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Water Quality Prediction Using Artificial Intelligence Algorithms

Prof. Namrata Ghuse[1], Nilesh Dalvi[2], Mothabhau Borkar[3], Amit Admane[4]

[1]Assistant Professor [2 3 4]Student
[1 2 3 4] Department of computer Engineering
[1 2 3 4] Sandip Institute of Technology and Research Centre, Nashik

Abstract - An accurate prediction of water quality (WQ) related parameter is considered as pivotal decisive tool in sustainable water resources management. For this aim, monthly average data of water temperature (T), Turbidity, pH, Electrical Conductivity (EC), Alkalinity (Alk), Calcium (Ca), chemical oxygen demand (COD), Sulfate (SO4), total dissolved solids (TDS), total suspended solids (TSS), and BOD measured for ten years period were used in this study. Firstly, considering that water quality parameter changes have obvious time characteristics, a time series prediction model of water quality parameters is established based on LSTM. The water quality is predicted in this paper. It is found that it is important to keep the water level in the reservoir at a relative high level. Finally, the dataset we are using is numerical type excel sheet dataset which have data of water quality parameters such as ph , hardness, sulphate, etc. The dataset is collected from the Kaggle. The Programming language we are using is Python. The whole Project is based on window application, so we are using Anaconda software for coding via Spider editor. To record all the registrations and data of user we are using Sq lite software.

***Key Words*:** Water quality, Modelling, Intelligent water service, Support Vector machine**.**

1. INTRODUCTION

Human life is significantly reliant on the availability of water because humans depend on water for many activities such as for drinking, cooking, farming, personal hygiene, industrial and manufacturing purposes. This has made the prediction of Water Quality a difficult task in recent times and many scholars have dedicated much effort to Water Quality assessment due to its importance to human life. Water Quality management is necessary for the effective management of all water related resources. With the development of modern information technology, the introduction of artificial intelligence algorithms has gradually become one of the important directions for constructing water quality prediction models. The prediction of important parameters in water quality is based on the historical monitoring data of the national control section, using modern technology to estimate and speculate the future change trend of water quality index concentration, and predicting the concentration of major pollutants in the water reflecting the degree of pollution is of great significance for making appropriate water environment management decisions. The water quality of the natural runoff varies from Grade I to Grade II, but the water quality of Qiantang River in generally is worse than Grade V. Thus to modeling the water dynamics and to predict the water quality of the reservoir is of great importance for the reservoir operation and the water supply security of Hangzhou city. The quality of any body of surface of ground water is a function of either both human and natural influences.

Without human influences water quality would be determined by the weathering of bedrock minerals, by the atmospheric processes of evapotranspiration and the deposition of dust and salt by wind, by the natural leaching of organic matter and nutrients from soil, by hydrological factors that lead to runoff, and by biological processes within the aquatic environment that can alter the physical and chemical composition of water. Poor water quality has a direct impact on water quantity in a number of ways. Polluted water that cannot be used for drinking, bathing, industry or agriculture effectively reduces the amount of useable water within a given area.

2. LITERATURE SURVEY

In [2020] Naima Khan & Nirmalya Roy introduced “Water Quality Assessment with Thermal Images”. They tried to provide a possible solution by building a risk analysis framework for the urban water supply system. They collected the data from industrial processes to perceive water quality changes, and further for risk detection. In order to provide

explainable results, they propose an Adaptive Frequency Analysis (Adp-FA) method to resolve the data using indicators' frequency domain information for their inner relationships and individual prediction. They also showed the feature distances of these water samples with the safe water sample. Their proposed framework can differentiate features for different impurities added in the water samples and detect different category of impurities with average accuracy of 70%.

In [2020] Delight Sekhwela, Pius Adewale Owolawi, Temitope Mapayi, Kehinde Odeyemi introduced "Water Quality Monitoring with Notifications System". In this System They used cheaper and easier process to examine the quality of water samples for drinking from different sources .With this in mind, they experimented few water samples from different places of USA including artificially prepared samples by mixing different impurities. They investigated their heating property with the sample of marked safe drinking water. They collected thermal images with 10-seconds interval during cooling period of hot water samples from the boiling point to room temperature. Then extracted features for each of the water samples with the combination of Convolution Neural Network (CNN) and Recurrent Neural Network (RNN) based model and classified different water samples based on the added impurity types and sources from where the samples were collected. They implemented smart technology in the distribution networks just to ensures a rapid detection of abnormalities. In short word basically this system presents a field study to Observe & monitor quality of the water using smart notification system. In this paper, Water Quality with Notifications System is presented to better the lives of the people by providing an easy and simple mechanism to know the water quality stored in the reservoir. It holds different sensors for getting water quality parameters namely PH Sensor, Nitrate Sensor, Turbidity Sensor, Water Level Detection Sensor.

