Prediction Water Pollution Using Machine Learning

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1 Introduction

All the studies on WQI are reviewed and studied keenly.WQI is the unique rating and its very valuable to depict the amount of pollution on the water. water quality is measured with different parameters like

(1) Turbidity

(2) Temperature

(3) Dissolved Oxygen

(4) PH

(5) Phosphate

(6) Nitrate

These are the parameters on which WQI depends and predict the water quality based on the above mentioned parameters Q values.

(1) obtain measurements on individual water quality indicators

(2) transform measurements into "sub-index" values to represent them on a common scale

(3) aggregate the individual sub-index values into an overall WQI value. In this study, the weighted arithmetic mean method for WQI is used as shown in Figure **??**.

Water quality index by weighted arithmetic mean μ method WQIA can be found out by the following formula:

Value of WQI	Quality of Water
90-100	Excellent
70-90	Good
50-70	Medium
25-50	Bad
0-25	Very Bad

2 Methodology

The Water Quality Index model developed in the present study consists of 5 steps:

1. Selection of parameters for measurement of water quality.

2. Development of a rating scale to obtain the rating (V r).

3. Estimating the unit weight of each indicator parameter (W i) by considering the weightage of each parameter.

4. Determining the sub-index value (W i V r).

5. Aggregating the sub-indices to obtain the overall WQI. The above steps are elaborately discussed below:

2.1 Selection of parameters for measurement of water quality

The evidence of high organic pollution in the river basin is considered as a basis of selecting the water quality parameters viz. pH, DO, BOD, electrical conductivity (EC),turbidity,change in temperature, nitrate ,nitrogen, total coliform as significant indicator parameters of surface water quality in the present study.

2.1.1 Effect of PH

PH values is mainly used to predict acidity or alkalinity of the water.As human beings body consists of about 55-65 percent of water so PH plays an important role in dealing with the body's health, disease conditions and health. it is mandatory for our body to maintain the pH range about 7.0-7.2. The digestion and absorbtion of the vitamin and minerals of the body will not function if the pH is less than 5.3. so pH around 6.4-6.5 is mandatory for human body to function normally.Now what if pH is above 8.5,it have equal effects on our body like skin diseases,eye irritation and also the main reason behind the swelling of hair fibres.If the water's pH is around 3.5 it adversely effects the fish reproduction and ultimately fish will die nevertheless it as adverse effects on human beings. The pH of range 6.5-8.5 for the classes A,B,D and E and for C its 6-9 ,these ranges of pH were given by the Central Pollution Control Board .

2.1.2 Effect of dissolved oxygen

Water Temperature,salinity,altitude,turbulence are important parameters which gives the amount of dissolved oxygen to be present in the surface water.In the water the dissolved oxygen is about 5 to 14.5 mg of oxygen per litre.The pollution of the water also highly dependent on the dissolved oxygen content.As the content of the dissolved oxygen increases then the WQI(Water Quality Index) value also increases to certain point and then decreases .The concentration that can be dissolved in the water entirely depends on the surface water temperature so it may change from time to time and place to place and also it's not fixed.Central pollution control board has defines Dissolved oxygen values 6,5.4 and 4mg per litre for classes A,B,C and D respectively.

The maximum concentration of oxygen that can dissolve in water is the function of water temperature, and therefore may vary from place to place and time to time. In India average tropical temperature is 27 C. The corresponding average DO saturation concentration reported is 8 mg/l (Metcalf and Eddy 1972). Central Pollution Control Board , has defined DO values 6, 5, 4, and 4 mg/l for classes A, B, C, and D, respectively. Considering the classification in the similar guideline for DO for this study, the DO ranges for classes 1–5 are allotted in decreasing progression.

2.1.3 Effect of nitrate

If there is excess amount of nitrate nitrogen then it may cause eutrophication of the overlying or the surface water.Due to this excess nitrate present in the water, it may even kill a fish and also the lake by hardly providing any oxygen.If nitrate level is excess then it may cause the difficulty in taking the oxygen for the aquatic animals and ultimately leading to the death.

When the nitrite nitrogen reacts with iron in RBC(Red Blood Cells) to form the methemoglobin which is mainly responsible for reducing the oxygen carrying capacity of the hemoglobin.If the children of below 2-3 years take the excess nitrate nitrogen water its highly risky and ultimately the person may die.

So,it is very important to check the amount of the nitrate nitrogen in the water in order to check the WQI(Water Quality Index).

system transform nitrate to nitrite. The nitrite reacts with iron in the hemoglobin of red blood cells to form methenoglobin, which lacks the oxygen-carrying ability of hemoglobin. This creates the condition known as methenoglobinemia (sometimes referred to as "blue baby syndrome"), in which blood lacks the ability to carry sufficient oxygen to the individual body cells. Infants under 1 year of age have the highest risk of developing methenoglobinemia from consuming water with elevated levels of nitrate.

2.1.4 Temperature

Temperature is also considered as a vital tool for predicting the WQI(Water Quality Index).Various studies have shown that a slight increase in temperature around 10°C then there is a change in metabolism of the plants.

The recent studies depicted a standard relationship between water and temperature and metabolic rates.This occurs because at higher temperature many of the cellular enzymes becomes active and increase in metabolic process almost doubles,and an increase in temperature also increases the oxygen consumption of the aquatic animals.

2.1.5 Turbidity

High Turbidity will reduce the aesthetic quality of rivers and streams and it also have a strong impact on tourism as well.Turbidity can also increase the cost of purifying water and food.it also harms all the aquatic animals by reducing the supply of the food for these animals

Fine particles can have harmful impact on fish in these ways

1) As discussed above it reduces the food supply.

2) It restricts the maturity of the eggs of aquatic animals

3) Fish will be made easier when turbulence is high.

2.1.6 Effect of Phosphate

The main use of phosphate is it's an essential component in the growth of the aquatic plants and animals in the river. And also it's the backbone of the Kerb's cycle and also for the DNA.High phosphorous is very toxic to the animals , aquatic plants and human beings.Phosphorous is also the key factor of photosynthesis The effect of phosphorous on the human beings are that they effect the digestive system of human beings.

3 Code

pollution code

4 Pseudo Code

```
for i in range (0,pollution.size):
    k=vamshi(lat1,lon1,lat2[i],lon2[i])
    if(pollution[i] greater than 65 and pollution[i] less than 82 and k less than 200):
        pollution[i]=(82-pollution[i])*pollution-cost
    k=k*travel-cost+pollution[i]
    print("cur cost=",k)
    if(total-cost greater than k and k less than 200000):
        total-cost=k
        popy=i
print("total cost=",total-cost)
print("Latitude= ",lat2[popy])
print("Longitude",lon2[popy])
```

The above code prints the minimum cost to supply the water from river to given village location.

5 Results and Conclusion

WQI determines the usability of the water. By analyzing the parameters we calculate WQI, and categorize the water as excellent,good,medium ,poor and very poor. Water having WQI greater than 82 can be used for drinking purpose, greater than 72 can be used for bathing , and WQI less than 70 is risky.

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