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Research on Pollution Level of Anyang City Based on BP-MIV Neural Network

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Abstract: *This paper collects data on 9 zonings in Anyang, China, and comprehensively considers the impact of natural factors, living factors and industrial factors on each zoning. The input factors of the pollution levels of the 9 districts of Anyang City from 2008 to 2017 are input into the network. The zoning environmental quality index is the network output, and the BP-MIV (Back-Propagation neural network-Mean impact value) model is established to explore the non-equilibrium effect of various factors on the innovation level, and the pollution of the city in the next three years. Forecast at the level. The results show that the order of influencing factors of pollution level is industrial level, living level and natural level. This result is consistent with the actual pollution situation of each division.*

Keywords : *Pollution level, BP-MIV, Influence factors, Environmental quality*

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I. Introduction

Since the industrial revolution of the 18th century, the world has entered the era of industrialization. However, due to the expected negative impact on industrial development, there are three major global crises, and environmental pollution is one of them [1]. China's environmental pollution is also not optimistic. For example, in 2013, 25 provinces and more than 100 cities have been subjected to “ten stagnation”, and environmental pollution problems need to be resolved. The state's investment in pollution control has increased year by year, but it is better to prevent pollution beforehand. In this context, it is particularly important to study the factors affecting environmental pollution.

In recent years, Anyang City is moving towards the direction of industrial big cities. Now the pollution caused by industrial development has already threatened people's health. Now it is the time to analyze the factors affecting the pollution level of each district in Anyang City, taking targeted measures to create Anyang, which is sky blue, water net and green land.

II. Determination of Pollution Level Indicators

The pollution level evaluation is to measure the pollution degree of a division, and it is also an important indicator for prevention and control of pollution [6]. Therefore, according to the data and availability of factors, this paper divides the evaluation system into three sub-level indicators: natural factors, living factors, industrial factors, in order to reflect the degree of influence of each factor in more detail, and each level. The indicator is divided into several three-level indicators. The relationship between the indicators is shown in Figure 1.

First, from the natural level, the pollution caused by natural causes is natural pollution. If the natural pollutants exceed the standard level, it will also pollute the environment. When exploring the level of pollution, natural factors cannot be ignored. Moderate wind speed plays an important role in the environment. Small objects such as carbon dioxide, sulfur dioxide, near-floor heat exchange, and dust in the air are strengthened or accelerated as the wind speed increases. The six-level wind speed is strong wind. This paper takes the number of days of the sixth-grade wind in one year as the evaluation index. The amount of atmospheric precipitation is the result of the combined effect of water vapor transport, exchange and precipitation conversion rate in the context of large-scale circulation [7]. Environmental pollution will increase the amount of dust in the atmosphere, and dust can act as a condensation nuclei, which is conducive to the formation of precipitation. Many of the particles emitted from large industrial cities have the function of water condensation nuclei. Therefore, when there are other precipitation conditions in the atmosphere to match, precipitation weather will occur. In the downwind areas of large industrial cities, precipitation is more. This shows that the precipitation is negatively correlated with the environmental quality index. Vegetation cover can intercept atmospheric precipitation, slow down surface runoff, increase water permeability and water source, maintain water and soil, and also regulate climate, beautify the environment, purify air, smoke and dust, breed species, and protect biodiversity. Sexuality,

maintaining ecological balance diversity [4]. Obviously it is positively related to the environmental quality index.

