International Journal of New Developments in Engineering and Society
ISSN 2522-3488 Vol. 5, Issue 3: 26-30, DOI: 10.25236/IJNDES.2021.050303

Prediction of Knowledge Transfer Effect Based on Particle Swarm Optimization Improved BP Neural Network

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Abstract: *BP neural network is optimized by improved particle swarm optimization (PSO), the prediction model of knowledge transfer effect is established, and the prediction effect is compared with that of BP neural network model. The research results show that the prediction effect of knowledge transfer effect prediction model based on particle swarm optimization (PSO) optimized BP neural network is due to BP neural network.*

Keywords: *knowledge transfer, particle swarm optimization, BP neural network*

Technology exchange is an important way to promote economic growth and enterprise technological innovation. The essence of technology exchange is the transfer of knowledge. Knowledge transfer can reflect the systematic exchange of information and skills between different innovation entities, which is the core link of knowledge management activities. More and more enterprises enhance their core competitiveness through knowledge transfer. However, many factors will affect the effective transfer of knowledge. Szulanski et al. (2004) found that when the knowledge receptor feels that the knowledge source is reliable, it will show less suspicion and be more willing to accept information. Xiao Xiaoyong et al. (2005) concluded that Inter Organizational Knowledge transfer is affected by many factors, among which the motivation, reliability and ability of knowledge source to send knowledge are important factors.

Jiang Huawei (2021) found that the neural network had the disadvantages of local extremum and slow convergence when predicting the storage quality of wheat. Based on this, he proposed a BPNN prediction model optimized by particle swarm optimization. Duan Xinhui (2021) used the improved BP neural network of particle swarm optimization algorithm to predict wind speed. The research shows that the improved PSO-BP prediction method is better than BP neural network. He Dan (2021) used PSO-BP model to predict wastewater treatment results. It was found that PSO-BP model was more accurate than BP model and GA-BP model. Therefore, this paper uses the BP neural network prediction model optimized by particle swarm optimization algorithm to predict the influence of various factors on knowledge transfer.

1. Evaluation Index System of Knowledge Transfer Effect

Li Jinghua's knowledge transfer influencing factor index system is adopted as the knowledge transfer influencing factor index system. The primary index system includes knowledge characteristics, knowledge source characteristics, knowledge receiver characteristics and transfer scenarios, and the secondary index includes implicit, causal fuzziness, expressibility, transfer intention, transfer ability, receiving intention, absorption ability, knowledge distance, trust Network relationship dimension and network structure dimension are shown in Table 1.

Table 1: Influencing factors and indicators of knowledge transfer

Primary index	Secondary index
Knowledge characteristics	Internal recessive Causal fuzziness Expressibility
Knowledge source characteristics	Transfer intention

ISSN 2522-3488 Vol. 5, Issue 3: 26-30, DOI: 10.25236/IJNDES.2021.050303

	Transfer capability
Knowledge receiver characteristics	Willingness to receive Absorptive capacity Knowledge distance
Transfer situation	trust Network relationship dimension Network structure dimension

2. Results

2.1 Data Collection

The evaluation index of knowledge transfer effect based on PSO-BP neural network includes 12 items, including 11 input indexes and 1 output index. The respondents were all senior managers of enterprises. 194 questionnaires were sent out in the form of e-mail. A total of 108 valid questionnaires were collected.

2.2 Evaluation of Knowledge Transfer Effect

The 81 groups of training data are used to train PSO-BP neural network until the optimal result is obtained. The prediction results of PSO-BP neural network model are compared with those of BP neural network model. After training, the parameters of PSO-BP optimization neural network are reset in this paper. The parameter settings are shown in Table 2. In this paper, the number of input layer nodes of BP neural network is set as 11, the number of hidden layer nodes is set as 11 and the number of output layer nodes is set as 1.

Table 2: Parameter setting of PSO algorithm optimization network

Population	Maximum inertia weight	Minimum inertia weight	1Acceleration factor 1	Acceleration factor 2
20	0.9	0.3	2	2

2.2.1 Comparison of Prediction Results of Two Networks

(1)Error comparison

Apply the data to the two prediction models respectively to obtain the estimated value of the evaluation result of knowledge transfer effect. Compare the two prediction results with the actual value. The results are shown in Figure 1. The figure 1 shows that there is a certain gap between the predicted values of the two models and the actual values. However, the difference between the predicted value and the actual value of PSO-BP neural