In [2020] Di Wu, Member, IEEE, Hao Wang, Member, IEEE, Hadi Mohammed, and Razak Seidu introduced the "Quality Risk Analysis for Sustainable Smart Water Supply Using Data Perception". The of this study used water quality data to build a machine learning model. Experts used the adp-FA algorithm's RMSE(root mean square error). Then experts compared this method with ANN and Random Forest. However, the traditional methods frequently used, are based on laboratory analyses and take several days. To prevent earlier water quality degradation, they needed a real-time monitoring. To construct Sustainable Smart Water Supply systems experts were facing serious challenges. But, using adp-FA algorithm experts managed to analyse the quality risk of the smart and sustainable water supply by using data perception. This study takes the assumption as each indicator is independent. But different from other work to analyse each indicator separately, here they can provide a perspective to find the relationships between indicators by frequency analysis. At the same time, they presented various evaluations to show the prediction accuracy. In this section, They show the scalability of this method can serve as a very powerful tool for practical water quality early warning.

In [2019] Baoxiang Chen, Chao Kong, Yu Xiu, Liping Zhang introduced "An Effective Construction Pattern of Wireless Sensor Network for Water Quality Detection". They first investigated the scalability properties of this method from indicator, geography and time domains. For this application, experts selected industrial quality data sets collected from a Norwegian project in 4 different urban water supply systems, as Oslo, Bergen, Strømmen and Alesund and employ the proposed method to test spectrogram, prediction accuracy and time consumption, comparing with classical Artificial Neural Network and Random Forest methods. As the results shown the method of "an effective construction pattern of wireless sensor network for Water Quality detection" performed better in most of the aspects. According to them, it is feasible to support industrial water quality risk early warnings and further decision support. However, there are expensive instruments and paper sensors to detect the quantity of minerals in water. But these instruments are not always convenient for easy determination of the quality of the sample as drinking water. They conduct extensive experiments based on different wireless sensor network construction pattern to handle water quality detection task, employing well-selected hardware and well-designed software to realize networking and data analysis. Both quantitative results and qualitative analysis verify the effectiveness and rationality of our WQD method. The accuracy of this sensor id up to 80%.

In [2018] Muhammad Bilal, Abdullah Gani, Mohsen Marjani, Nadia Malik introduced "A Study of Detection and Monitoring of Water Quality flow". The objective of this to study and monitor the Water Quality flow. Their aim in this study is to give the overview of the data sources. According to the theirr survey, in many places the quality of ground water and river water as drinking water healthy for people is very poor, even in some places is not worth drinking. Hence, to tackle those problems this study guides the researcher and provides insights to the researchers about the possible ways and sources of data that can be utilized by keeping tradeoffs in consideration. What they presents in this study is the feedback of these smart devices, the analysis of water quality signals and finally a comparison with laboratory tests. This work presents a review of the recent works carried out by the researchers in order to make water quality monitoring systems smart, low powered and highly efficient such that monitoring will be continuous and alerts/notifications will be sent to the concerned authorities for further processing. The developed model is cost effective and simple to use (flexible). Three water samples are tested and based on the results,

the water can be classified whether it is drinkable or not.