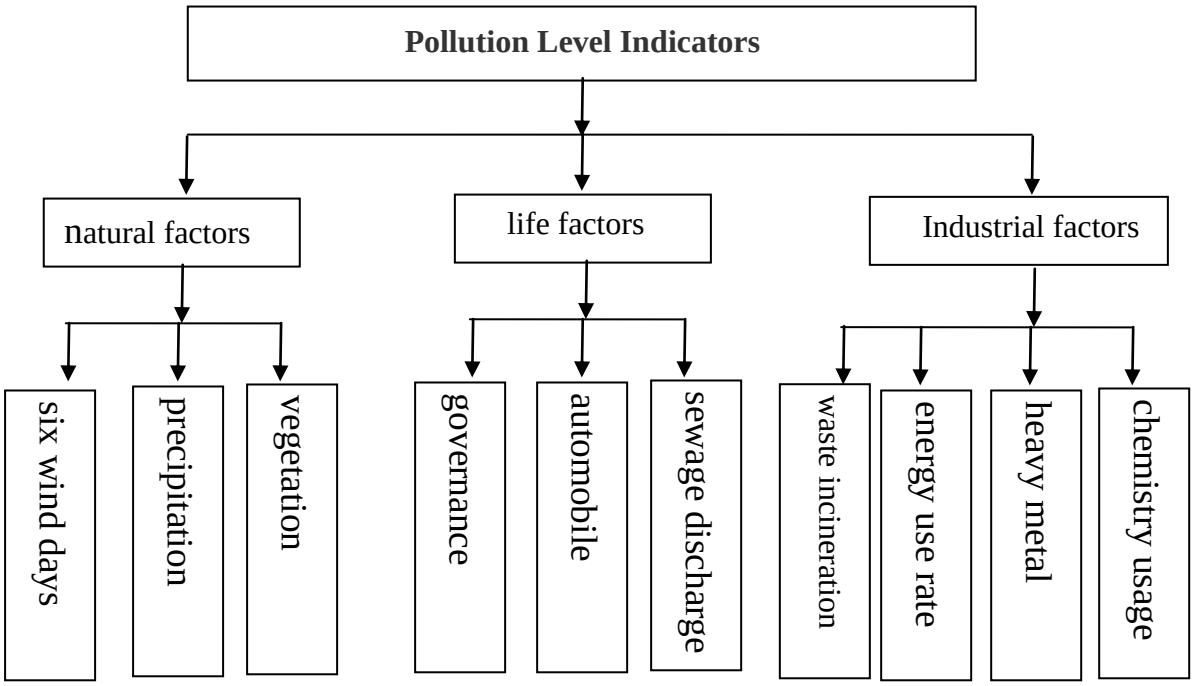

Fig 1 Pollution level influence factor system

Secondly, from the perspective of living standards, Anyang, as a large industrial city, has been greatly damaged by the environment, and the government is fully committed to the management of the environment. When the government faces environmental pollution control in this city, if the supervision system is not perfect, it may cause pollution control to be in trouble. Therefore, the government plays a leading role in pollution control. Obviously, the improvement of the environmental quality index cannot be separated from the government's governance. Research shows that there are more than one hundred kinds of pollutants in automobile exhaust gas. With the development of the automobile industry, the number of automobiles is growing rapidly, and the environment faces great challenges [3]. Domestic sewage is the wastewater discharged by residents in their daily lives, mainly from residential buildings and public buildings. The pollutants contained in domestic sewage are mainly organic matter and a large number of pathogenic microorganisms. The organic matter present in domestic sewage is extremely unstable and is easily corroded to produce malodor. Bacteria and pathogens multiply by the organic matter in domestic sewage, which can lead to the spread of infectious diseases.

Finally, from the industrial level, industrial pollution prevention is the focus of China's environmental protection work. Environmental pollution is largely caused by industrial development. Increasing the incineration rate helps to reduce the environmental pollution of garbage. Organic compounds have now penetrated into people's living materials, such as explosives, fragrant drugs, synthetic fibers, etc., which greatly affect people's daily lives. The current coal utilization rate is not high, and most of the coal is used for combustion. With large-scale coal combustion, sulfur in coal is oxidized into sulfur dioxide, which is emitted into the air along with the flue gas, polluting the atmosphere and endangering animals and plants and human health.

