Ground Water Level Prediction Using Pso-Svr

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Abstract: The level of groundwater is the amount of water found beneath the surface of Earth in soil pore spaces and rock formations fractures. One of the important factors affecting the growth of the national economy and society is the ongoing decrease in groundwater rates. The prediction of variations in groundwater level (GWL) is very significant in the management of water resources. Groundwater level has unpredictable characteristics due to natural and anthropogenic factors influences. Water below the land surface appears in two zones - saturated and the unsaturated zone. When rainfall occurs, a part of it infiltrates into the ground. Some amount of this infiltrated rain is held up by the upper layer of soil in its pore spaces

Index Terms: GWL,GNU,PSO-SVR,CART,LR,ME.RSME,Permafost,R

1. INTRODUCTION

[2]Groundwater is the water present beneath Earth's surface. Typically, Groundwater is thought to flow into shallow aquifers, but it can also contain soil moisture, permafrost (frozen soil), immobile water in very low permeability bedrock, and deep geothermal and oil-forming water in the technical sense. Groundwater is believed to provide lubrication that may influence the motion of faults. Much of the subsurface of Earth is likely to contain some water, which in some cases can be combined with other liquids. Groundwater is not limited to Earth alone. Groundwater might have affected the development of some of the landforms observed on Mars. [1]Groundwater is often cheaper than surface water, more convenient and less prone to contamination. It is therefore widely used for the distribution of public water. Groundwater, for instance, is the largest source of available water storage in the U.S., and California withdraws the largest amount of groundwater in all states every year.[3] Underground dams produce far more water than all surface reservoirs and ponds in the United States, including the Great Lakes. Many municipal water supplies come from soil water alone.

2 LITERATURE SURVEY

Conducting literature survey prior to begin a research project is vital in understanding the Machine Learning algorithms. Missing data is a given in the medical domain, so machine learning models should have satisfactory performance even when missing data occurs. [4]Groundwater levels is the vital point for many countries economy and is predicted by linear regression model with small samples and data size. In this paper we introduce machine learning tools with linear regression model based on the satellite data of water levels and population of the respective areas in last two years. The results of this experiment show that our proposed framework is better than other machine learning approaches to predict the two- year overall water level.

[5]Areas with less population does not affect the water levels but largely populated areas drastically affect the water levels. The annual rainfall is also an important factor. Several predictive models based on traditional statistical methods and machine learning techniques have been reported, however, no guidance to variation in performance has not been provided to date.[6]Therefore, in this study, we perform linear regression algorithm in the machine learning to improvise the efficiency of the model. The performance of this regression algorithm is evaluated in conjunction with several feature selection strategy and the impact of the feature selection on performance is future evaluated.

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3 EXPERIMENTAL INVESTIGATIONS

3.1 LAGUAGE R

For numerical computation and visualization, R is a language and environment. It is a GNU project close to the S language and environment that was created by John Chambers and colleagues at Bell Labs (formerly AT&T, now Lucent Technologies).[7]R can be considered as another S implementation. There are some significant differences, but a majority of code written for S runs unchanged under R. R includes a wide range of statistical (linear and nonlinear simulation, classical statistical evaluation, study of time series, grouping, clustering,...) and visual techniques, and is highly extensible. In statistical methodology, the S language is often the vehicle of choice, and R provides an Open Source route to participation in that activity. One of the strengths of R is the ease with which well-designed plots of publishing value can be generated,[9] including mathematical symbols and formulas where appropriate. The settings for the minor design choices in graphics have been taken very carefully, but the user maintains full control. R is licensed as Free Software under the GNU General Public License of the Free Software Foundation in source code form. It compiles and runs on a wide variety of UNIX platforms and similar systems (including FreeBSD and Linux), Windows and MacOS.

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[8] R is a programming language and programming environment for statistical analysis, representation of graphics and reporting. R was developed at the University of Auckland, New Zealand by Ross Ihaka and Robert Gentleman and is currently being developed by the R Design Core Team. R is available free of charge under the GNU General Public License and pre-compiled binary versions are available for different operating systems like Linux, Windows and Mac. This programming language was named R, based on the first letter of first name of the two R authors (Robert Gentleman and Ross Ihaka), and partly a play on the name of the Bell Labs Language S.

4 EXPERIMENTAL RESULTS

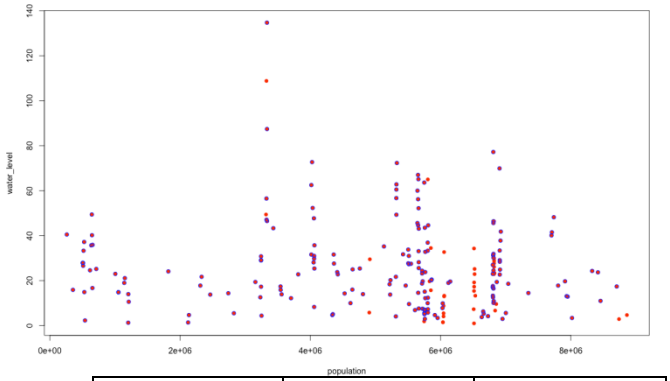
Firstly, we need to take the data and convert it into the csv file. [11]The data should be imported and then analyse the data how many wells are active and how many wells are inactive. After that we need to divide the data as the training set and test set. Then, by using the in- built packages in R we predict the waterlevel and then find the accuracy of the technique i.e., how much accurately the gorundwater level is being predicted among the all data sets of training data set and test data set. After finding the accuracy of the technique we need to plot by representing the trained data and predicted data.

Terms	SUPERVISED LEARNING	UNSUPERVISED LEARNING
Input data	Uses known and labled data as input	Uses unknown data as input
Computational Complexity	Very complex	Less computational complexity
Real time	Uses off-line analysis	Uses real-time analysis of data
Number of classes	Number of classes are known	Number of classes are unknown
Accuracy of results	Accurate andReliable results	Moderate accurate and Reliable results

5 DISCUSSION OF RESULTS

Then in this case the Maximum likelihood estimation procedure will not be the same as the one for ordinary least squared fit. MLE calculations in truncated observations case are a bit cumbersome. It can be probed whether a slight variation in the ordinary least squared fit procedure can be equivalent to the truncated-case MLE. In the worst case, the MLE calculations for the case of truncated observations can be carried out using some numerical optimization procedure.[12]These are the few results and comparisons we represent here how the ground level water prediction can be done. We also had the rainfall data measured at rain-gauge stations in Thane and Latur. We developed rainfall models using this dataset too.[13] The rainfall at an observation well in the months June-September in a year t i.e. rt was calculated differently in this case. Each taluka in a district would have a rain-gauge station. All the observation wells in a taluka 'T' were assigned the rainfall measured in the months June-September at rain-gauge station located in taluka 'T'.

Architecture	ME	MAE



PSO-SVR	2.73	31.11
CART	1.88	18.92
LR	1.72	17.26

Table 6.1 *Comparision of ME and MAE of our proposed models*

6 CONCLUSION

We proposed a better method for the estimating groundwater level for the given data set using the Linear Regression method. Using this Method, a clear equation is generated and on comparing different algorithms we selected the best configuration and trained our model using Texas Dataset wells[226 areas], Population_18[226 areas] and test our model with Population_19[226 areas] and we noticed the highest accuracy.

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