Research on the Fusion Model of Sports and Medicine Based on Artificial Neural Network Health Analysis and Forecast ——Take atherosclerosis as an example

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Abstract: Purpose: With the increasing application of artificial neural network technology in medical diagnosis and health risk prediction, the model of sports medicine integration based on ANNs health risk prediction will provide an operable new idea for the development of sports medicine integration in China. Method: This study takes the more common atherosclerosis as an example and uses the artificial neural network analysis technology to predict the disease risk of 1109 patients, explores the effect of physical activity in predicting models, and explores new ideas for the integration of sports and medicine. Results: The model based on the LSTM network has a good predictive effect in realizing the level of physical activity and the risk of atherosclerosis. Therefore, it is recommended to include indicators such as physical activity level and exercise habits to predict and manage disease risks in the development of the integration of sports and medicine.

1. Introduction
Physical and medical fusion is an effective measure to achieve the deep integration of national fitness and national health, and it is an important way to implement the healthy China strategy [1]. However, its development in China is still in the initial stage of clarifying the concept and connotation and clarifying the system and mechanism model. The difficulty in the implementation of the integration of sports and medicine, the obscure path, and the prominent contradictions are urgent problems [2]. Exploring the effective carrier and the way of the physical and medical fusion is the direction to solve this problem. With the popularization of artificial intelligence and AI technology in the field of health care, Artificial Neural Networks (ANNs) has been increasingly used in medical diagnosis and health risk prediction [3]. Therefore, the integration model of physical medicine based on ANNs health risk prediction will Provide a new and operable idea for the development of the integration of sports and medicine in China.

Atherosclerosis (Atherosclerosis, AS) is a chronic inflammatory change in which a large amount of cholesterol ester accumulates on the blood vessel wall to form atherosclerotic plaque, which causes the thickening of the blood vessel wall and the narrowing of the lumen [4]. In recent years, people have paid more and more attention to atherosclerosis because the pathology of atherosclerosis caused by a variety of clinical sudden cardiovascular diseases is generally recognized [5]. At present, cardiovascular and
cerebrovascular diseases are the number one killer of global health, as well as a major global public health problem [6][7][8]. The prevention and control of atherosclerosis directly determines the effect of prevention and control of cardiovascular diseases. Based on this, this research focuses on atherosclerosis as an example to analyze and discuss the construction of the artificial neural network risk prediction model of the fusion of sports and medicine.

2. Objects and methods
The data comes from the physical examination data of the Health Management Department of Henan Provincial People's Hospital from July 1, 2020 to December 31, 2020. Before the start of the experiment, each physical examination patient was clearly informed of the specific experimental operation, and the International Physical Activity Scale (IPAQ) long questionnaire was carefully filled out under the guidance of medical staff. In the end, 5000 physical examination data were randomly selected, referring to the atherosclerosis standard of the World Health Organization, 1108 cases and 2136 non-atherosclerosis cases were included, and 3244 cases with incomplete physical examination data and invalid data were excluded. The physical examination data of 1108 cases of atherosclerosis were computer-trained.

This paper conducts experiments on data based on the basic theory of LSTM network. The basic theory of LSTM network: The main structure of LSTM memory unit is gate and memory cell, and the gate includes: input gate, output gate, and forget gate. The gate structure can effectively retain the information of the end node of the Internet of Things, so it can realize the maintenance and update of memory cells.

The basic theory of LSTM network: The main structure of LSTM memory unit is gate and memory cell, and the gate includes: input gate, output gate, and forget gate. The gate structure can effectively retain the information of the end node of the Internet of Things, so it can realize the maintenance and update of memory cells, as shown in Figure 1.

The forget gate takes the input information value \( x^{(t)} \) at the current moment and the information value \( h^{(t-1)} \) of the hidden state at the previous moment as the input of the activation function sigmoid, thereby generating a weighted output value \( f^{(t)} \) between [0,1]. The weight value is the probability that the memory unit forgets the state of the upper layer of the cell. By multiplying \( f^{(t)} \) it by the cell state \( C^{(t-1)} \) of the last moment of the memory unit, the degree to which the information of the upper layer is retained is controlled.
The input gate uses the sigmoid activation function and the tanh activation function to control the value of new input information that can enter the cell state. Among them, the tanh activation function generates new memory cells \( C^{(t)} \), and the sigmoid activation function can generate a weight value between \([0,1]\) to control the amount of information entering the cell state. We can effectively combine the input gate and forget gate to update the cell state from \( C^{(t-1)} \) to \( C^{(t)} \).