III. Model Construction and Solution

The pollution level is a sequence that changes with time, and its variation law is consistent with the characteristics of nonlinear dynamic systems [4]. Because BP neural network has good fitting property, it can better approximate any nonlinear dynamic relationship [9]. Therefore, it is feasible to use BP neural network to study the pollution level of Anyang City. Therefore, when analyzing the influence of various factors on the pollution level of Anyang City, the evaluation object can be evaluated through the training of BP neural network.

The basic idea of the BP neural network algorithm is that the signal propagates forward and the error propagates backward. This network consists of a three-layer network structure, including an input layer, a hidden layer, and an output layer. In the process of neural network training, the influencing factors composed of 10 indicators are used as input neurons of the neural network, and Anyang City is divided into 9 divisions, and

the environmental quality index of each division (see Table 1) As an output neuron, in the forward propagation process, the signal is processed by the input layer through the hidden layer by layer, and then output by the output layer. If the output layer is not output, the signal is backpropagated. Backpropagation is the final error update weight and threshold by the fast descent method, that is, the output error is propagated to the input layer in some way, and the error signal is used as the modification. The basis of the neural network, so that the output predicted by the neural network is constantly approaching the desired output.

Table 1 Environmental Quality Index of Each District of Anyang City

Year	Wen feng	Bei guan	Yin du	Long an	Lin zhou	Tang yin	Nei huang	An yang	Hua xian
2008	2.051	2.862	2.781	2.832	2.561	2.398	2.871	3.028	2.638
2009	2.038	2.913	2.846	2.918	2.738	2.481	2.905	3.079	2.529
2010	2.177	3.465	2.928	3.352	2.972	2.572	3.472	3.178	2.573
2011	2.473	3.641	3.028	3.253	2.846	2.691	3.638	3.265	2.614
2012	2.514	3.268	3.472	3.375	3.013	2.579	3.276	3.382	2.657
2013	2.659	3.715	3.134	3.203	3.576	2.653	3.702	3.201	2.748
2014	2.763	3.851	3.265	3.495	3.496	2.748	3.863	3.462	2.781
2015	2.876	3.852	3.374	3.548	3.755	2.819	3.645	63537	2.804
2016	2.852	3.827	3.517	3.572	3.951	2.953	3.729	3.561	2.953
2017	2.947	3.891	3.583	3.583	3.946	3.013	3.873	3.583	2.976

The MIV method judges the relative importance of the influence of the factors by the magnitude of the absolute value of the output, where the symbol indicates the direction [10]. The specific method is as follows: firstly, the BP neural network is trained and simulated to obtain the data P, and then each of the independent variables in the data P is increased by 10% or reduced by 10%, and two new training data independent variables are obtained. Then use these two sets of data to simulate and predict the results in a well-established neural network. The values are set to Q1 and Q2, and the difference between Q1 and Q2 is obtained. This difference is called MIV, and finally the average is taken. For MIV, according to this method, the MIV of each factor can be calculated according to this, and the degree of influence of each network output is sorted, and finally the degree of influence thereof is determined.

The model input in this paper is the influencing factors of 10 pollution levels in Anyang in 2008-2017. The output sequence is the environmental quality index of each year. Therefore, the calculated MIV can reflect the importance of the factors affecting the 10 pollution levels in Anyang in 2008-2017, and analyze the extent of the impact of the indicators on the pollution levels in Anyang. Table 2 shows the distribution trends of various indicators MIV in various places.

This paper randomly selects data from 9 different regions in Anyang as network training samples, and uses MATLAB R2016b to train and learn the established BP network. The number of network iterations is set to 1000, the learning rate is 0.01, and the training error target value is 10^{-7}, when the network trains to the 20th step, the training is stopped. At this time, the sample mean square error is 2.9076×10^{-11}, which has reached 10^{-7}. The convergence result is shown in Figure 3. A higher R value indicates that the actual output value is closer to the desired output value, and when R=1, it indicates that the actual output exactly matches the desired output. Through the linear regression analysis of the actual output and expected output value of the network through Figure 4, the correlation degree of them is 1, which reflects its fitting degre. In addition, the sample partial autocorrelation function is another method for describing the structural characteristics of the stochastic process. Therefore, the partial autograph of the autoregressive process can be estimated by using the partial autocorrelation graph, and the blue line of 5 in the figure represents the center. Line 2 standard deviation width when k>2, $f(k)$=0. The partial autocorrelation function has a truncation characteristic after the lag period 4, so this feature can be used to identify the order of AR(p).

