

**LETTER TO THE EDITOR****Cause Analysis of Haze Based on Big Data of Cloud Computing**

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The advent of the era of big data not only brings new opportunities for social and economic development, but also provides new technical means for the management of fog and haze weather. This paper analyses the causes of fog and haze based on cloud computing big data. Big data technology is used to monitor the atmosphere of Chinese environmental terminal. The main reason for the formation of haze is that the increase of fine particulate matter concentration in the atmosphere results in the decrease of visibility and the formation of haze weather. Then the application of big data technology in haze control, put forward the corresponding control and prevention measures.

Cloud Computing; big data; haze; Control

**1 INTRODUCTION**

In recent years, many factors in China have contributed to the accelerated deterioration of air quality, resulting in frequent haze weather, which has a serious impact on the normal social order and public health (Rey et al., 2018). The deterioration of air quality in Beijing-Tianjin-Hebei, Pearl River Delta, Yangtze River Delta and Guanzhong is particularly significant. The most typical and most influential area is Beijing-Tianjin-Hebei region. The rapid economic development is the direct cause of the haze weather. Cities continue to develop at high altitudes, the surface roughness increases, the urban canopy rises, the heat island effect is remarkable, the local circulation strengthens, the air diffusion ability weakens, the structure of the atmospheric boundary layer becomes more complex, the pollutant transboundary transport becomes more and more serious, and the mutual pollution becomes more and more serious (Cheng et al., 2018). Therefore, how to coordinate the relationship between the rational and rapid development of regional economy and the improvement of atmospheric environmental quality has become the focus of attention.

Wan-Yu Chang published a paper entitled "Performance Data Envelopment Analysis of Environmental Management System Based on Artificial Intelligence in Convention and Exhibition Industry" on Ekoloji's Issue 107 in 2019. This paper uses DEA to evaluate the performance of an AI-based environmental management system. The evaluation process includes selecting appropriate input and output factors to effectively evaluate the system performance of each DMU. There are three input and output variables, which are selected from a series of samples made up of different exhibition companies in Taiwan through a rigorous process. The data used in this document include published documents and annual reports. This article is very good, but it has not been applied to the field of haze environment. To this end, the causes of haze based on cloud computing big data are analyzed.

**2 IDEA DESCRIPTION**

## 2.1 Big data

With the development of network technology and cloud computing, more and more data will be stored on cloud platforms. The security of cloud computing and cloud storage has become a major concern when users choose cloud services (Wang et al., 2017). Big data refers to data sets with large capacity, multiple types, fast access speed and high application value. Big data processing technology mainly includes Big data acquisition, integrated mining analysis, visual analysis and prediction analysis (Wu et al., 2018).

### 2.1.1 Data acquisition

Big data acquisition methods include system log acquisition method, network data acquisition method (unstructured data acquisition) and other data acquisition methods. Chukwa, Flume, Scribe and other data acquisition tools are mainly used in the system log acquisition method. The network data acquisition method mainly collects unstructured data and stores them in a structured way. Data are collected from websites mainly through open API or web crawler methods; other data collection methods mainly collect data with high confidentiality requirements, such as subject research data, enterprise production and operation data, which need to be obtained through cooperation with enterprises or research institutions (Smogavec et al., 2016).

### 2.1.2 Data integration

Big data integration refers to cleaning and clipping the collected raw data, laying a good foundation for data analysis, and making data analysis more convenient through diversified data sharing.

### 2.1.3 Data Mining Analysis

Big data mining mainly excavates hidden knowledge and information from a large number of seemingly irregular data, which is not easy to find.

### 2.1.4 Data visualization analysis

Data visualization technology refers to the display of various types of data in a certain way. Visualization is not a common pattern, but a complex chart which contains a large amount of data information and can be easily understood and read.

### 2.1.5 Predictive analysis

Predictive analysis is a data mining algorithm and technology that can be used to predict future results of structured and unstructured data. At present, the popular forecasting and analysis tools are SPSS, Stata, SAS and so on. These analysis tools are relatively simple to learn, and the analysis results are clear and intuitive. With the development of science and technology, the related hardware and software solutions are becoming more and more mature, and the application scope of big data technology is gradually expanding. It can be seen everywhere that big data technology is applied to collect data, build models and make predictions (Guo and Wang 2019; Han et al., 2018; Liu et al., 2018).

## 2.2 Cause of the haze

The results of atmospheric monitoring at Chinese Environmental Monitoring Station show that visibility is closely related to atmospheric humidity, wind speed, temperature difference and PM<sub>2.5</sub>, visibility is negatively correlated with atmospheric humidity, and visibility decreases with the increase of atmospheric humidity; visibility is positively correlated with wind speed and decreases with the decrease of wind speed; negatively correlated with temperature difference and decreases with the increase of temperature difference; negatively correlated with PM<sub>2.5</sub> and decreases with the increase of PM<sub>2.5</sub>. PM<sub>2.5</sub> refers to the aerodynamic equivalent diameter of 2.5 μm particles in ambient air, also known as fine particles, fine particles can be suspended in the air for a long time, affecting visibility. The higher the fine particulate matter content is, the more serious the air pollution will be and the more serious the haze phenomenon will be. Therefore, the concentration of fine

particulate matter in the atmosphere will rise, resulting in the decrease of visibility, which is the main reason for the formation of haze weather.

### **2.3 Application of Big Data Technology in Haze Control**

Big data technology can provide favorable information and services for the country, enterprises and individuals by collecting, processing and mining relevant data. The application of big data technology in haze control will help to improve the efficiency of haze control. By means of big data, we can monitor and forecast the haze situation, and look at the factors affecting the haze from the end to trace the origin of the haze. The causes of haze are analyzed in detail, and the causes of haze are mediated by means of economic, technological and market competition, so as to promote the adjustment of economic structure, speed up the progress of science and technology, improve the quality of people's lives and reduce the occurrence of urban haze. Making use of big data to control haze can be done mainly through the following aspects.

