



A SURVEY ON AIR QUALITY CONTROL TECHNIQUES

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Abstract—Air pollution is becoming an environmental intimidation with the increase in industrialization and urbanization. The air quality is becoming important both for the environment, community as well to the society. There are different type of numerical as well as statistical tools for the prediction and section of air quality, but Artificial Neural Network is considered to be a better predictive and data analysis tool for Air quality control. The data sets gathered from a set of air quality monitoring stations, embedded low-cost e-participatory pollution sensors and the road network available data. These data are used in the air quality indexes calculation and then the generation of a dynamic traffic network. Hence, this paper focuses on a comprehensive review on existing air quality control techniques through hadoop framework.

Keywords—Air quality control, Artificial Neural Network, Fuzzy logic, Map Reduce.

1. INTRODUCTION

The start of modern course and more quick speeding up from quite a long while as more nations have set out on fast advancement, the structure of the climate has been step by step changing and hence this variety in the organization in the constituents of the environment brings about air contamination. In this way, Air Pollution can be characterized as the nearness of substances in air lacking focuses with the goal that they are debilitate to be hurtful to human, plant, creature life, and the most extraordinary harm to nature and the climatic conditions. At the end of the day one might say that, air contamination crushes the agreeable delight throughout everyday life, property and condition. In the present situation of industrialization, the unfavorable impact on ecological issues is viewed as a major issue to both creating and created nations.

2. AIR POLLUTION

The headways in innovation and quick change in broad daylight necessities/needs prompts industrialization, prompts air contamination, ends up significant worry to be anticipated and a few control techniques/procedures ought to be embraced to address the unfavorable impacts of air pollution. The insufficient amount of substances that are added to the atmosphere either through man-made or natural processes, called air pollutants.

Air contamination can additionally be characterized into two segments visible air contamination and imperceptible air contamination. Another method for taking a gander at Air contamination could be any substance that holds the possibility to block the air or the prosperity of the living creatures making due in it. The sustainment of everything living is because of a blend of gases that on the whole shape the climate; the awkwardness caused by the expansion or decline of the level of these gases can be unsafe for survival.[8]

3. NEED FOR AIR POLLUTION CONTROL TECHNIQUES

The pathways for the vehicle and change of issue inside four all out regions that make up planet Earth (biosphere, hydrosphere, lithosphere, and the climate) are called as Bio-geo-compound cycle. These cycles governs the functioning of the Earth. The Earth is open to electromagnetic radiation from the sun and outer space, but is a virtually closed system with regard to matter. Thus, the matter enclosed within the Earth from the time of its birth is transformed and circulated geographically. Biogeochemical cycles are natural cycles but due to different types of physical as well as chemical world effects, these cycles are affected. With the rapid changes in these cycles the atmosphere surrounding the Earth, responsible for the existence of life on the planet is affected which in return affects the life on Earth.

Due to such adverse effects, Weather forecasting, an application of Science and Technology is used to predict the state of the atmosphere for different locations. Air quality models play a vital role in all aspects of air pollution control and air quality planning, where prediction is a major component. Air quality forecasts provide the public with air quality information which allows people to take precautionary measures to avoid or limit their exposure to unhealthy levels of air pollution.

3.1 Impacts of Air Pollution

The present happening life presence on Earth is in threat due to rapid increment of different impacts, for example, a worldwide temperature alteration, numerous health disorders that are found in human body also in creatures. Indeed, even the sustenance, leafy foods we eat isn't sheltered, it likewise get influenced by different air toxins. Hence, the examination

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demonstrates that the individuals, creatures, plants and the earth encompassing them are altogether influenced by the air contamination and its unsafe poisons.

4. LITERATURE REVIEW

In this literature review the different algorithms used in different survey papers are explained below with necessary pros and cons. The expectation of air quality is getting to be basic for limiting the ecological irregular characteristics advance successfully tends to the air contamination. There are distinctive sort of numerical and measurable devices for the forecast and investigation of air contamination. The rise of cutting edge registering/investigation procedures from customary processing strategies to late delicate figuring methods are adequately tends to the air quality forecast.

The conventional approach for air quality forecast utilizes scientific and measurable procedures. In these methods, at first a physical model was composed and afterward information is coded with numerical differential conditions. Be that as it may, such techniques experiences inconveniences like they give constrained exactness as they were not able anticipate the extraordinary focuses i.e. the contamination greatest and least shorts can't be resolved utilizing such approach. Additionally, such strategies were long and wasteful approach for better yield expectation. In any case, with the progression in innovation and research, another option to customary strategies has been proposed i.e. Artificial Intelligence (AI) methods can be utilized for expectation purposes. Among different kinds of delicate registering strategies, the accompanying are the real air contamination prescient model methods.

- Artificial Neural Networks (ANN)
- Support Vector Machines (SVM)
- Fuzzy Logic (FL)
- Hidden Markov Model (HMM)
- Genetic Algorithm
- Hadoop MapReduce
- Back Propagation Neural Network

4.1. Artificial Neural Network

With the pioneering work of McCulloch & Pitts, Artificial Neural Networks (ANN) has its roots in wide interdisciplinary history from the early 1940's. ANN raised as a mechanism to mimic the human's brain processes. ANN is an intelligent system that has the capacity to learn, memorize and create relationships among the data. ANN is made up by the simple processing units, the neurons, which are connected in a network by a large number of weighted links where the acquired knowledge is stored and over which signals or information can pass.

