

Disease Diagnosis Based on Sleep Index

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Abstract: Based on the known eight types of diseases, neural networks were used to diagnose the patients on the 10 samples in the attachment. In each of the eight known types of diseases, 20 samples were taken and a total of 160 learning samples were trained and tested for validity. The 10 groups of data in the annex were respectively input to the neural network to obtain the types of diseases the patients suffered. Qualitative diagnosis The specific disease the patient suffers.

Keywords: Sleep quality, Medical diagnosis, BP Neural Networks

1. INTRODUCTION

The quality of sleep affects people's work and study efficiency and body function, and many factors affect the quality of sleep, many of the pathological features of the disease accompanied by sleep quality problems. Study of various diseases and the relationship between quality of sleep and make medical diagnosis is an important measure to improve the quality of sleep. Medical diagnosis is the medical staff based on the patient's medical history, symptoms and other information to summarize the results. After sum analysis, a process of etiology, so come to an accurate and reliable conclusion is very important. Reasoning is an important part of diagnosis, but because doctors often rely on their own knowledge of the pathology and years of accumulated experience to come to the diagnosis results, influenced by subjective factors, may cause misdiagnosis. The diagnosis is actually a classification process, so the prediction can be made based on the patient's sleep indicators (sleep quality, time to sleep, sleep time, sleep efficiency, sleep disorders, hypnotic drugs, daytime dysfunction).

2. MODEL ESTABLISHMENT AND SOLUTION

2.1 Neural Network Fundamentals

The basic processing unit of neural network is neuron, a large number of neurons are widely connected to form a neural network. The network usually contains input layer, hidden layer (middle layer) and output layer. Each layer includes multiple neurons. There is one layer

between input layer and output layer. The hidden layer can be multi-layer or not. Neurons are connected to each other through the right, the first layer of neurons only on the next layer of neurons, the interaction between the same layer of neurons, the size of the weight on behalf of the level of neurons on the next level of neurons influence level. In the network, the excitation function that acts on neurons usually adopts the type function, as shown in the following formula:

$$f(x) = \left(\frac{1}{1 + e^{-Qx}} \right)^{-1}$$

In the formula: Q is to adjust the form of excitation function parameters, said the gain value. The larger the value of Q, the steeper the S-shaped curve. Conversely, the more flat the curve, usually Q= 1.

Based on the multi-layer feed-forward neural network model of BP neural network, Sun advanced neural network model for diagnosis of lung cancer. Based on previous studies, the steps and flow chart of establishing neural network were summarized.

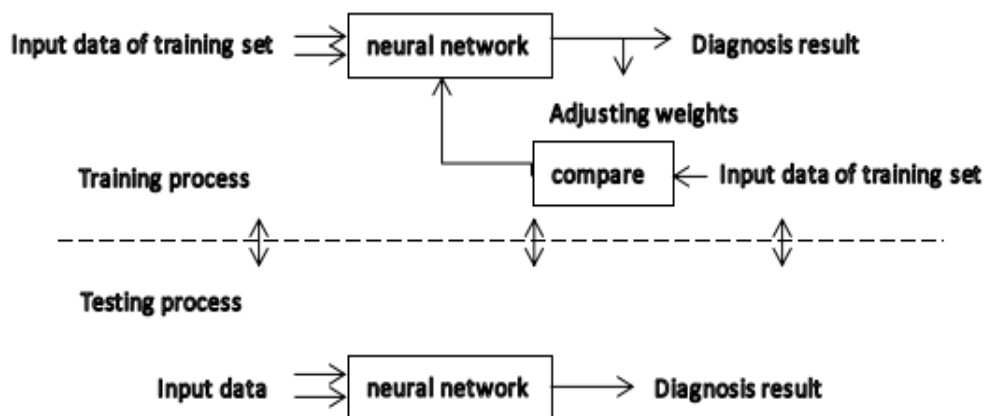


Figure 1 neural network disease prediction flow chart

2.2 Establish a neural network of medical diagnosis system

2.2.1 Data collation

Set the input vector as X, then $X=(X1,X2,X3,X4,X5,X6,X7)$ respectively corresponding to the diagnosis of seven indicators, Network output vector diagnosis diagnostic results, as shown in Table 1:

Table 1 Representative symbols in the neural network

Category	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8
Category Meaning	000	001	010	011	101	100	111	110

Seven indicators of sleep were selected and twenty of each of the eight categories of disease were taken as input to the neural network.

2.2.2 Establish neural network model

For each diagnostic network, which includes several indicators, it has a few input units and seven articles. Single hidden layer, the hidden layer number between 4-10, used the sensitivity of the pruning algorithm to determine the hidden layer of the best neurons. The output of each diagnosis network has 8 kinds, so the number of output units is 3; the number of training times is 1000, the training target is 0.0001, the learning speed is 0.1; the hidden layer adopts the tangent function and the output type is trained by the logarithmic function network Function is set as shown in Table 2:

Table 2 network structure

	Enter the number of cells	Number of hidden layer units	Number of output units
Sleep quality	1	4	3
Sleep latency	1	5	3
Sleep time	1	6	3
Sleep efficiency	1	7	3
Sleep disorder	1	8	3
Hypnagogue	1	9	3
Daytime dysfunction	1	10	3

Through repeated training, training process shown in Figure2 and Figure 3.