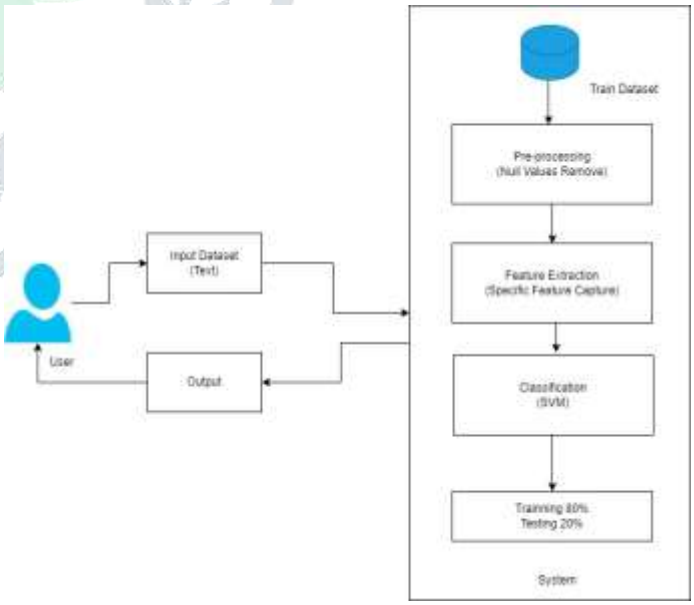
In [2017] Christine Saab, Isam Shahrour ,Fadi Hage Chehade introduced "Smart Technology for Water Quality Control: Feedback about use of water quality sensors". Their intention behind this system is to presents a field study of the use of this technology in a project conducted at the campus of the University of Lille within the European project"SmartWater4Europe". Many attempts are being made by researchers for the detection and monitoring of water quality and flow to overcome the uncertainties associated with the quality of drinking water available to the general public and early warning of floods by adopting computing techniques. The prevailing situations of water crisis i.e. nonavailability of drinking water, unpredicted floods, rapidly changing paths of water streams, are of great concern. To prevent those situation from happening Experts provided the feedback about the use of Water Quality Sensors to spread the awareness among the society. This paper present the feedback of these smart devices, the analysis of water quality signals and finally a comparison with laboratory tests.

In [2017] Sona Pawara, Siddhi Nalam, Saurabh Mirajkar, Shruti Gujar, Vaishali Nagmoti introduced "Remote Monitoring of Waters Quality from Reservoirs". They introduced this system to monitor the quality of Water in the reservoirs. In many places, the quality of ground water and river water as drinking water healthy for people is very bad, even in some places is not worth drinking. These conditions forced the poor still use the water for their daily needs so that it can have an impact on their health. Therefore, to avoid these things experts used remote monitoring of water quality in reservoirs to provide good water quality. Potable water has a certain standard indicators, namely: indicators of physical, chemical, and biological. This data is transferred by radio frequency transmitter module to the lab, thus eliminating the need of physically going to the water bodies, ensuring real time on demand data of contamination level and also acts as warning system for hazardous levels of contaminants. Analysis of Real-Time Water Quality Monitoring Data Based on. The real-time water quality monitoring network has been operational for water resource protection and water quality detection. It is useful for management plans of water utility and local authorities to realize change characteristic of water quality.

In [2016] Taufiqurrahman, Ni'am Tamami, Dito Adhi Putra, Tri Harsono introduced the "Smart Sensor Device for Detection of Water Quality as Anticipation of Disaster Environment Pollution". The aim of this study is to detect water quality using smart sensor device to avoid environmental pollution that cause harm to the water supplies. In the system, the principle of wavelet analysis widely used in dynamic data processing was introduced. The parameters used to determine these indicators include the degree of acidity (pH), total dissolved solids (TDS), transparency or turbidity and water temperature. This study makes a water quality detection tools by using four parameters above. Determination of water quality using fuzzy logic, divided into three categories: water quality is good, less good and bad. The experimental results in some places of the water source was obtained detection of water quality accurately:
(1). Water quality is good for water from the local government water company of Surabaya and Malang; mountain spring water, wells water in Malang; and aqua water, (2). Water quality is less good for wells water in Surabaya, and (3). Poor water quality for tap water mixed with soap.

3. SYSTEM METHODOLOGY

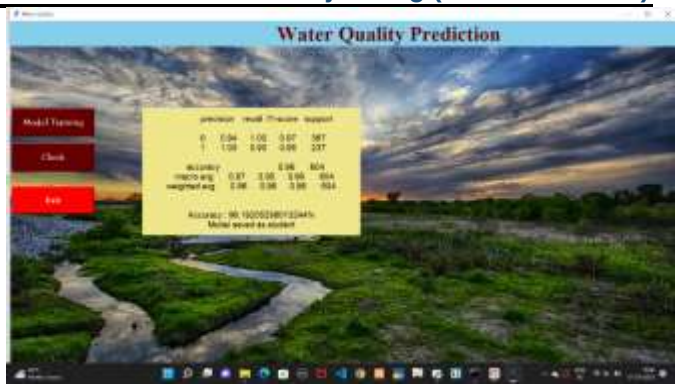
The propose system, is to predict the Water Quality using SVM (Support Vector Machine) Algorithm and group Method of Data handling. The Propose System is experimentally evaluated on a Water Quality related datasets . The factors that are we are using to determine water quality are water quality parameters such as ph , hardness, sulphate, etc. Then system preprocess the input dataset for cleaning the excess data or to remove null data. Then by using feature extraction method system selected the main features or shortlisted the main features. By using Model training and testing on the dataset using SVM algorithm for the Classification process. Here we get the output screen. If we put the values of trained dataset such as ph, sulfate, etc. we get the result of Water Quality Prediction. We can Predict the water is good or bad.