Table 2 MIV values for each region

Indicator number	Wen feng	Bei guan	Yin du	Long an	Lin zhou	Tang yin	Nei huang	An yang	Hua xian
1	0.6534	0.2469	0.6234	1.0395	0.9779	0.5534	0.2248	2.2451	0.3153
2	0.6772	0.6543	1.2335	0.0055	1.7524	0.3655	0.2093	0.8499	0.2263
3	0.9230	0.4096	1.4016	0.2279	0.3092	0.2171	1.7354	0.1688	0.2588
4	3.3258	1.5555	0.0427	0.7157	1.8978	1.1290	0.238	0.5045	0.1334
5	1.8216	0.4869	0.758	0.8611	1.9145	0.5445	1.3661	0.9038	0.4894
5	1.8216	0.4869	0.758	0.8611	1.9145	0.5445	1.3661	0.9038	0.4894
6	0.3991	1.2021	0.6137	0.235	2.6092	0.6338	0.0722	1.0386	0.2727
7	0.1747	0.1322	0.2835	0.4692	0.5939	1.2145	0.4949	0.2281	0.288
8	0.7979	0.2265	0.8244	1.5375	0.4432	0.907	4.8051	5.2942	0.0704
9	2.076	2.2174	0.2123	0.8987	0.1391	0.1838	0.1311	0.7192	0.1794
10	1.3634	0.5623	0.6101	0.2246	4.2952	0.2596	0.3559	4.343	2.9828