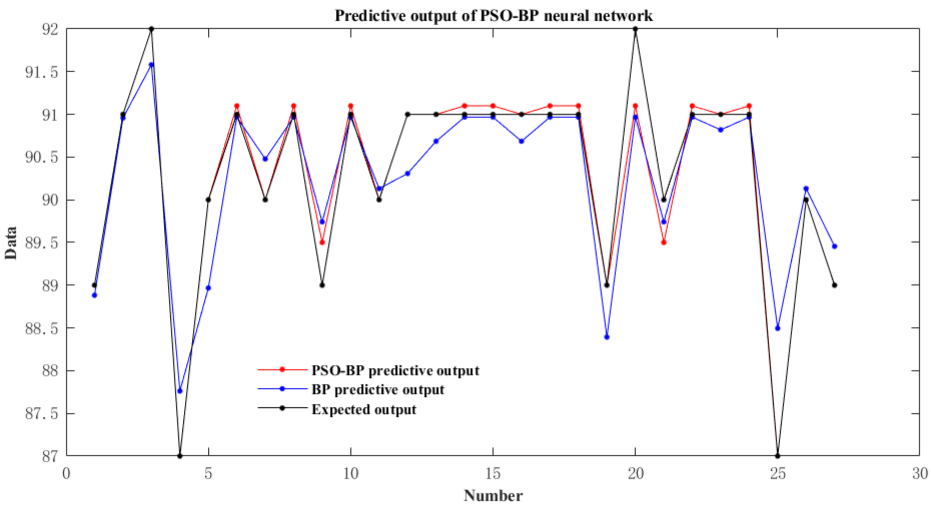

Figure 1: The comparison of evaluation results

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The figure 2 shows that the maximum absolute error of the forecasted value of knowledge transfer effect of PSO-BP model is 0.5 and the minimum is -0.9, and the maximum absolute error of BP is 1.4945 and the minimum is -1.0329, indicating that compared with the prediction model of knowledge transfer effect of BP, the model of knowledge transfer effect of PSO-BP is more stable.

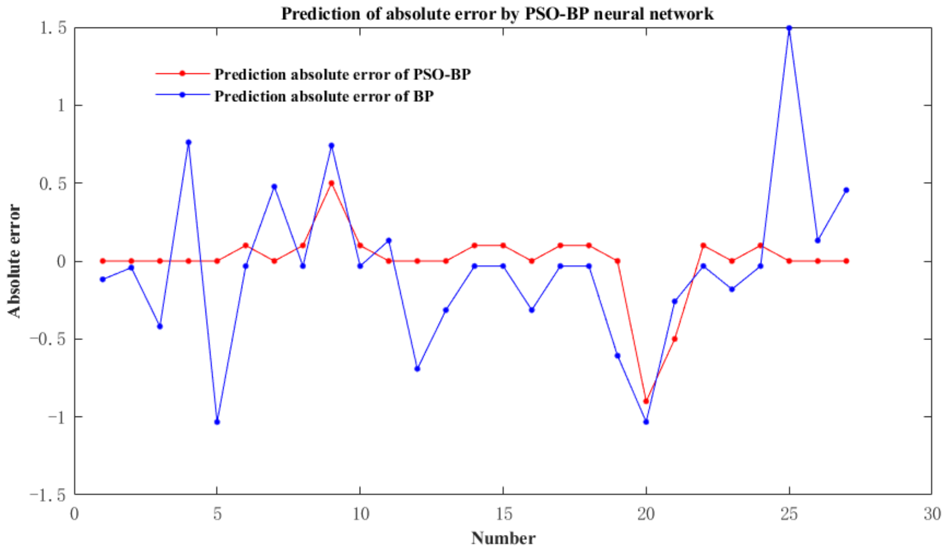

Figure 2: The comparison of absolute error of evaluation results

The figure 3 shows that the relative errors of PSO-BP prediction model and BP prediction model are less than 10%. However, the maximum relative error of PSO-BP neural network prediction model is 0.9783%, while the maximum relative error of BP neural network prediction model is 1.7178%, and the relative error of PSO-BP k prediction model is better than BP prediction model as a whole. The data show that PSO-BP has higher accuracy than BP.

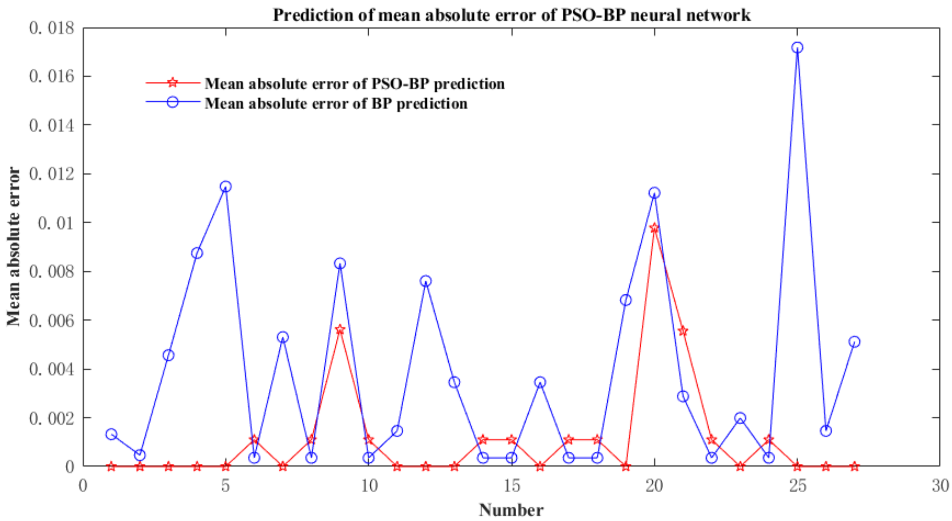

Figure 3: The comparison of relative errors

The table 3 shows that in terms of PSO-BP neural network model, the average relative error is 0.14% and the root mean square error is 0.23. In terms of BP neural network, the average relative error is 0.39% and the root mean square error is 0.52. The data show that PSO-BP neural network model is more stable.

