

Prediction of Groundwater Level In District Level By Implementing Machine Learning And Advanced Softcomputing Techniques

Mooramreddy Sree Devi^{1*}, Vempalli Rahamathulla²

¹Dept. of MCA, CCMIS, S V University, Tirupati, Andhra Pradesh, India.

²Dept. of MCA, Sree Vidyanikethan Institute of Management, Tirupati, Andhra Pradesh, India

Corresponding Author: msreedevi_2007@yahoo.com

DOI: <https://doi.org/10.26438/ijcse/v7si6.122124> | Available online at: www.ijcseonline.org

Abstract-Groundwater plays a major role in human life. Now-a-days, the Groundwater levels are gradually decreasing due to pollution and over usage of water and lack of rains. The air pollution caused by industries and human wastage reduces the Groundwater. The increased Groundwater threat is a threat to human life. There is no proper planning and infrastructure to preserve the Groundwater. The bore wells and tube wells pump the Groundwater from a very deep source. Over usage of sand also causes the decrement of Groundwater level. Now-a-days, due to the the scarcity of Groundwater, the farmer is unable to decide the kind crop to be grown in his/her land. This is a complex task. The food bowl of India is day by day becoming weak due to a the scarcity of Groundwater. "Atmospherical science is the best source of study for analyzing and predicting the weather phenomenon and suggests ways and means overcome the problem"[1].

Keywords: Rainfall, Geographical Parameters, an aquifer

I. INTRODUCTION

The recent technology of Artificial Neural Networks supports weather analysis process. The networks are a collection of nodes. The network is trained with current values. Based on the learning mechanism, the network can analyze the Groundwater. A detailed report may be generated with the learning mechanism. "The ground level water prediction depends on important parameters of water survey"[2]. The Geographical parameters are used for prediction of Groundwater. The existing data values are given as inputs and the network will be trained. For accuracy, we can modify the network and also the learning mechanism.

We, the team of two members conduct a survey in and around of Chittoor district to analyze the Groundwater levels. Chittoor district is one of the largest one facing water problems in Andhra Pradesh. Very low rainfall is recorded in the district is subjected to frequent drought conditions due to monsoon failures in the recent decade. There is a dire need to analyze and forecast the Groundwater level in the district. This will help farmers to decide the cropping pattern. The major contribution of the proposed project to suggest crops to be grown by farmers. By Implementing the Artificial Neural Networks model to water analysis, we can reduce the the scarcity of water by proposing the water preserving methods and alternate crops.

II. THE SPECIFIC OBJECTIVES

1. To analyze the present Groundwater Level
2. To predict the future Groundwater Level.
3. To facilitate farmers to decide the viable crops in terms of water resources.
4. To Develop Water Management Techniques.
5. Host a web site and publish the periodical reports for the use of the public.

III. PROBLEMS INTENDED

1. Chittoor District is a drought prone area.
2. Water management in the drought area is a very complex task.
3. Many farmers lose crops due to lack of knowledge of water resources.
4. There is no proper model for Groundwater analysis to the knowledge and information of researchers.
5. Enormous the scarcity of drinking water.

IV. ORIGIN OF THE PROPOSAL

Now-a-days, due to the the scarcity of Groundwater, the farmer is unable to decide the kind crop to be grown in his/her land. This is a complex task. The food bowl of India is day by day becoming weak due to the scarcity of Groundwater. Atmospherical science is the best source of

study for analyzing and predicting the weather phenomenon and suggests ways and means overcome the problem.