\[
f^{(t)} = \sigma(W_f[h^{(t-1)}, x^{(t)}] + b_f)
\]

The output gate uses the tanh activation function to effectively process the current cell state to obtain the cell state information value \( C^{(t)} \) at the next moment, and uses the sigmoid activation function to obtain the weight value \( o^{(t)} \) to control the filtering degree of the cell state, and finally obtain the hidden information \( h^{(t)} \) of the next time.

\[
o^{(t)} = \sigma(W_o[h^{(t-1)}, x^{(t)}] + b_o)
\]

\[
h^{(t)} = o^{(t)} \cdot \tanh(C^{(t-1)})
\]

3. Research results

3.1. Regression analysis of the relationship between physical activity level and atherosclerosis

| Probability of neck atherosclerosis | Regression coefficients | Standard error | Z value | P>|z| | [95% Conf.Interval] |
|------------------------------------|-------------------------|----------------|---------|-------------|------------------|
| Age                               | 0.1351928               | 0.0058458     | 23.13   | 0.000       | 0.1237353 - 0.1466502 |
| BMI                               | 1.438984                | 0.1166258     | 12.34   | 0.000       | 1.210402 - 1.667566 |

Table 1 shows the regression analysis of the relationship between the level of physical activity and atherosclerosis. There is a significant correlation between the level of physical activity and the prevalence. The relationship between physical activity and disease is increasingly accepted by people along with the slogan "exercise is a good medicine". After the United States proposed that "exercise is a good medicine", clinicians have made "physical activity" a mandatory item for medical consultation (Thompson, Walter R, 2017). In March 2018, the U.S. Department of Health and Human Services (HHS)
updated and released the 2018 edition of the "U.S. Physical Exercise Guidelines". There is no special sports department in the United States. Therefore, the guidelines are jointly developed by health medicine, physical education, and government departments. The United States attaches great importance to the role of communities in promoting sports awareness and behavior. As of December 2018, a comprehensive literature report can clearly quantify the effectiveness of the implementation of the guidelines and promote health and reduce the burden of chronic diseases. Has played a significant effect in other aspects (King AC, 2019). Japan is one of the earliest countries to formulate and implement the coordinated governance of multiple subjects integrating sports and medicine, forming a comprehensive governance model for government legislation, social organizations, individual citizens, health and sports management departments (Guo Wei, Sone Junya, 2019). The model of the integration of sports and medicine in Germany is to give full play to the main role of non-profit social organizations and become the core of the integration of sports and medicine in health promotion (Lu Yi, 2016). The main bodies participating in the development of the integration of sports and medicine in developed countries have provided valuable experience for China to build a community sports and medicine integration model.

3.2. Batch increase model for predicting the risk of atherosclerosis by physical activity level

![Image](image1)

Figure 2 The batch increase model of physical activity level predicting the risk of atherosclerosis

It can be seen from the loss function that as the Batch increases, the Loss value has different situations. The Loss value drops the fastest at [0,200], and the Loss value drops relatively slowly at [200,600], and at [600,1000] Loss value It tends to a stable state. At this time, it shows that the model training for predicting the risk of atherosclerosis by the level of physical activity is stable, and the Loss value of the model is close to 0, indicating that the model has good predictive ability.

3.3. The physical activity level predicts the risk of atherosclerosis

![Image](image2)

Figure 3 Prediction of the risk of atherosclerosis by the level of physical activity
In this experiment, 50 samples of carotid atherosclerosis were selected as the test data set. In Figure 3, red is the standard result and blue is the predicted result. The figure clearly shows that the difference between the physical activity level prediction method and the actual result is small, which proves that the data used in this article can effectively predict the occurrence of carotid atherosclerosis.

3.4. The level of physical activity predicts the ROC of the risk prediction model for atherosclerosis

When artificial neural network calculates, roc curve is used to describe the prediction result. For the true positive rate on the ordinate and the true negative rate on the abscissa, the closer the enclosed area is to 1, the better the prediction result. The ROC value of this model is 0.92, indicating a better prediction effect.

![ROC curve](image)

Figure 4 ROC curve diagram of the prediction model of the level of physical activity predicting the risk of diabetes

4. Discussion

This study analyzed the physical activity level and disease risk prediction model of 1108 patients with atherosclerosis and found that the model can accurately predict disease risk. This will provide new ideas for clinical disease prediction and a new path for the integration of sports and medicine.

Acknowledgments

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