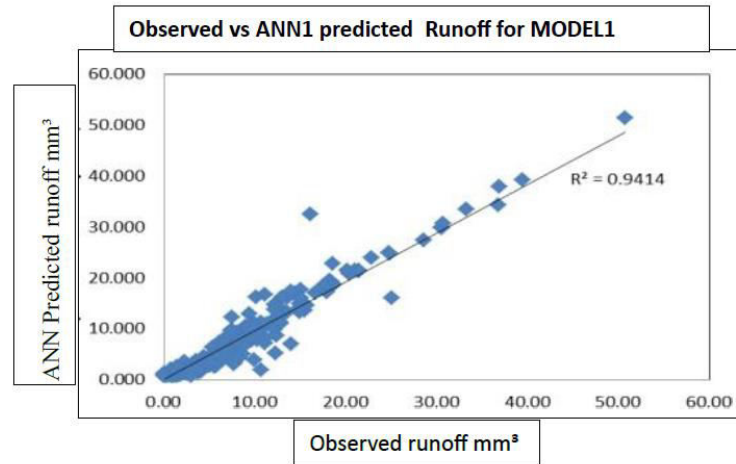
STEP-6 Obtain Best Ann Models After plotting various graphs, select best ANN models based on following

- 1) Root Mean Squared Error
- 2) Mean Squared error
- 3) Coefficient of Correlation
- 4) Coefficient of Regression

Details of TDANN MODEL1

Sr. No	Network	Archi.	Input	Target	No of neurons	R			MSE
						Training	Testing	Validation	
1	TDANN1	FFBP	3	1	8	0.995	0.95	0.997	2.057
2	TDANN2		3	1	9	0.517	0.425	0.799	384.394
3	TDANN3		3	1	10	0.969	0.959	0.959	45.33
4	TDANN4		3	1	11	0.995	0.995	0.996	2.587
5	TDANN5		3	1	12	0.99	0.997	0.993	2.158
6	TDANN6		3	1	13	0.989	0.994	0.983	5.646
7	TDANN7		3	1	14	0.988	0.976	0.978	3.97
8	TDANN8		3	1	15	0.996	0.874	0.984	2.214
9	TDANN9		3	1	16	0.992	0.994	0.989	4.68

RESULT



III. CONCLUSIONS

Artificial neural networks technology is still very new and is developing quickly. The most likely applications of neural networks is to simulate physical systems that are best expressed by parallel networks involving classification, association and reasoning rather than sequential arithmetic computing. Water resources engineering especially prediction of inflows and the optimal operation of reservoirs is one of the most promising application of ANN. An attempt will be made to develop artificial neural network model for reservoir operations and assess the application potential of the Artificial Neural Network in attaining the reservoir operational objectives compared with the conventional rule curves. In this paper, an attempt is made to present the literature review on applications of ANN in the field of water resources engineering with special mention to reservoir operation. This literature review may not be exhaustive but it glimpses the Artificial Neural Network's (ANN) contribution in the field of modelling reservoir operation..

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