Research on the Market Talent Demand Based on the Grey Prediction Model of BP Neural Network

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Abstract. Based on the grey linear regression and multi-attribute decision model of BP neural network, combined with the employment status of Chinese students, and based on the demand of the current talent market and the growth trend of the number of people in various industries, it is predicted that the future should develop education career, focus on economy and the development of high-tech industry.

Introduction

With the innovation of science and technology and the progress of society, talents have become the key to the construction of "One Belt And One Road". The vision of "One Belt And One Road" cannot be separated from the support of innovative and entrepreneurial talents, international organizational talents and professional talents. In this paper, a grey linear regression and multi-attribute decision model based on BP neural network was established. In combination with the employment status of Chinese students, a multi-attribute decision model was established to explore the administrative category and economic development status of a city, and Suggestions and opinions were put forward on the school's professional talent training plan in combination with local policies.

Grey Prediction Analysis

Grey prediction analysis is a multi-factor statistical method, which is mainly used to select the main factors from one aspect. The basic idea is to judge whether they are closely related according to the geometric similarity of sequence curves. The closer the curve is, the more accurate its prediction results will be. Compared with traditional methods, grey prediction analysis requires less data and requires less computation\(^{(1)}\).

With the original data sequence: \(X^0 = \{x^{(0)}(1), x^{(0)}(2), \ldots, x^{(0)}(n)\}\) Gray GM (1,1) model was established by using data sequence:

(1) Form an accumulative generation (1-AGO) data sequence to accumulate the original data sequence once:

\[
X^{(1)} = \{x^{(1)}(1), x^{(1)}(2), \ldots, x^{(1)}(n)\}
\]

\[x^{(1)}(k) = \sum_{i=1}^{k} x^{(0)}(i), k = 1, 2, \ldots, n\]

(2) Construct background values and solve parameter columns. The sequence of background values is:

\[z^{(l)} = \{z^{(l)}(2), z^{(l)}(3), \ldots, z^{(l)}(n)\}\]

\[z^{(l)}(k) = \alpha x^{(l)}(k-1) + (1 - \alpha) x^{(l)}(k), k = 2, 3, \ldots, n,\]

\[\alpha = 0.5\]
The bleaching differential equation of gray GM (1,1) model was established, i.e:

\[
\frac{dX^{(i)}}{dt} + aX^{(i)} = b
\]

Formula (2,1) is discretized, and the differential variable difference is, i.e:

\[
x^{(0)}(k) + az^{(1)}(k) = b, \quad k = 2, 3, ..., n
\]

Where \(a\) and \(b\) are model parameters; \(-a\) is called the development coefficient, and its size reflects the growth rate of the sequence; \(b\) is the grey action, and the parameter columns in (2,2) are obtained by using the least squares estimation:

\[
\tilde{a} = [a, b]^T = (B^T B)^{-1} B^T Y
\]

\[
B = \begin{bmatrix} -z^{(1)}(2) & 1 \\ -z^{(2)}(3) & 1 \\ -z^{(1)}(n) & 1 \end{bmatrix}, \quad Y = \begin{bmatrix} x^{(0)}(2) \\ x^{(0)}(3) \\ x^{(0)}(n) \end{bmatrix}
\]

(3) Establish grey GM (1,1) prediction formula

By \(X^{(i)}(1) = x^{(0)}(1)\) solving differential equation (2,1), the time response formula of gray GM (1,1) model can be obtained:

\[
x^{(1)}(k+1) = [x^{(0)}(1) - b/a]e^{-ak} + b/a, \quad k = 0, 1, ...
\]

After \(X^{(1)}\) reduction and reduction 1-LAGO, the prediction formula is as follows:

\[
X^{(0)}(K+1) = x^{(1)}(k+1) - x^{(1)}(k) = (1 - e^{(a)})[x^{(0)}(1) - b/a]e^{-ak} \quad k = 0, 1, ...
\]

Research on the Market Talent Demand of Grey Prediction Model Based on BP Neural Network

When forecasting the demand for talents in the market, the main factors affecting the talent market should be analyzed according to the weight before the prediction, so as to reduce the workload and improve the accuracy of the prediction[2]. Due to the demand of the market, with local administrative category and economic development is often a non-linear relation, and neural network for nonlinear relationship just have good fitting, so this article use the gray prediction method combining the analysis and the BP neural network, forecast talent market demand, the first use of grey forecasting model to find the main factors impact on the talent market, using the BP neural network to influence factors and the relationship between learning and talent market demand forecast. The specific modeling process is as follows:

(1). Normalize multiple indexes through factor analysis, calculate the weight value of each index, thus obtain the weight of each index, and analyze the main factors influencing it.

(2). The grey linear regression combination model based on BP neural network is used to predict and analyze the potential talent demand of a city in the next few years.

(3). Establish multi-attribute decision-making model for the administrative category, possible geographical region, economic status and development of high-tech industry of the city.

(4). Based on the established talent demand model and combined with local policies, the city was predicted and analyzed, and the final prediction results were obtained.
The Example Analysis

This paper takes the talent demand model of a city's employment market and the three influencing factors of employment demand, expected occupation and expected education background as examples, and conducts weight analysis on the influencing factors through factor analysis. The results are shown in table 1.

