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Research on the Method of Material Scheme Matching Based on Deep Learning

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Abstract: Based on the research of the deep learning network and the material scheme matching method, a material scheme matching method based on the combination of materials, solid ID data and multi-layer perceptrons is proposed. Based on the relationship among engineering design standards, general equipment selection and material procurement standards, a material and solidified ID data information system is formed. Then, collect, sort, and model electrical primary and secondary equipment and line information to form a model structure of plans and materials; finally, integrate and analyze historical data to form a typical plan material matching library. The training of the perceptron network obtains the material plan matching network. Experimental results show that the matching method of material schemes using materials, solidified ID data and multilayer perceptron network can achieve 96% matching accuracy, which solves the problem of information barriers in design standards, general equipment requirements and material procurement standards. The development of the material plan provides new ideas.

1. Introduction

With the rapid development of economy, the scale of power grid construction is becoming larger and larger, and the type and quantity of material procurement are increasing year by year. The accuracy and efficiency of material bidding are more and more important. However, with the expansion of the scale of material procurement, the traditional way of relying on designers to select material codes and check material parameters is very easy to make mistakes, and they are often not familiar with the procurement standards, which leads to the weak universality of equipment, the unchanged operation and maintenance in the later period, and the low efficiency of material bidding. At the same time, the application of procurement standards and general selection in the design source is not mature, and the perfect management system has not been established [1-3]. There are information barriers in design standards, general equipment requirements and material procurement standards; design selection, standard selection and review involve multiple disciplines, with weak interdisciplinary collaboration and poor sharing and interaction; the application of high-quality equipment, general design and standard materials before design is not in place, which restricts the improvement of pre qualification quality and standardization application level of demand plan; procurement standards" The contradiction between supply and demand has not been fundamentally

improved[4,5].

In recent years, the rapid development and popularization of computer hardware. Deep neural network has been widely used in various fields. It integrates big data technology into engineering material procurement management to make material management implement the concept of the whole process of engineering construction. It will provide certain reference for material management in the early design stage of the project and greatly improve the level of engineering project management [6,7]. This paper proposes a material scheme matching method based on the combination of material, solidified ID data and multi-layer perceptron. This method constructs the material standard system of “design project material” source application, breaks the barriers between professional and data sources through big data analysis and network collaboration, establishes the reasoning mechanism of purchasing standard data, builds the application fusion model of bill of materials, technical specification ID and general equipment standard, realizes the modular selection and intelligent review of materials, and greatly reduces the application cost And review the cost of human, financial and material resources, so as to ensure the integration and efficiency of all aspects of procurement and supply, and promote the development of material specialty to the mode of intelligent excellence.

2. Electrical Equipment of Power System

2.1 Electrical Primary System Equipment

The system composed of generator, transmission line, transformer, circuit breaker and other power generation, transmission, transformation, distribution and other equipment is called primary system. It can send the electric energy generated by the generator to the distribution system step by step through the power transmission and transformation equipment, and then distribute the electric energy to the users by the distribution line. Primary system is the carrier of electric load, which has the characteristics of high voltage or high current. Correct selection of primary system structure scheme, cable and electrical equipment and correct construction can ensure the normal operation of power supply system. In the primary system, all electrical equipment is collectively referred to as primary equipment. The common primary equipment includes high voltage fuse, high voltage disconnector, high voltage load switch, high voltage circuit breaker and high voltage switch cabinet[8,9].

2.2 Electrical Secondary System Equipment

The secondary distribution system is composed of relay protection, safety automatic control, system communication, dispatching automation, DCS automatic control system and so on. It is an indispensable part of the power system. It can realize the contact monitoring and control between people and the primary system, so that the primary system can operate safely and economically. In the process of substation design, long-term development is often the main planning principle. It is necessary to strengthen the planning of the construction environment and grasp the actual construction requirements in time, so as to integrate external factors and carry out the planning and design of the scheme. In the early planning and later construction period, the construction should be carried out according to its particularity. In the early design, we should pay attention to the particularity of equipment operation, strengthen the design quality, ensure the overall stability and safety of the main wiring planning scheme, ensure that all modules can be contacted, clarify the overall planning scope and standards, and avoid the construction of the substation Events inconsistent with the standard planning occurred[10-13].