4. RESULT

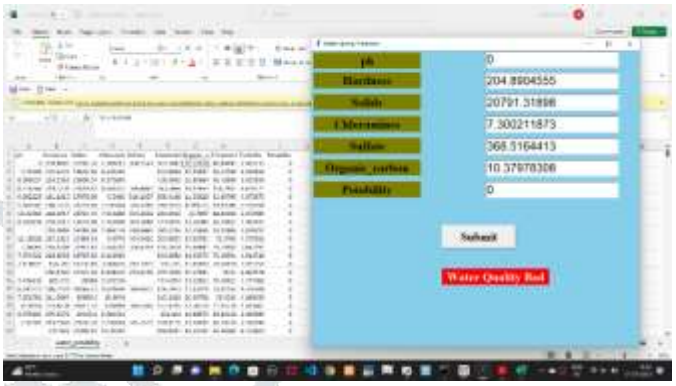
For Software Interference The Proposed system has been developed using Window application Anaconda via spider editor.

Main Page



Accuracy

Registration



Water Quality Result

Log In

Model Training & Check

5. CONCLUSION

The proposed models were evaluated and examined by some statistical parameters of Water such as ph, Hardness, Solids, Chloramines, Sulfate ,etc. However, the SVM algorithm has achieved the highest accuracy of Model. After we put parameter values in output screen, system shows the water quality is good or bad. The accuracy of the prediction of water quality is more than 90%. To Predict the Water Quality we used Support Vector Machine Algorithm. The SVM algorithm is used to gain more accuracy in Water Quality Prediction. Modeling and prediction of water quality are very important for the protection of the environment. Developing a model by using advanced artificial intelligence algorithms can be used to measure the future water quality.

6. REFERENCES

1)Naima Khan, Nirmala Roy, "Water Quality Assessment with thermal images," Published in 2020 IEEE international Conference on smart computing, 2020.

2) Delight Sekhwela , Pius Adewale Owolawi, Temitope Mapayi , Kehinde Odeyemi , "Water Quality Monitoring with Notifications System" Published in 2020 2nd international multidisciplinary information technology and Engineering Conference (IMITEC), 2020.

3) Di Wu, Member, IEEE, Hao Wang, Member, IEEE, Hadi Mohammed, and Razak Seidu , "Quality Risk Analysis for Sustainable Smart Water Supply Using

Data Perception" IEEE transactions on Sustainable Computing. (volume: 5, issue: 3),2020.

4) Baoxiang Chen, Chao Kong, Yu Xiu, Liping Zhang , "An Effective Construction Pattern of Wireless Sensor Network for Water Quality Detection" Published in 2019 5th international conference on Big Data and Information Analytics (BigDIA) ,2019.

5) Muhammad Bilal, Abdullah Gani, Mohsen Marjani, Nadia Malik ,"A Study of Detection and Monitoring of Water Quality flow" published in 12th international Conference on Mathematics, Actual Science, Computer Science and Statistics (MACS) , 2018.

6) Christine Saab, Isam Shahrour ,Fadi Hage Chehade, "Smart Technology for Water Quality Control: Feedback about use of water quality sensors" Published in 2017 Sensors Networks and Smart and Emerging Technologies (SENSET), 2017.

7) Sona Pawara, Siddhi Nalam, Saurabh Mirajkar, Shruti Gujar, Vaishali Nagmoti "Remote Monitoring of Waters Quality from Reservoirs" Published in 2017 2nd International Conference for Convergence in Technology (I2CT),2017.

8) Taufiqurrahman, Ni'am Tamami, Dito Adhi Putra, Tri Harsono "Smart Sensor Device for Detection of Water Quality as Anticipation of Disaster Environment Pollution" Published in 2016 international Electronics Symposium (IES),2016.

9) T. Taskaya-Temizel and M. C. Casey, "A comparative study of autoregressive neural network hybrids," Neural Networks, vol. 18, no. 5–6, pp. 781–789, 2005.

