Bulletin of Environment, Pharmacology and Life Sciences
Bull. Env. Pharmacol. Life Sci., Vol 11 [5] April 2022 : 104-108

Online ISSN 2277-1808
Journal's URL:http://www.bepls.com
CODEN: BEPLAD
ORIGINAL ARTICLE **OPEN ACCESS**

Assessment of Drinking water quality by Machine learning-based sensors

Chitaranjan Dalai[1], Syed Azahad[2], P. Suganthi[3], Surya Narayan Sahu[4]
1. Assistant Professor, Department of Civil Engineering, Odisha University of Technology and Research, Bhubaneswar-751003, Odisha, India
2. Associate Professor, Department of Computer Science and Engineering, Methodist College of Engineering and Technology, Abids, Hyderabad, Telangana - 500001
3. Assistant Professor,Department of Computer Science and Engineering,Sri Sai Ram Institute of Technology,Chennai, Tamilnadu.
4.AAssistant Professor, Department of Electrical and Electronics Engineering, Centurion University of Technology and Management, Odisha-752050,India.
Correspondence e-mail:cdchittaranjan1@gmail.com

ABSTRACT
Water is the most important resource available on earth. It's used everywhere in households, industries, and agricultural fields. Water quality is very much crucial for drinking purposes and processing food items. Water quality is monitored under various factors such as ph value, the color of the water, salm, and other minerals levels present inside the water. That's why it's essential to ensure the quality of the level and ensure such tests that promptly give results. The most conventional methods involve the measure of ph level, clarity of the water in the laboratory. These are very time-consuming and less efficient methods. There is a very much need to use machine learning algorithms to develop such models that promptly determine the water's quality. The proposed strategies discussed in this paper take input of the water temperature, turbidity of the water, ph of the water, and amount of dissolved solids present in the water. The algorithms from the machine learning that has been applied in this case study are supervised machine learning named Q-Learning Algorithm which requires the data that is being given to the model to be well labeled, and models then provide an analysis of water quality and other essential factors necessary to indicate the quality of the water.
Keywords: *Drinking Water, Sensor Monitor, Machine Learning, Water Quality, Supervised Machine Learning, Q-Learning Algorithm.*

Received: 18.02.2022 Revised: 12.03.2022 Accepted: 24.03.2022

INTRODUCTION

In most of the world, groundwater is the only source that is used for all the day-to-day activities drinking, agriculture, and industrial use. Water is being used in most countries that are available by ground sources. This water is used by the farmers for agriculture purposes, it is used in households for cleaning, drinking, and other activities. It's used in industries especially the food processing industry and agriculture industry. Apart from the ground sources, water is also being used from springs, rivers, ponds, and bays.The method which is being used in this paper is supervised machine learning. The steps involved in this are as follows:

1. AdaickalamPre-processing
2. Feature extraction
3. Training and testing
4. Classification

The first step involved is the data processing. The data that is being given as input to the model should be cleaned, smoothed, and added proper labels, and the unnecessary data gets removed from the original data to get the predictions in the right way. Before starting the processing steps, it's necessary to know what the standards are set by the world health organization for optimum water quality. The data that's obtained in this study is cleaned and unnecessary data is removed by using the technique of the box plot analysis. The data is then normalized to get only those values in the normal scale by using the q-value of normalization. The data is being converted into the range of 0 to 100. The data is converted in this for the sake of the calculation of the water quality index.

Most probably for an image processing, the system would require enough distortion techniques for it, here in the article [1], the author has explained the stepping process to avoid the reference image while using an ML-based model, in according to that the first step he introduced the convolutional neural network models and by avoiding the pre-processing technique. Only some countries, cities, and village people do not have any water resource management problems. Still, more than 40 percent of people are suffering from water scarcity and getting impure water to drink. From this article [2], the author has used the refractive index gathered from the changes that occur in water, which is changed into the salinity of total dissolved solids. These proposed models are compassionate models to predict the detected images. Spectra fingerprint of humans consuming water from WTP comes over several light-absorbing methods by adding organic and non-organic substances [3]. Water analyzing can be made in different ways; for example, the image capturing and processing can be made from inner or outside of the water level; in such case, article [4] do consists of the recent technology about underwater networking concepts that are firmly constraints under the transmission capability and bitrate facility. Degradation also comes under the water quality management process, which results in additional treatment for those degradation methods; in this paper [5], the author investigates the water supplying system that is undergone with both the surface water, groundwater, and other resources, here the trihalomethane shows up the rise in trend of using quality water by increasing the rate.