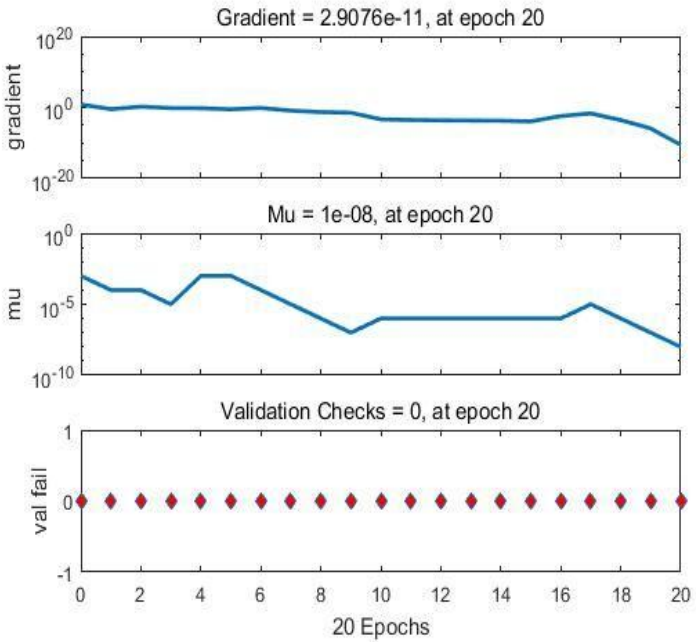

Fig 2 BP-MIV neural network training status

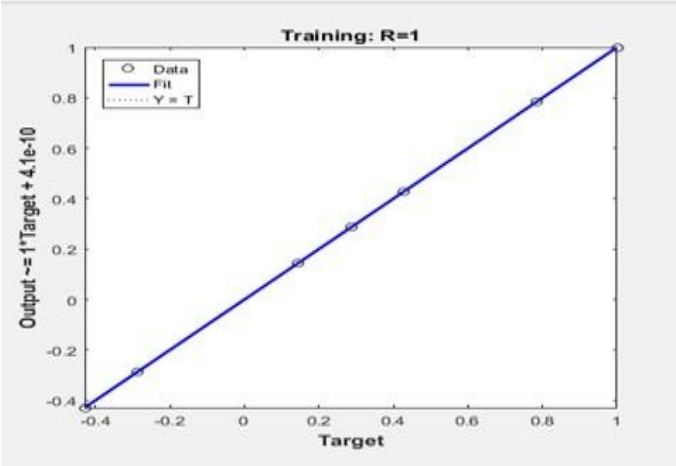

Fig 3 Regression analysis of actual output value and expected value of network training

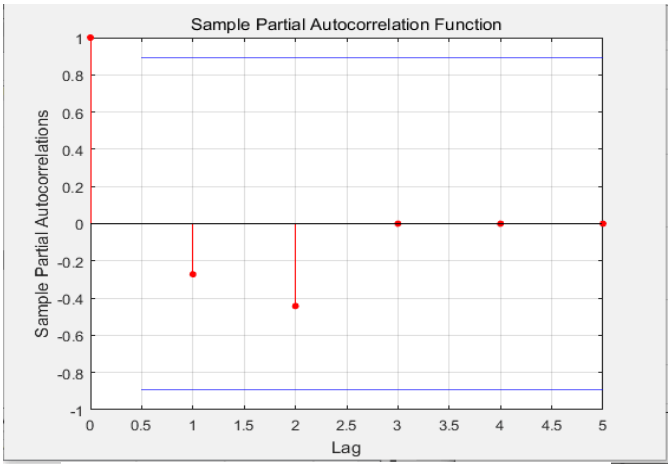

Fig 4 Sample partial autocorrelation function graph

IV. Conclusions and recommendations

1) The MIV values of each zoning index are sorted from large to small. The results show that among the influencing factors of pollution levels in Anyang City, natural factors (including indicators 1-3), living factors (including indicators 4-6), and industrial factors The number of occurrences (including indicators 7-10) is 6, 14, and 16, respectively. Therefore, it shows that the level of industrial factors has a significant impact on the pollution level in Anyang, followed by the level of living factors, and finally the level of natural factors. According to this conclusion, all localities can increase the industrial management system and formulate corresponding policies to further improve the environmental level in Anyang.
2) The primary energy use level factors of the district have a great impact on the regional environment. The reason is: the new energy industry in these three regions is booming, especially in Neihuang County, Neihuang County is based on resource advantages, adheres to the combination of independent development and foreign investment, and vigorously implements a green low-carbon strategy to develop clean low-carbon energy. As the main direction of adjusting the energy structure, the development investment and consumption proportion of renewable resources such as solar energy and geothermal energy have been greatly increased. Up to now, the total installed capacity of new energy power generation in the county has reached 125 megawatts, and the annual output value has reached 147 million yuan.
3) In combination with the actual situation of various districts in Anyang City, the government should strictly manage industrial enterprises, for example: strictly implement environmental impact assessment and "three simultaneous" systems for construction projects (the main production project of construction projects and the prevention and control of pollution facilities are simultaneously designed and Construction, production and use at the same time). At present, the implementation rate of the national construction project EIA and the "three simultaneous" implementation rate have reached more than 95%, and strive to have new upgrades.
4) As we all know, Anyang's industrial development is more prominent, but at the same time of development, we should not neglect the protection of the environment. The issue of environmental pollution should attract people's attention. Now from the MIVs of various districts in Anyang, it can be seen that the industrial factors account for the largest proportion of the top four influencing factors, especially the incineration rate of industrial waste. The pollution of the air is extremely serious, and people's living environment is greatly affected. Therefore, all industries should strictly control the incineration rate of industrial waste to achieve the purpose of reducing industrial pollution.

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