Groundwater Quality Mapping using Spark-GIS

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Abstract: Contamination of underground water has become a common problem. Various chemicals get mixed in the water and make it contaminated. Certain effective measures have to be taken in order to clean these contaminants. For this to happen, the regions where the chemical contents are more have to be found out. This is implemented using Apache Spark framework and GIS tools.

Keywords : Apache Spark, PySpark, GIS.

I. INTRODUCTION

This is an International reputed journal that published With the increasing number of population, it has led to various side effects. One of them includes the contamination of the ground water. The ground water may contain few of the dangerous chemicals such as Fluoride, Nitrate and Iron. In order to perform necessary measures, the quantity of these contaminants has to be determined. This is achieved in the proposed work, using a framework called Apache Spark. All the necessary data across the state Karnataka is collected and processed using Apache Spark framework. The processed data is then pictured on a map over the GIS tool (Google Maps) is created based on the processing of surveyed data of Groundwater Quality of Shallow Aquifers of India, CGWB, 2010.

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II. APACHE SPARK

Apache spark is a quick, open source dispensed popular cause cluster computing framework. The fundamental leap forward from Hadoop is that, the spark uses in-memory processing of statistics pipelines and allows sharing between the processing steps. Spark permits 4 distinctive kinds of processing and statistical analysis. Spark finds it areas of usage in:

• Streaming: Streaming is relevant in processing incoming data in close to actual time.
• Batch: The jobs such as large map-reduce jobs that are performed by manipulating huge datasets are done in this mode.
• Interactive: Interactive is specially used for surveying the facts as huge chunks of information are in reminiscence and because of the very brief reaction time of spark.
• Iterative: Machine learning algorithms such as a gradient descent work in this mode where convergence is achieved by repetitively accessing the data.

III. PYSPARK

Pyspark isn't always a transliterated model of spark on a java enabled dialect of python consisting of Jython. Pyspark gives incorporated api bindings round spark and it also encourages the full practice of using python surroundings among all the nodes in the cluster with the help of pickle python serialization and, prominently, elements get right of entry to the rich ecosystem of python's libraries which includes: information processing inclusive of Pandas or the Scikit-Learn. When a spark program is initialized, it first has to generate the SparkContext item. It states spark the way to get right of entry to the cluster. PysparkContext is created using the python. The spark JVM SparkContext is bound to the python software by a gateway called Py4J. The JVM SparkContext serializes the application codes and closures and then forwards them to cluster for the further execution. The cluster supervisor assigns assets & schedules, and then ships the closures to the spark employees within the cluster who spark off python virtual machines as required. The spark-worker is controlled similar to an executor controlling storage, cache and the computation.

IV. METHODOLOGY

The data is read in Apache Spark (pyspark) into a DataFrame (rows and columns) and cleaned the data which is not required for the analysis. Different tasks are performed for identifying the region of Karnataka affected by the contaminants like Fluoride, Iron and Nitrate. The data after the tasks performed are visualized for a better understanding of regions affected by the contaminants based on lower, middle and upper levels of contamination. Finally, a mapped layer of these data is created onto the Google Maps for picturing the affected regions for a better understanding of the problem.
V. RESULTS

A. Fluoride

The map in Fig2 shows the area of Fluoride contamination in the known districts of Karnataka. The following Fig3 shows the bar graph of total contaminated by Fluoride in Karnataka.

B. Iron

The map in Fig4 shows the area of Iron contamination in the known districts of Karnataka. The following Fig5 shows the bar graph of total contaminated by Iron in Karnataka.

C. Nitrate

The areas in the known districts of Karnataka where the Nitrate contamination in the soil is detected are marked in the map above in Fig6. Total contamination of Nitrate is represented in a bar graph as shown below in Fig7.
Fig7: Bar Graph representation of areas contaminated by Nitrate

VI. RESULTS

The proposed work is intended to find the regions around Karnataka affected by contaminants like Fluoride, Iron and Nitrate. These regions are pictured on a map using GIS tool (Google Maps). From these data the conclusions are drawn as below:

☐ The level of Fluoride contents in groundwater is majorly concentrated in Central and Northern regions of Karnataka while also considerable regions affected are towards the Eastern boundary of Karnataka.

☐ The level of Nitrate contents in groundwater lay upon a very huge area of Karnataka regions except the coastal regions.

The level of Iron contents in groundwater is almost entirely attributed along all the regions of Karnataka.

Note that the equation is centered using a center tab stop. Be sure that the symbols in your equation have been defined before or immediately following the equation. Use “(1)”, not “Eq. (1)” or “equation (1)”, except at the beginning of a sentence: “Equation (1) is . . .”

A. Figures and Tables

Positioning Figures and Tables: Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert figures and tables after they are cited in the text. Use the abbreviation “Fig. 1”, even at the beginning of a sentence.

Table- II: Name of the Table that justify the values

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The figure, graph, chart can be written as per given below schedule.

VII. FUTURE WORK

In the proposed work, Fluoride, Iron and Nitrate contaminated across Karnataka are determined. This process can be replicated with the other states of India and based on their contaminant levels an area can be specified based on different permissible levels of contaminant and visualized and mapped.

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