Table 3: The comparison of evaluation performance between PSO-BP and BP

prediction model	Maximum absolute error	Minimum relative error	Maximum relative error /%	Minimum relative error/%	Average relative error /%	Root mean square error
BP	1.49	-1.03	1.7178	0.0356	0.39	0.52
PSO-BP	0.5	-0.9	0.9783	0.0000	0.14	0.23

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(2)Fitting performance

Figures 4, 5 and 6 respectively show the robustness of 81 groups of training samples, 108 groups of overall samples and 27 groups of test samples of the knowledge transfer effect prediction model based on PSO-BP (robust, that is, the ability of the model to maintain a certain classification performance in any case), and figure 8 shows the robustness of BP neural network test samples. It is shown in Table 4.

Table 4: Comparison of robustness between PSO-BP and BP

Model	sample	R2
PSO-BP	Training samples	0.999733
PSO-BP	All samples	0.999798
PSO-BP	Test samples	0.999994
BP	Test samples	0.999968

The results show that the R2 value of the test sample of PSO-BP model is closer to 1 than that of BP. It can be seen that the generalization ability of PSO-BP neural network model is strong, which proves that PSO-BP model has good robustness, so the prediction function of PSO-BP model is better.

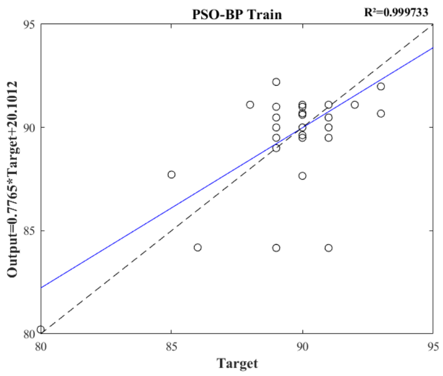

Figure 4: Prediction performance of PSO-BP training samples

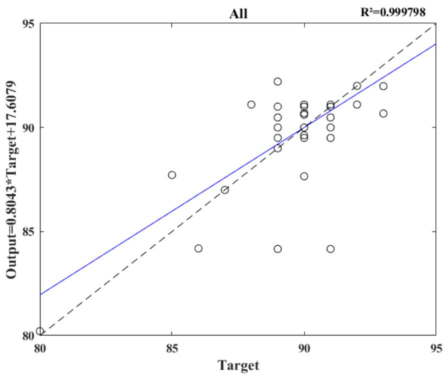

Fig5: Prediction performance of PSO-BP population samples

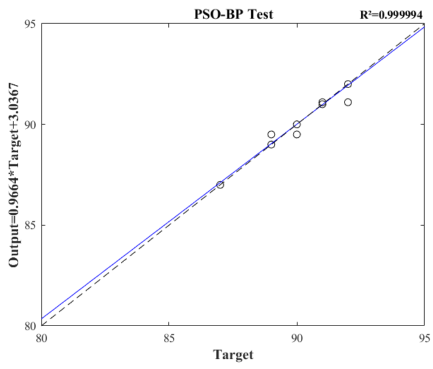

Fig6: Prediction performance of PSO-BP test samples

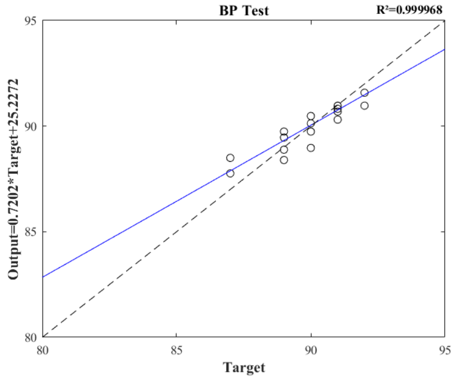

Fig7: Prediction performance of BP test samples

In order to compare the prediction performance of PSO-BP neural network, PSO-BP algorithm is compared with BP algorithm. In terms of relative error and root mean square error, the error of PSO-BP is less than that of BP, and PSO-BP has an absolute advantage in prediction accuracy; From the data fitting results, it can be seen that the model fitting effect of PSO-BP algorithm is significantly better than that of BP algorithm, and the classification effect is significantly improved. PSO-BP and BP are used to solve the prediction problem of knowledge transfer effect evaluation results in this paper, and the prediction accuracy is an important index to evaluate the classification performance of the model. The prediction accuracy of PSO-BP is higher than BP, so the application of PSO-BP is better than BP. Based on the above calculation results, it is feasible to use the PSO-BP algorithm proposed in this paper to predict the evaluation results of knowledge transfer effect.

Funding

1. Bureau of foreign experts of Jilin Province Talent introduction project L2021016

2. Humanities and social sciences research project of Jilin Provincial Department of Education JJKH20210315SK

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