Paper [6] represents the knowledge about reliable, efficient, and cost-effective techniques used for air quality monitoring or prediction system; this system consists of enough sensor modules, protocols that help in communication, station management, and cloud accessing techniques. With the elemental od novel, machine learning algorithm, the paper [7] utilizes the artificial neural networking modules, and that is being classified into a different set of pollution sources such as random forest and a significant analysis related to the regression modules, here the framework is being tested on an average range of sensor network benchmarks with a chemical concentration. Once the water quality monitoring has been connected with the cloud server, then the sensor data can be updated more accessible; for example, water quality monitoring system will not be replaced in a particular area the availability will be enough, and in according to that the sensor data can be stored using cloud-based technologies [8]. Drinking water treatments do consist of the variation between raw water quality and chemical dosage, which is particularly noted from water treatment planning, here the varied water resource does have different supply sources from the change in hydrologic condition, some of the ML algorithms used here are principal component, support vector, long short term memory, and other essential regression modules [9]. There are enough data-driven models used to predict water quality and indicate the public health risk possibilities; in that case, limiting factors can uptake the model predictions when the accuracy is high enough and the rate of forecasts is low [10].

MATERIAL AND METHODS

Proposed Work

Water quality evaluation is vital in industrial applications as well as scientific research. Nevertheless, given the frequency of sudden groundwater contamination accidents, the general stationary assessment for water quality must no longer indicate the real requirement. As a result, it is critical to properly as well as dynamically analyse the water characteristics of various regions, which seems to be a great field with in water environmental protection. The continuous evaluation in quality of water can issue an alert before such a problem reaches some vulnerable water areas. It is extremely beneficial to these places in terms of planning and successfully controlling water contamination is represented in the following equation (1).

$$P = \omega_1 P_1 + \omega_2 P_2 + \cdots + \omega_n P_n \qquad (1)$$

While P represents the level of groundwater, $P_1, P_2, \ldots, P_n$ denotes the numerous indicators was using to evaluate quality of the water, as well as $\omega_1, \omega_2, \ldots, \omega_n$ denotes the values for such indicators. To analyse quality of the water more precisely, the groundwater level of quality P is specifically defined as in the following equation (2).

$$P = X_1 . X_2 \qquad (2)$$

With $X_1 \in \{1, 2, \ldots, 6\}$ denotes the groundwater quality level as defined either by Chinese national b water quality guidelines as in equation (3).

$$y = \begin{cases} 0, & x \le x_b \ or \ x \ge x_{b+1} \\ \dfrac{x_{b+1} - x}{x_{b+1} - x_b}, & x_b < x < x_{b+1,} \end{cases} \qquad (3)$$

To address the issue of $(a|s,Q)$evaluating groundwater, several methods have been proposed. The reporting system method, fuzzy extensive evaluation technique as well as thorough water quality identifying $e^{Q(s,a)/\tau}$indicator method are the major methods with static water quality parameters. Although these strategies use their own merits, they also have significant drawbacks. The $\sum_{a'\in A} e^{Q(s,a')/\tau}$computation of a reporting system assessment approach, for illustration the equation (4), is complicated.

$$P(a|s,Q) = \frac{e^{Q(s,a)/\tau}}{\sum_{a'\in A} e^{Q(s,a')/\tau}} \qquad (4)$$

The reliability of the flexible thorough evaluation approach is inferior, and it cannot provide an evaluation for groundwater in grades lower than Grade V.

RESULTS AND DISCUSSION

The computation system based on the Deep learning model is quite sophisticated, and selecting training data for the Deep learning model is challenging. Because diverse indicators are thought to have same impacts in water quality evaluation, the general thorough water quality recognition index technique cannot perform particular analyses based on the features of distinct water bodies.