3. Construction of Multilayer Perceptron Model

Through the analysis of the development of single-layer perceptron, in order to meet the better effect, the hidden layer is added on the basis of it. In this way, the number of hidden layer and neuron layer can be increased by increasing the number of hidden layer. This way is called multi-layer perceptron, also known as deep neural network. Deep level network structure has a better effect for the single unexplained feature extraction, and now it has been widely used in data feature extraction and prediction. The network structure of multilayer perceptron is shown in Figure 1[14-16].

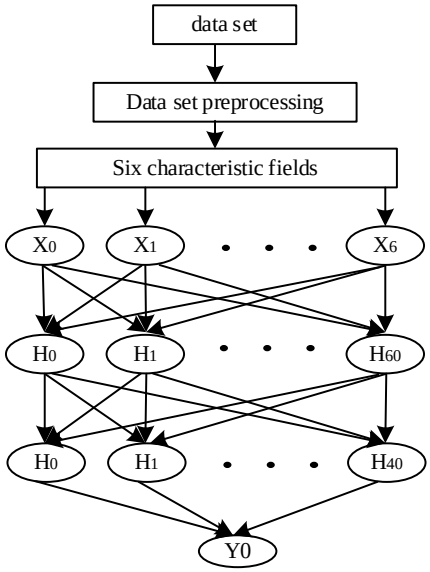


Fig.1 Multilayer Perceptron Network

There are four layers in multilayer perceptron, one input layer, two hidden layers and one output layer. The first hidden layer and the second hidden layer are set with 60 and 40 neurons respectively. In the hidden layer, the uniform The random number of distribution initializes the values of weight and bias, selects the relu as the activation function, and adds a dropout layer after each hidden layer. In this way, when the model is trained, some weights of the hidden layer can be reset to zero randomly, so as to reduce the interdependence between nodes, regularize the network, and reduce the risk of network structure; the output layer sets a God The sigmoid is selected as the activation function[17].

In depth study and comb the engineering design standards, general equipment selection and material procurement standards of equipment parameter model and standard materials and curing ID parameters of the corresponding situation. According to the carding results, the material master data and curing ID list are supplemented and modified to form the material and curing ID data information system. Through the collection, sorting and modeling of electrical primary and secondary equipment and line information, the model structure of scheme and material is formed; through the integration and analysis of historical data, the material matching Library of typical scheme is formed, which provides the basis for the generation of new project material procurement scheme. The system combines big data analysis technology, material matching database and account data of typical schemes to quickly locate typical schemes and provide schemes according to matching degree for users to select and adjust according to actual situation.

In order to select the most representative feature data of support vector machine material matching method model from the data features selected according to relevance. The features with little correlation are excluded and the influence on absolute error is observed. Then the

representative data features are selected as the input of SVM material matching method model, and the matching scheme is taken as the output of the model. The main class description, middle class description, small class description, material code, material property and technical specification ID are selected as the input features of SVM. Then, there are only three categories of primary equipment, secondary equipment and installation materials in the large class description, and they are introduced in turn in the following middle class and small class. Therefore, they are highly related and independent of each other To reflect the characteristics of the matching scheme. The structure of training and prediction is shown in Figure 2.

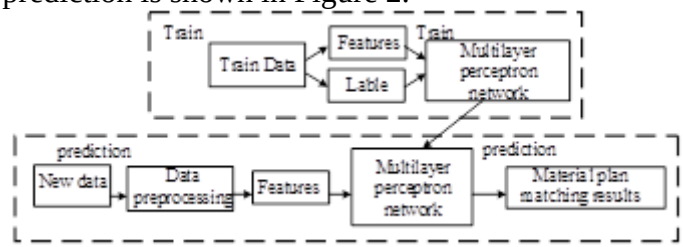
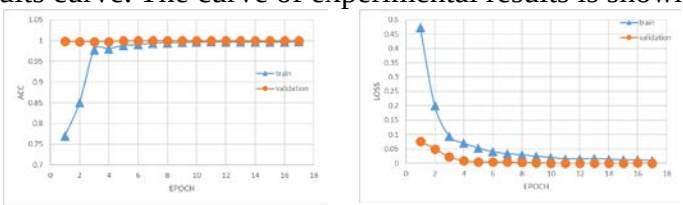