Groundwater plays a major role in human life. Now-a- days, the Groundwater levels are gradually decreasing due to pollution and over usage of water and lack of rains. The air pollution caused by industries and human wastage reduces the Groundwater. “The increased Groundwater threat is a threat human life”[3]. There is no proper planning and infrastructure to preserve the Groundwater. The bore wells and tube wells pump the Groundwater from very deep source. Over usage of sand also causes the decrement of Groundwater level. The complicated task related to the Groundwater is aquifer. This may happens due to human activities. The Groundwater fluctuations are caused because of different human activities. The Groundwater level fluctuations should be a monitor for taking precautions. Now a days the computer-related technologies such as ANN, Machine Learning, Big Data Analytics are widely implemented for data analysis and prediction implementations. These models majorly depend on input data which we are submitted as the initial data. This process is successfully implemented with linear and non-linear techniques. The aquifer contains a under water layer as shown in figure 1

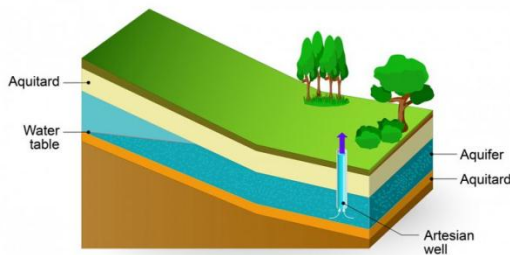


Figure 1: Aquifer

V. LITERATURE SURVEY

Machine Learning is recognized as one of the popular tools for solving hydrological problems such as prediction of rainfall, prediction of Groundwater level, prediction of thunderstorms etc. The Machine Learning Sub domain ANN was implemented in the year of 1992 for Groundwater analysis by aziz and Wong. “The transmissivity was obtained for groundwater with the help of ANN”[4]. The transmissivity was implemented by training the network with accurate input values. “Theis and Jacob, coulibaly etal. Implemented the machine learning in 2001 to simulate the groundwater fluctuation in Gondo Aquifer, with the help of structures and Private Neural Networks”[5]. In the year 2003 RNN (Recurrent Neural Network) was implemented with the short range of data (Approximately 7 years). “Esmaili Varaki has designed an Network based models for identifying the fluctuation of alluvial aquifer Groundwater level”. In the year 2005 Lahem et al, proposed a Machine

Learning model for dynamic water level in Karstic aquifer . “Also Ioannis eta al, in the year 2010 used soft computing approach for karstic aquifers, which is still in use to simulate the numerical groundwater model”[6]. In the next area of research Udemy implemented the combination of statistics and Neural Network to form a powerful machine learning mechanism for Groundwater analysis. The Machine Learning approach was implemented in the year 2017 to predict the rainfall by V.Rahamathulla and Dr. S.Ramakrishna and noticed the maximum accuracy of results for the rainfall prediction. “ MSE(Mean Square Error) and Regression techniques was implemented in 2007 to improve the accuracy of prediction by Rosmina”[7].

VI. THE ROLE OF RAINFALL

Rainfall is one of the major resources for the Groundwater. The variations in the rainfall is also caused fluctuations in the Groundwater levels. “The rainfall is manorly depends on temperature, humidity, wind speed, wind direction and cloud cover”[8]. The area which is covered with maximum cloud may have the chance of getting the rainfall. “The heavy rainfall increases the Groundwater level by proportionating” [9][10]. The major considerable factors for Groundwater is rainfall.

VII. EXPERIMENT DESIGN

The aquifer with the plain surface of 30 m length and 26 meters of width has been chosen from the chittoor district of Gadhanky village to conduct the Groundwater level study. The data set was collected for 5 years and applied Machine Learning to obtain the next prediction values.

The capability of the prediction may be increased by the trained network. The task has been divided into 4 groups, according to the hydrological characteristics such as

- Groundwater depth
- Hydraulically transmissivity
- Rainfall
- Transmissivity

The detailed study identifies the 450 epochs for training and 150 data records are used for training the data. The network is trained with the set of data values, and the results are shown in the table1.