<table>
<thead>
<tr>
<th>Element</th>
<th>Initial Eigenvalue</th>
<th>Retriving-Square-Sum-Loading</th>
<th>Cycling Square Sum Loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.204</td>
<td>64.089</td>
<td>64.089</td>
</tr>
<tr>
<td>2</td>
<td>1.116</td>
<td>22.321</td>
<td>86.411</td>
</tr>
<tr>
<td>3</td>
<td>.680</td>
<td>13.590</td>
<td>100.00</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Education exposure: 64.089%/(64.089%+22.321%+13.590%)=0.64089
Job requirements: 0.22321
Expected position: 0.13590

Thus, a linear regression model of market talent demand based on three indexes of a city is est

According to the talent demand of "A City's employment market" and the employment status of Chinese students, the actual talent demand model data of A City were established, and the potential talent demand of a-city in the next three years was predicted and analyzed[3]. According to the change trend of employment rate of Chinese students from 2015 to 2018, it can be seen that engineering and science in undergraduate disciplines remain basically stable. The employment rate of management, economics and art graduates continued to decline six months after graduation. Science, literature, art, history and law continue to bottom the list[4].

Firstly, the grey GM(1,1) model and multiple regression model are established according to the sample values. The fitting values of these two models are taken as the input of BP neural network, and the actual sample values are taken as the ideal output to train the network. The training error of the network is calculated. When the error reaches the set accuracy, the training stops. At this time, the network can be used for prediction. Therefore, block diagram of grey linear regression combined prediction model based on BP neural network can be constructed as shown in the following figure:

![Gray Linear Regression Combination Model Structural Diagram Based on BP Neural Network](image_url)

Taking the fitting results of gray GM(1,1) model and multiple linear regression model of talent demand in A city's job market from 2011 to 2018 as the input of BP neural network, the improved BP neural network was established, that is, there were two neurons in the input layer. The talent demand in city A's job market is used as the expected output. The output layer has 1 neuron and the number of hidden layers is 9.

A method that determines the selection of parameters, functions (activation and transfer functions), and the number of hidden layer nodes
Formula \( n_i = \sqrt{n + m + a} \) or \( n_i = \log_2 n \) (where \( m \) is the number of output neurons, \( n \) is the number of output units, \( n \) is \([1,10]\)), and \( a \) is the constant between \([1,10]\).

Finally, according to the prediction formula and method of the model, the predicted results are shown in the following table:

<table>
<thead>
<tr>
<th>Industry</th>
<th>Growth rate (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communications/technology</td>
<td>467.75</td>
</tr>
<tr>
<td>Security/housekeeping/other</td>
<td>433.42</td>
</tr>
<tr>
<td>Hotels/tourism</td>
<td>393.20</td>
</tr>
<tr>
<td>IT-QM/technical/support/and/more</td>
<td>288.81</td>
</tr>
<tr>
<td>Translation</td>
<td>259.53</td>
</tr>
<tr>
<td>Movies/TV/and/recreation</td>
<td>235.95</td>
</tr>
<tr>
<td>Electronics/appliances/semiconductor/instrumentation</td>
<td>213.35</td>
</tr>
<tr>
<td>General/merchandise/retail</td>
<td>206.80</td>
</tr>
<tr>
<td>Construction/infrastructure/gardening</td>
<td>201.89</td>
</tr>
<tr>
<td>Advertising</td>
<td>129.23</td>
</tr>
</tbody>
</table>

Table 2 shows the industry with a growth rate of more than 100% in the next three years. According to the research, an industry with a growth rate of more than 100% can show great market potential in the future. By the prediction results indicate: the next three years, the 10 industry for the next three years the industry talents are needed most, and that 10 Communications/technology in the industry and Security/housekeeping/other industry growth rate of more than 400%, is the most need talent industry over the next three years. And Communications technology industry and Security/housekeeping/other industries is A high-end technology, is A service industry, suggesting that A city in the next three years high-end industry has developed rapidly, and social service industry also needs the service personnel.

Based on the industry growth rate and conclusions, the administrative category, possible geographical region, economic status and high-tech industry development of a city are inferred. The fitting comparison is made according to the data of seven known representative cities in the region, and the results are as follows:

![Urban prediction results](image)

Figure 2. City prediction results.

Has can be seen from the predicted results, the relative residual Q test is 0.0027, the variance ratio C test is 0.0215, and the small error probability P test is 1. It can be seen that this judgment is relatively accurate. The residual Q test is only 0.0027, and the variance ratio C test is only 0.0215, with an error of only 2%. In addition, the prediction curve is very close. After comparison with the data of seven representative cities in the region, the conclusion is drawn that city A is A prefecture-level city and its region is east China. High-tech industry develops rapidly and its economic status is gradually improving.
Conclusion

Based on the theoretical basis of establishing the background of talent demand model, this paper applies the grey linear regression and multi-attribute decision model based on BP neural network, and combines the employment status and career preference of Chinese students with weight analysis to establish the weighted arithmetic average operator (WAA) algorithm to predict the administrative category and economic status of a city.

1) The multi-attribute decision model was used to predict the administrative category and economic development of A City. The new and reasonable ideas ensured the comprehensiveness and feasibility of the plan.

(2) Analyze the talent demand model of A City's employment market from both qualitative and quantitative perspectives, use SPASS software for factor analysis, calculate the weight value of the three indicators, analyze their weight, and conduct normalization processing of the data.

(3) The established model can be closely related to the actual situation, and the proposed problems can be solved in combination with the actual situation, so that the model is closer to the actual situation, with strong universality and generalization.

Market demand is the core of a social widespread problems, this paper established the gray linear regression model based on BP neural network can also be effectively applied to urban road traffic, the practical problems such as stock prediction, has high precision, thus can be applied to any complex environment in real environment, and has high efficiency and universality.

References