Fig.2 Multilayer Perceptron Network Training Prediction Structure Diagram

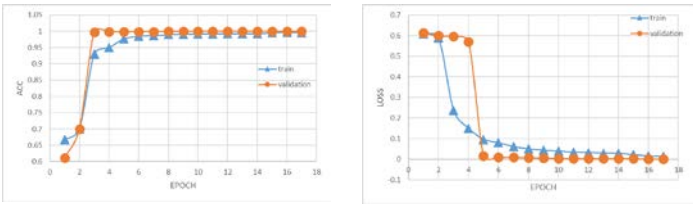
In the same experimental environment, 16000 groups of data are generated, and 12800 groups of training samples and 3200 groups of test samples are selected. The matching scheme is used as the output feature to train and predict the two models. The loss function value and prediction accuracy are used as performance indicators to evaluate the performance of the traffic measurement model. Using the program simulation to generate the three digit input characteristic data of 1 and 0, the definition of 111 represents the large class description, 110 represents the medium class description, 100 represents the small class description, 101 represents the material code, 011 represents the material property and 011 represents the technical specification ID. Program simulation is used to generate five bit matching scheme data of 1 and 0, and 11111 is defined to represent a matching scheme, and so on, there are 32 matching schemes. By analyzing the influence of the number of different batch data on the accuracy of the matching scheme, the reasonable number of batch data is obtained.

4. Experimental Results and Analysis

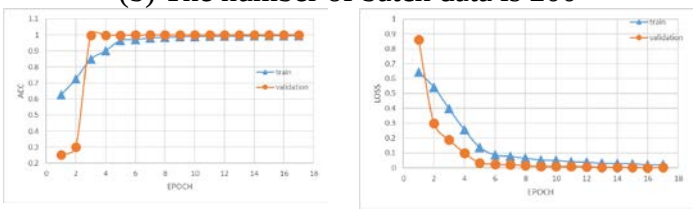
In order to analyze the influence of the number of different batch data on the material scheme matching system, through the analysis of the number of batch data, we set the number of batch data as 150, 200, 250, 300 for network training, so that we can get four groups of different batch data number experimental results curve. The curve of experimental results is shown in Figure 3.



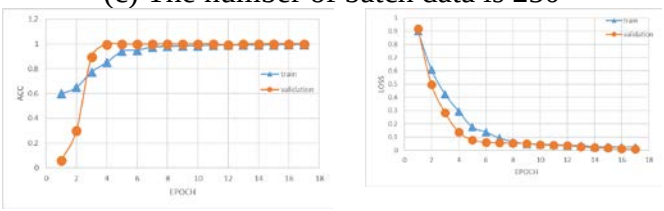
(a) The number of batch data is 150



(b) The number of batch data is 200



(c) The number of batch data is 250



(d) The number of batch data is 300

Fig.3 Experimental Result Curve of Different Batch Data Number

There are accuracy and loss functions in each training cycle, and their values are shown in Table 1.

Tab.1 Different batch data number parameter table

Number of batches	Loss function value	Test accuracy (%)	Test error trend
150	0.0021	93.12	Epoch is 10, and tends to be stable
200	0. 0018	96.78	Epoch was 12, and tended to be stable
250	0.0013	96.63	Epoch is 9 and tends to be stable
300	0.0025	95	Epoch was 14 and tended to be stable

By analyzing the experimental results in Fig. 3 and table 1, it can be concluded that the test accuracy of different input batch number data can reach more than 93%, the longest stable training period of 300 batches is 14, and the difference of stable training periods of 150 and 250 batches is not big, which are 10 and 9 respectively, but the accuracy of 250 batches can reach 96.63% The loss function values of 200 and 250 are similar, but they are obviously lower than the loss function values of 150 and 200 batches. Although the test accuracy of 200 and 250 batches can reach 96%, the network with 250 batches has faster convergence speed and can achieve the desired effect more quickly. Therefore, the material scheme matching network selects 250 batches as the parameter of batch data Training.

5. Conclusion

A material scheme matching method based on material, solidifying ID data and multi-layer perceptron is proposed. 16000 sets of data are used to train and verify the multi-layer perceptron network, and the flow pattern recognition network with 250 batch data parameters and recognition rate not less than 96% is determined. This method realizes the modular selection and intelligent review of materials, and greatly reduces the human, financial and material costs of declaration and review. The research conclusion can provide reference for the development of material specialty to intelligent excellence mode.

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