Table1: The parameters of groundwater

S . N o	Fir st Layer In put	Ne xt Layer In put	Ep och	Lear ning Rate	R tr ain	R valid ation	R T est	M SE	Data Utiliz ation
1	5	4	400	0.44	0.85	0.076	0.7	7	70-15-15

							4		
2	4	3	40 0	0.06	0. 47	0.87	0. 6 7	5	70- 15-15
3	5	3	50 0	0.07	0. 89	0.76	0. 8 2	5	70- 15-15
4	5	4	50 0	0.05	0. 79	0.67	0. 7 3	3	70- 15-15
5	5	3	30 0	0.90	0. 64	0.87	0. 7	2	70- 15-15
6	5	4	40 0	0.89	0. 69	0.87	0. 7 8	2	70- 15-15
7	5		40 0	0.79	0. 79	0.89	0. 8 4	3	70- 15-15

VIII. ALGORITHM FOR GROUNDWATER PREDICTION

- Step 1: present the input vector (v)
 - Step 2: Calculate the scalar values v+1
 - Step 3: Calculate the related input values
 - Step 4: Identify the de-scaled output values
 - Step 5: Present v+1 input vector to the network to produce the required output.
- predicted results are shown in the figure 3

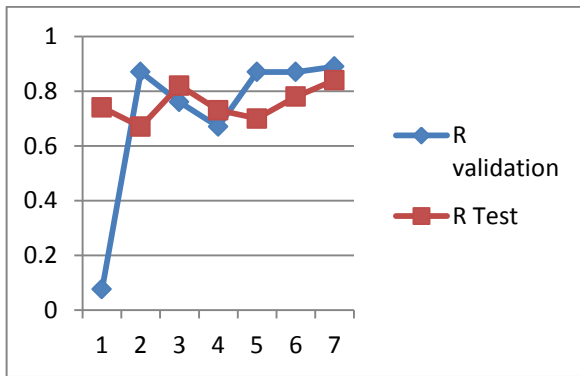


Figure 2: Prediction of Groundwater

IX. CONCLUSION

The main aim of this research paper is to implement the Machine Learning to predict the Groundwater Level. The dataset was collected from the plain aquafiere and

implement with the help of neural networks for the actual prediction. The data was collected from 20 Groundwater Stations and implemented with the help of Machine Learning with the intension of Predicting the Groundwater Level. The extensions of this study is to implement for the Andhra Pradesh and all other states of the India. We are planning to host a web site that provide immediate prediction results for the formers and work management people.

REFERENCES

- [1]. Aziz,A.R.A. and Wong, K.F.V. (1992) Neural network approach the determination of aquifer parameter. Groundwater, v.30(2), pp.164-166.
- [2]. ESMAILI VARAKI, M. (2003) Presenting an intelligent model for estimating the fluctuation of alluvial aquifer groundwater level by using artificial neural network. the collection of first two yearly conference of managing water resources of Iran.
- [3]. GIDSON, S (2009). Application of Artificial Neural Networks in the Field of Geohydrology. Thesis for Msc of University of the Free State.
- [4]. KAASTRA, I. and BOYD, M. (1996). Designing a neural network for forecasting financial and economic time series. Neurocomputing, v.10(3), pp.215-236.
- [5]. MAIER, H.R. and DANDY, G.C. (2000) Neural networks for the prediction and forecasting of water esources variables: a review of modeling issues and applications. Environ. Modell. Software, v.15, pp.101-124.
- [6]. TASLLOTI, B. (2004) Estimating groundwater level by using MODFLOW and artificial neural network, Msc thesis of irrigation and drainage engineering, Tarbiat Modares University of Tehran, Iran.
- [7]. VEMURI, V.R. (1992) Artificial Neural Networks, Concepts and ControlApplications, IEEE Computer Soc. Pr., Los Alamos, California.
- [8]. V.Rahamathulla, S.Ramakrishna.(2017) Prediction of rainfall through Data Science using Time Series analysis and Prediction Analysis, IJETCS, Volume 7, Issue 1, January – February 2018.
- [9]. LALLAHEM, S., MANINA, J., HANI,A. and NAJJAR,Y. (2005)on the use of neural networks to evaluate groundwater levels in fractured porous media. Jour. Math. Computer Modell., v.37, pp.1047-1061.
- [10]. NAZARI, J. and ERSOY, O. (1992). Implementation of Back Propagation Neural Networks with Matlab, School of Electrical Engineering – Purdue University, West Lafayette, Indiana,

Authors Profile

Dr.Mooramreddy Sreedevi Working as a Assistant Professor in the Dept.of Computer Science, S.V.University, Tirupati since 2007.