#### **2.3.1 Using Big Data Monitoring to Combat Illegal and Violatory Acts**

Big data monitoring is mainly through the establishment of a complete air quality monitoring system, integrating the information of relevant departments such as transportation, industry and commerce, quality supervision and other departments about pollution source enterprises, combining with the information reported by the public, and then using certain analysis methods to analyze and model these data intelligently, find out the key points of haze pollution, and accordingly put forward some effective measures for haze pollution control.

#### **2.3.2 Using big data to forecast and control haze pertinently**

Big data can be used to predict air quality more accurately in the future. Big data analysis and prediction is to continuously superimpose the velocity and composition of pollutants in the atmosphere on the pollutant emission curve. According to the superposition results of pollutant emission curve, the air quality in the next few days can be predicted, and the severe polluted weather that may occur in the future can be more accurately identified. Moreover, using Big data analysis can determine which pollutant is the most important source of pollution. Furthermore, it can also judge which industry the pollutant mainly comes from. In view of the main source of pollution, the most effective prevention and control measures are put forward to reduce the discharge of major pollutants, gradually alleviate air pollution and effectively prevent the arrival of heavily polluted weather before the occurrence of heavily polluted weather. For example, pollutants mainly come from the transport industry, which can temporarily change the restriction policy of motor vehicles to reduce emissions; Pollutants mainly come from the iron and steel industry, which can force annex iron and steel plants to shut down for several days, or shut down enterprises that exceed emission standards.

#### **2.3.3 Intelligent travel using traffic information provided by big data.**

Automobile exhaust is one of the important sources of haze pollution. During the rush hour of commuting in big cities, the emission of vehicle exhaust caused by the increase of driving vehicles and congestion is very huge, because the traffic demand is inevitable, so the emission of vehicle exhaust can only be reduced by alleviating traffic congestion. Big data can provide real-time traffic information. Residents can get this information through the Internet, choose intelligent travel, and avoid congestion in time. Big data can also be used to estimate the speed, flow and emissions of each road through the history of each road, and predict the speed, flow and emissions of each road at a certain time in the future through machine learning and data mining. It can not only provide a reference for residents' travel choice, but also provide a reference for relevant departments to deal with traffic congestion and environmental pollution.

#### **2.3.4 Using big data for multivariate co-governance**

For the management of haze, it is not enough to rely only on government departments, but also to strive for

the joint efforts of enterprises and citizens to build a multi-governance model of government, enterprises and citizens. Government departments should abandon the "self-centered" administrative management thinking, collect public opinion appeal information and governance suggestions through electronic platform, and provide reliable information basis for air quality monitoring and haze management decision-making. Enterprises can use big data to monitor their own pollution emissions to see if they meet the emission standards, and if they fail to meet the emission standards, they can find out in time and take relevant environmental protection measures. Citizens can provide pollution evidence to relevant government departments through mobile air quality monitoring equipment in time to facilitate timely handling of pollution incidents by government departments.

### **3 PREVENTION AND CONTROL**

#### **3.1 Exhaust Gas Emission Control**

Vehicle exhaust is the main source of fine particulate matter in air pollutants. Hydrocarbons, nitrogen oxides and carbon monoxide in vehicle exhaust have undergone photochemical reactions under the action of sunlight. Their products are photochemical smog with high toxicity, which seriously threatens human life. Therefore, in order to reduce the emission of motor vehicle exhaust, we should choose more public transportation or green transportation when traveling, such as public bicycle or walking, which can reduce the emission of motor vehicle exhaust. At the same time, we should eliminate the old motor vehicles with high emission, and try our best to promote and encourage individuals to buy new energy vehicles.

#### **3.2 Pollution Control of Coal Combustion**

The combustion of coal will produce a large number of polluted gases, which will lead to the increase of fine particulate matter content, and the air pollution will be more serious. Therefore, we should strictly control the consumption of coal and gradually reduce the consumption of coal, and use non-fossil energy instead of fossil energy, such as water, electricity, solar energy and so on. But at present, there is no feasible way to use natural gas instead of coal. This is because the pollutants (mainly sulphur dioxide and particulate matter) contained in natural gas combustion are much less than that of oil and coal. Natural gas can be used to replace the domestic gas and the traffic gas of small boilers. This part of pollution is more difficult to control. At the same time, coal can be mostly used in the power sector, because when the power sector converts coal into electricity, it can eliminate sulfur dioxide and nitrogen oxides and reduce the formation of haze. Great achievements have been made in pollution control of coal-fired power plants in China.

#### **3.3 Personal prevention**

In severe fog and haze weather, we should try our best to minimize going out, avoid rush hours and traffic congestion in the morning and evening, wear a mask when going out, and wear a medical N95 mask; open fewer windows, especially in the morning and evening when the fog and haze is serious, open a small gap when opening the window for ventilation, and place more green crown plants indoors; after leaving the door, we should pay attention to one. People are hygienic and clean, wash their faces, rinse their mouths and clean their nasal cavity in time. They can drink more water and eat more fruits in peacetime, and take vitamin D supplements at the same time.

### **4 CONCLUSION**

Big data can change the way of thinking of social governance, and will become an effective means to improve the ability of haze pollution control. Introducing big data into haze control will help the government, enterprises and the public to have a thorough understanding of air quality, enhance the enthusiasm of pollution

control and take timely and effective measures to deal with haze pollution.

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