The forecast of air quality, successfully tended to by the expectation of different air contaminations like Sulfur, Nitrogen, carbon monoxide, ozone, suspended particulate issue (SPM) by partitioned the informational collection into preparing, approval and check facilitate recreation utilizing ANN[1].

ANN was effectively addresses the prediction of Sulphur Dioxide distribution and the future concentration in the air by modeling the Sulphur Dioxide concentration and its distribution from the air pollution station.

4.2 Support Vector Machines (SVM)

Support vector machines and support vector systems are supervised learning models with regulated learning calculations that separate the data which is used for gathering and relapsing investigation. The major SVM takes a course of action of data and predicts every given data of two possible classes shapes the yield, making it a non-probabilistic matched direct classifier[2].

The SVM display gives a promising option and beneficial in times arrangement information investigation for foreseeing the level of air toxins. The capability of applying SVM display in encompassing air toxin expectation contemplated and anticipated as a most encouraging methodology in forecast of PM10 poison.

4.3 Fuzzy Logic

The expression "fuzzy logic" was presented with the proposition of fuzzy set theory is a type of many-esteemed rationale, manages thinking that is inexact instead of settled and correct[3]. Fuzzy Logic deals with thinking and gives a superior review that characterizes every one of the conditions that are required for foreseeing the air contamination forecast.

In sugarcane preparing industry, fuzzy rationale can be utilized to order and measure levels of contamination as poor, common, great and fantastic. The Mamdani fuzzy surmising framework gives the outcomes to expectation of the air quality in and around the sugarcane business.

4.4 Hidden-Markov Model(HMM)

A Hidden Markov Model(HMM) is a classical approach for time series analysis and prediction[4]. A HMM is based on the relationships between the attributes of particular data items and a data set. Hidden Markov Model (HMM), a probabilistic function of a Markov Chain, enables the prediction of PM2.5, using the meteorological measurements and its observation levels.

4.5 Genetic Algorithm

Genetic Algorithm is based on Darwin's Theory[5]. It begins with arbitrary created individual population and then fitness is evaluated and parents are selected from the individuals. Genetic Algorithms effectively addresses the change of the accumulation of the surrounding atmosphere and prediction of the thickness of the air pollutants.

Genetic Algorithms are effectively applied to extract the optimal feature subset of a large database containing pollutant concentration measurements, and feeds to a nearest neighbor algorithm in order to predict the daily maximum concentration for pollutants.

4.6 Hadoop Mapreduce

The parallel computing programming model Mapreduce is used to process data collected by sensors. Mapreduce is proposed by Google Labs. It is a programming model for processing large data sets and easily writing applications which process vast amounts of data in-parallel on large clusters. It is used to distribute computing, on clusters of computers[6]. The Mapreduce job divides the input dataset into independent fragments which are processed by the map tasks in a parallel manner. The framework sorts the outputs of the maps and then input to e reduce job. In our case, both the input and the output of the job are stored in a Hadoop Hbase.

4.7. Back Propagation Neural Network

Back Propagation Neural Network (BPNN), a multilayer feed forward neural network trained by error back propagation algorithm to minimize the sum squared error of network is adopted in this paper, with the learning algorithm ranging from Levenberg-Marquardt[7] backpropagation to Bayesian Regularization back propagation and Scaled Conjugate Gradient back propagation, seeking for the best performance of networks. It has been proved that a single hidden layer network can approximate any continuous function to any desired accuracy.

Table -1 Summary of Literature Review:

Methods	Pros	Cons
Artificial Neural Network	Moderately simple to utilize.	Frequently mishandled in situations where less complex arrangements like straight relapse would be ideal.
	Can estimate any capacity, paying little mind to its linearity.	Requires a poop heap of preparing and cases.
	Extraordinary for complex issues like picture acknowledgment.	Expanding precision by a couple of percent can knock up the scale by a few extents.
Support Vector Machine	SVM's are great when there is no clue on the information.	Choosing a "good" kernel function is not easy.
	The kernel trick is real strength of SVM.	Long preparing time for substantial datasets.
Fuzzy Logic	The capacity to manage vulnerability and nonlinearity.	They are not robust at all.
	The simplicity of usage.	They give the same importance to all factors that are to be combined.
Genetic Algorithm	Particular, isolate from application.	No assurance of finding worldwide maxima.
	Backings multi-objective.	Time taken for meeting.
	streamlining Good for "loud" situations	Limitless arrangements.
Hadoop Map Reduce	Scalability.	Intuitive Processing.
	Cost-effective solution.	In-memory Processing.
	Parallel processing.	Diagram Processing

Hidden Markov Model	Productive learning calculations gaining can happen specifically from crude grouping information.	HMMs often have a large number of unstructured parameters.
	Can be consolidated into libraries.	Proteins fold into complex 3-D shapes determining their function.
Back Propagation Neural Network	Relatively simple implementation.	It is easy to create a number of examples of the correct behaviour.
	Standard method and generally works well.	Outputs can be Fuzzy.

5. CONCLUSION

In this paper a study was carried out on various Air Pollution control techniques with most emerging Hadoop Mapreduce techniques. The observed main causes for air pollution and the factors that can be responsible to minimize it. In Pollution prediction, Mapreduce techniques plays vital role. Further the implementation design provides a solution based on the air pollution for a particular city.

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