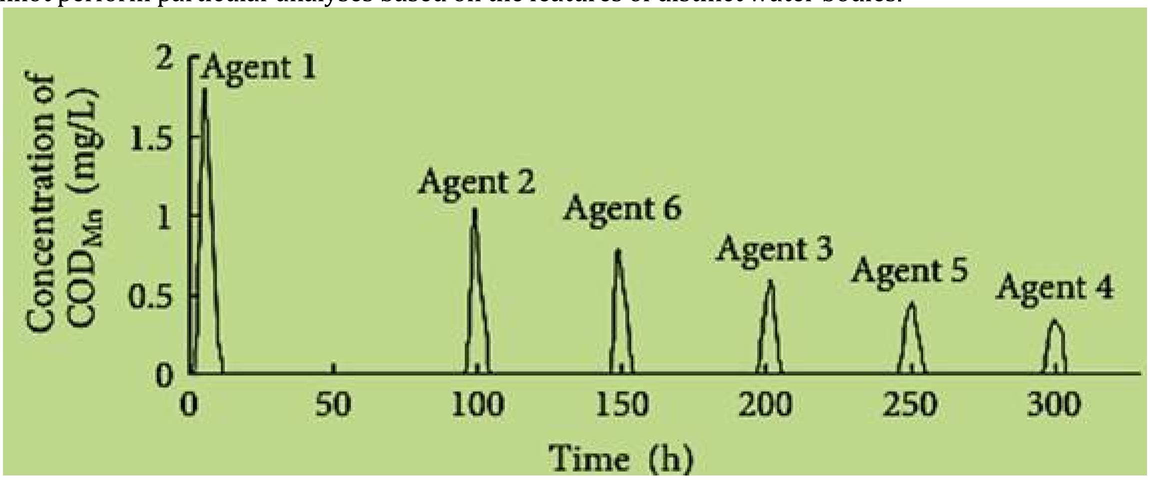

Figure 1: Assessment of Drinking Changes of water quality and the diffusion time of pollutant in each agent by Machine learning based sensors

Static evaluations can only assess groundwater after water contamination has occurred. To address this issue, an increasing amount of research has already been directed toward hydraulic pressure quality evaluation approaches. The probabilistic complete overhaul, for example, was used to evaluate changes in quality of water over time (show in Figure 1). The researchers used neural-based modelling and multivariate data tools to investigate the spatial variation and source identification of pollution. There has been a lot of study on dynamic groundwater resources evaluation methods, and few have looked into the problem of fast detection for unexpected water quality. There are few methods for determining the quality of the water of many other regions based on the water improvement of one place in the very same watershed.

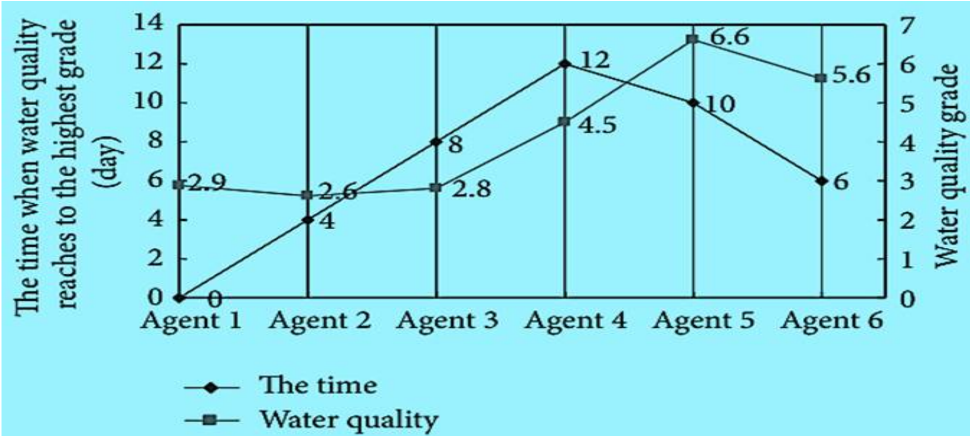

Figure 2: Assessment of Drinking Dynamic assessment results of water quality for different agents by Machine Learning based Sensor

To successfully control water emissions and increase water quality of the environment, the tendency of groundwater contamination should be precisely forecasted whenever a groundwater contamination event happens. Since it is a complicated system problem, the conventional strategy can efficiently address it. Recently, there has been a growing emphasis on the executive strategy, which isn't just a practical but is also an efficient option (refer Figure 2). Consensus challenge in network connection of numerous agents having intrinsic highly nonlinear including selected sample information. A communication technique for a project allocation scheme that can show emergent behaviors in adaptable agent social networking sites. In the multifarious system, an agency is described as an organism with the ability to perceive the surroundings, solve problems, plus communicate with outside environment.