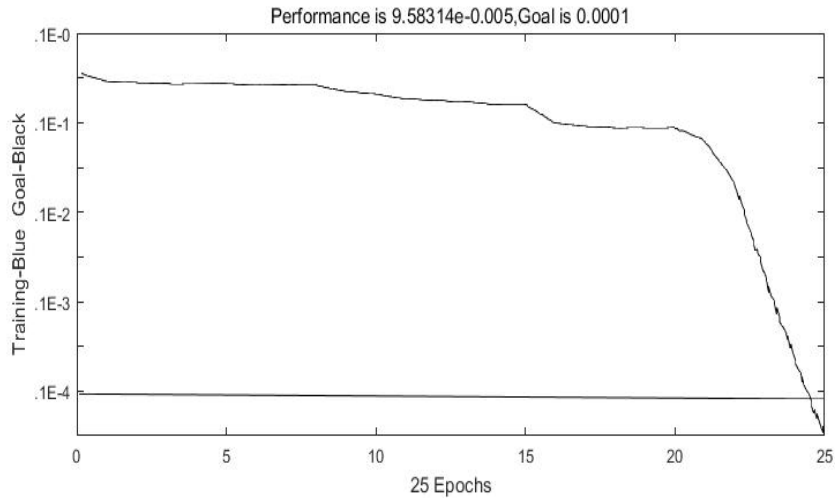


Figure 2 implied layer unit number 3 training map

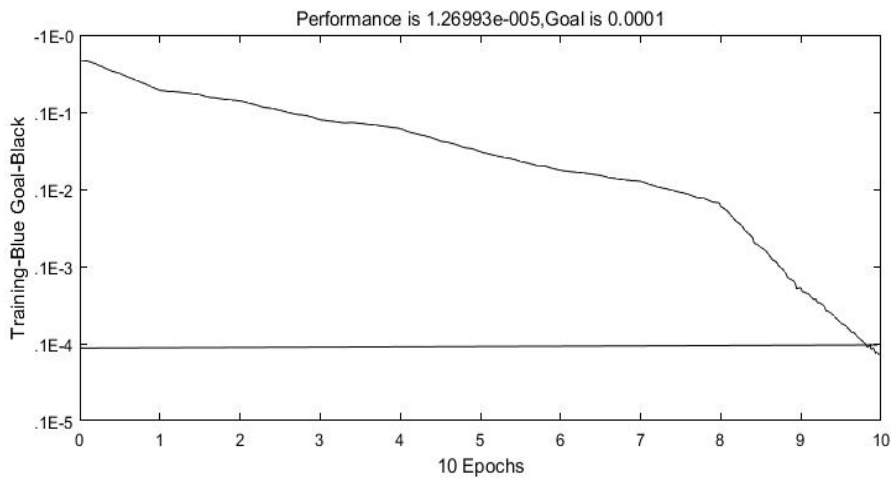


Figure 3 implied layer unit number 9 training map

When the number of hidden layer units increased from 3 to 9, the training error gradually decreased, but the number of hidden layer units continued to increase, and the training error increased. When the number of hidden layer units is increased from 3, the test error fluctuates slightly when the number of units is 7, but the test error generally increases. Taking into account the training error and test error of each hidden layer unit number, the number of hidden layer units is decided 9.

The patient's diagnostic indicators for the input data to the network added to its output, and constantly adjust the output of the neural network and the actual prevalence of illness, when the output of the training set of sample network is basically guaranteed to be consistent with the actual (about 80% Above), it is considered that the neural network can already be used for prediction. The consistency of the forecast for the input data is 84%, then the forecast can be made.

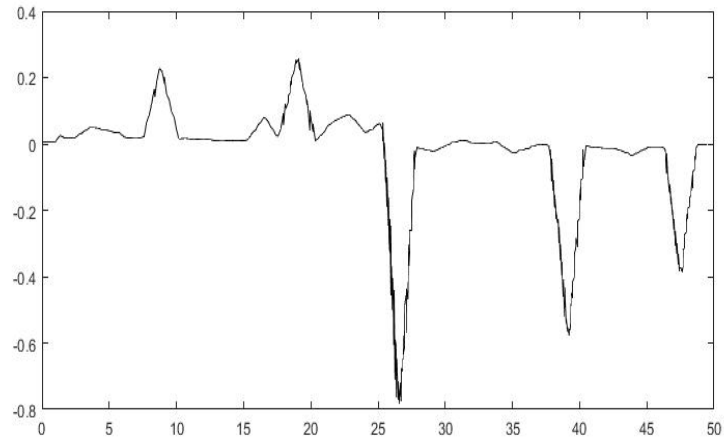


Figure 4 Prediction error curve

2.2.3 Neural network calculates the output

Ten indicators of sleep in patients with seven indicators into a trained neural network to get the output of the network, as shown in Table 3:

Table 3 diagnostic classification table:

Patient	1	2	3	4	5	6	7	8	9	10
Category	101	100	101	101	100	101	100	100	100	111

3. CONCLUSION

According to the diagnostic results in Table 1 and the consistent eight types of diseases, the final 10 patients corresponding to the disease were: patients 1,3,4,6 are Category 5 disease; patients 2,5,7,8,9 Belongs to Category 6 disease; patient 10 is a Type 7 disease.

Many modern diseases with the concomitant of sleep quality, based on sleep indicators of patients with medical diagnosis can reduce the subjectivity of diagnosis to some extent, and can be based on the relationship between disease and sleep quality to give more targeted medical advice.

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