10) K. Farrell-Poe, W. Payne, and R. Emanuel, Water Quality Monitoring, University of Arizona Repository, 2000.

11) P. Zeilhofer, L. V. A. C. Zeilhofer, E. L. Hardoim, Z. M. . Lima, and C. S. Oliveira, "GIS applications for mapping and spatial modeling of urban-use water quality: a case study in District of Cuiabá, Mato Grosso, Brazil," Cadernos de Saúde Pública, vol. 23, no. 4, pp. 875–884, 2007.

12) M. A. Kahlown, M. A. Tahir, and H. Rasheed, National Water Quality Monitoring Programme, Fifth Monitoring Report (2005–2006), Pakistan Council of Research in Water Resources Islamabad, Islamabad, Pakistan, 2007

13) UN water, "Clean water for a healthy world," Tech. Rep., Development, 2010

14) K. Farrell-Poe, W. Payne, and R. Emanuel, Water Quality & Monitoring, University of Arizona Repository, 2000.

15) T. Taskaya-Temizel and M. C. Casey, "A comparative study of autoregressive neural network hybrids," Neural Networks, vol. 18, no. 5–6, pp. 781–789, 2005.

16. C. N. Babu and B. E. Reddy, "A moving-average filter based hybrid ARIMA-ANN model for forecasting time series data," Applied Soft Computing, vol. 23, pp. 27–38, 2014.

17) X. Zhang, N. Hu, Z. Cheng, and H. Zhong, "Vibration data recovery based on compressed sensing," Acta Physica Sinica, vol. 63, no. 20, pp. 119–128, 2014.

18) M. M. S. Cabral Pinto, C. M. Ordens, M. T. Condesso de Melo et al., "An inter-disciplinary approach to evaluate human health risks due to long-term exposure to contaminated groundwater near a chemical complex," Exposure and Health, vol. 12, no. 2, pp. 199–214, 2020.

19) M. M. S. Cabral Pinto, A. P. Marinho-Reis, A. Almeida et al., "Human predisposition to cognitive impairment and its relation with environmental exposure to potentially toxic elements," Environmental Geochemistry and Health, vol. 40, no. 5, pp. 1767–1784, 2018.

20) Y. C. Lai, C. P. Yang, C. Y. Hsieh, C. Y. Wu, and C. M. Kao, "Evaluation of non-point source pollution and river water quality using a multimedia two-model system," Journal of Hydrology, vol. 409, no. 3-4, pp. 583–595, 2011.

21) J. Huang, N. Liu, M. Wang, and K. Yan, "Application WASP model on validation of reservoir-drinking water source protection areas delineation," in 2010 3rd International Conference on Biomedical Engineering and Informatics, pp. 3031–3035, Yantai, China, October 2010.

22) I. R. Warren and H. K. Bach, "MIKE 21: a modelling system for estuaries, coastal waters and seas," Environmental Software, vol. 7, no. 4, pp. 229–240, 1992.

23) D. F. Hayes, J. W. Labadie, T. G. Sanders, and J. K. Brown, "Enhancing water quality in hydropower system operations," Water Resources Research, vol. 34, no. 3, pp. 471–483, 1998.

24) G. Tang, J. Li, Z. Zhu, Z. Li, and F. Nerry, "Two-dimensional water environment numerical simulation research based on EFDC in Mudan River, Northeast China," in 2015 IEEE European Modelling Symposium (EMS), pp. 238–243, Madrid, Spain, October 2015.

25) L. Hu, C. Zhang, C. Hu, and G. Jiang, "Use of grey system for assessment of drinking water quality: a case S study of Jiaozuo city, China," in 2009 IEEE International Conference on Grey Systems and Intelligent Services (GSIS 2009), pp. 803–808, Nanjing, China, November 2009.

26) E. Batur and D. Maktav, "Assessment of surface water quality by using satellite images fusion based on PCA method in the Lake Gala, Turkey," IEEE Transactions on Geoscience and Remote Sensing, vol. 57, no. 5, pp. 2983–2989, 2019.

27) S. Jaloree, A. Rajput, and G. Sanjeev, "Decision tree approach to build a model for water quality," Binary Journal of Data Mining & Networking, vol. 4, pp. 25–28, 2014.

28) J. Liu, C. Yu, Z. Hu et al., "Accurate prediction scheme of water quality in smart mariculture with deep Bi-S-SRU learning network," IEEE Access, vol. 8, `pp. 24784–24798, 2020.