CONCLUSION

In this paper, water quality is being calculated by the use of machine learning algorithms. The water quality index is set by the world health organization. So that machine learning algorithm that gives the lowest values of the errors and gives a good prediction about the water quality is most favorable. Water is the important resource available on earth and that's why its quality should be paid much attention to. The conventional methods that are being employed to measure the quality of the water are osmosis, membrane method, and some ph and turbidity tests. These quality tests are very time-consuming and also take much of the time.

With the help of the machine learning algorithms, there can be a decrease in the processing time and the results can be even more promising. The machine learning algorithms are driven by the data. The data that is being given as input can be temperature, turbidity, ph of the water. These values are then being given as input to various machine learning algorithms to get the water quality index. Some of the data is given for the testing and some for the training of the model. The trained models that give low root mean square and other errors are being selected.

ACKNOWLEGEMENT

The authors acknowledge the subjects who were involved in the study.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest for this study

REFERENCES

1. G. TakamTchendjou and E. Simeu, (2021). "Visual Perceptual Quality Assessment Based on Blind Machine Learning Techniques," *Sensors*, no. 1, p. 175. doi: 10.3390/s22010175.
2. S. K. Roy and P. Sharan, (2016). "Application of machine learning for real-time evaluation of salinity (or TDS) in drinking water using photonic sensors," *Drinking Water Engineering and Science*, no. 2, pp. 37–45. doi: 10.5194/dwes-9-37-2016.
3. S. Hossain, C. W. K. Chow, G. A. Hewa, D. Cook, and M. Harris, (2020). "Spectrophotometric Online Detection of Drinking Water Disinfectant: A Machine Learning Approach," *Sensors*, no. 22, p. 6671. doi: 10.3390/s20226671.
4. J.-M. Moreno-Roldán, M.-Á. Luque-Nieto, J. Poncela, and P. Otero, (2017). "Objective Video Quality Assessment Based on Machine Learning for Underwater Scientific Applications," *Sensors*, no. 4, p. 664, doi: 10.3390/s17040664.

5. S. Chowdhury, (2018). "Water quality degradation in the sources of drinking water: an assessment based on 18 years of data from 441 water supply systems," *Environmental Monitoring and Assessment*, no. 7. doi: 10.1007/s10661-018-6772-6.
6. B. Jo and R. Khan, (2018). "An Internet of Things System for Underground Mine Air Quality Pollutant Prediction Based on Azure Machine Learning," *Sensors*, no. 4, p. 930. doi: 10.3390/s18040930.
7. L. Grbčić, I. Lučin, L. Kranjčević, and S. Družeta, (2020). "A Machine Learning-based Algorithm for Water Network Contamination Source Localization," *Sensors*, no. 9, p. 2613. doi: 10.3390/s20092613.
8. B. K. Jha, (2020). "Cloud-Based Smart Water Quality Monitoring System using IoT Sensors and Machine Learning," *International Journal of Advanced Trends in Computer Science and Engineering*, no. 3, pp. 3403–3409. doi: 10.30534/ijatcse/2020/141932020.
9. H. Wang, T. Asefa, and J. Thornburgh, (2021). "Integrating water quality and streamflow into prediction of chemical dosage in a drinking water treatment plant using machine learning algorithms," *Water Supply*, no. 3, pp. 2803–2815. doi: 10.2166/ws.2021.435.
10. T. Xu, G. Coco, and M. Neale, (2020). "A predictive model of recreational water quality based on adaptive synthetic sampling algorithms and machine learning," *Water Research*, p. 115788. doi: 10.1016/j.watres.2020.115788.

CITATION OF THIS ARTICLE

Chitaranjan Dalai, Syed Azahad, P. Suganthi, Surya Narayan Sahu**,** Assessment of Drinking water quality by Machine learning-based sensors, Bull. Env. Pharmacol. Life Sci., Vol 11[5] April 2022.104-108