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Early Diagnosis of anxiety Disorder Using Artificial Intelligence

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Abstract

Contemporary societal and environmental transformations coincide with the emergence of novel mental health challenges. anxiety disorder, a chronic and highly debilitating illness, presents with diverse clinical manifestations. Epidemiological investigations indicate a global prevalence of 5%, with an additional 10% exhibiting subclinical symptoms. Notably, 9% of adolescents demonstrate clinical features. Untreated, anxiety disorder exerts profound detrimental effects on individuals, families, and the broader community. Therefore, it is very meaningful to predict anxiety disorder through machine learning algorithm analysis model. The main research content of this paper is the analysis of the prediction model of anxiety disorder by machine learning algorithms. The research purpose of machine learning algorithms is to use computers to simulate human learning activities. It is a method to locate existing knowledge, acquire new knowledge, continuously improve performance, and achieve self-improvement by learning computers. This article analyzes the relevant theories and characteristics of machine learning algorithms and integrates them into anxiety disorder prediction analysis. The final results of the study show that the AUC of the artificial neural network model is the largest, reaching 0.8255, indicating that it is better than the other two models in prediction accuracy. In terms of running time, the time of the three models is less than 1 second, which is within the acceptable range.

Keywords: *Anxiety Disorder, Mental Illiness, Patient, Machine Learning, Neural Model*

1. Introduction

At present, many people in China are still running for life, living under the pressure of life and work, but long-term psychological pressure and mental depression are likely to lead to mental illness.

The number of patients with chronic diseases in China ranks first in the world. In addition, the deteriorating natural environment and high-pressure social environment have increased residents' health awareness, and these status quo have led to an increasing demand for medical care. However, compared with high-income

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countries, the proportion of domestic doctors is still low[1]. Limited medical resources make the existing medical system unable to cope with the future development of medical health. New solutions are urgently needed. Some researchers believe that mathematical models can be used to predict the onset of anxiety disorder and disease prevention.

The idea that computer models should be used first in predictive models related to anxiety disorder has gradually been accepted. In recent years, many researchers have studied the analysis of anxiety disorder prediction models and have achieved good results. For example, Benedikt S believes that the effect of cognitive behavioral therapy on anxiety disorder has been confirmed by a large number of studies, but it must be admitted that cognitive behavioral therapy is highly professional, expensive, and lacks professional therapists, and is investigating After reviewing the nature of cognitive behavioral therapy received by patients with obsessive-compulsive disorder, it is found that most of them simply do not meet the minimum standards of cognitive behavioral therapy[2]. Ksn A believes that psychotherapy can change the metabolism of the brain, which means that psychotherapy may also have adverse reactions that hinder the smooth progress of the treatment. Unlike drug therapy, the side effects of psychotherapy can take a lot of time and be accepted by others. Fear of treatment of mental illness and reduced happiness, etc[3]. At present, there are many researches on the analysis of anxiety disorder prediction models by machine learning algorithms. These predecessors' theories and experimental results provide a theoretical basis for the research of this article.

This paper analyzes the anxiety disorder prediction model based on the machine algorithm model, analyzes the relevant characteristics and applications of the machine learning algorithm, and the artificial neural network learns through induction. It learns from a 1644 large number of samples and then adapts internally. In this process, it continuously adjusts the weight of each neuron interface, and finally, the weight distribution of the neural network converges to a constant range[4-5]. Through the use of artificial neural network models with strong learning ability and good generalization performance, variables are continuously introduced for training, and finally the adaptation results of the prediction model become better..

2. Related research

2.1 Related Concepts of Machine Learning Algorithms

Machine ensemble learning is to combine different classifiers by selecting a suitable method, and then evaluate the final classification result through the classifier formed by ensemble learning. The final result will be closer to the output of the actual objective function than the optimal situation of a single classifier[6]. We can actually convert between weak learning and strong learning algorithms. We find a weak learning classifier that is slightly better than general random guessing, and then convert it to a strong learning classifier, so you don't need to find the harder to obtain the latter.

(1) Integrated learning Boosting algorithm

The integrated learning Boosting algorithm is one of the classic algorithms in the learning set. After multiple sampling, the data set can be divided into several data subsets with the same number of samples. Then the new data set can be separately trained to have multiple weak classifiers, and then the weak classifiers can be grouped into strong classifiers in a specific way. The ensemble learning algorithm uses the Booststrap sampling principle to train many different classifier data sets[7-8]. Since the percentage of minority samples is small, we can use iterative calculation to improve the accuracy of minority samples. The unbalanced state can be reduced by applying several random samples to the unbalanced sample set. The ensemble learning enhancement algorithm can achieve more efficient classification accuracy in the training data, while reducing the classification error of a small number of samples. At the same time, it may have better generalization in

predicting data samples. Since the decision tree is very sensitive to small changes in the training data set, it is very suitable for the training data interruption process.

(2) Integrated learning AdaBoost algorithm

AdaBoost is based on an enhanced integrated learning algorithm. The process of adjusting the parameters of the integrated learning algorithm can improve the accuracy and generalization ability of the algorithm. Due to the above advantages of the AdaBoost algorithm, it is very suitable to be applied to various classification scenarios to solve the problem of fuzzy weight mode and complex assumptions of the amplification algorithm[9]. Therefore, this study chooses the AdaBoost algorithm as the model to make better anxiety disorder predictions. The AdaBoost algorithm also has some disadvantages. For example, it is susceptible to noise interference, and its effectiveness is closely related to the choice of patient classifier. At the same time, there is a large classification error for high-dimensional data. Therefore, the application of anxiety disorder prediction has certain risks, and there is no related anxiety disorder application. This paper chooses to integrate the AdaBoost learning algorithm for the subsequent introduction of anxiety disorder prediction models, hoping to provide theoretical and practical contributions to the application of integrated learning in anxiety disorder prediction through experiments and result analysis, and provide a way for integrated learning.

(3) Mathematical model of machine algorithm prediction

Mathematical models can actually prevent the onset of diseases. For a specific object, it can be approximated by a mathematical structure according to the inherent laws of the disease and related risk factors. These mathematical structures come from reality and are higher than reality. The computer language written as a program can quickly complete complex calculations and perform batch processing[10]. It has become the main method for predicting modern diseases, and it has also become the most popular method of health decision-making and disease control. For example, the American College of Cardiology has proposed prediction strategies by introducing models for predicting cardiovascular diseases; research on predicting cardiovascular and cerebrovascular diseases and other chronic disease models has proposed insurance strategies and regulations.

2.2 Related Characteristics of Machine Learning Algorithms

(1) Non-linear characteristics

Machine learning algorithm network neurons have two different states, namely activation and inhibition. These two states have a nonlinear relationship after a certain mathematical transformation. Among them, a network with threshold neurons can improve the storage space of the model and make the prediction accuracy of the model more accurate. Secondly, there are non-limiting features. The features of machine learning algorithms are controlled by the interconnection and interaction between the neurons of the neural network[11-12]. The network characteristics of artificial neurons are constantly stimulated by changes in information, and the internal mechanism of the machine learning algorithm itself is constantly updated. This is because it has the advantages of selfadaptation, self-organization and self-learning capabilities. This feature is used to explain the multiple stable equilibrium states of the machine learning algorithm. Since the function has different extreme values under different conditions, it leads to the diversity of system evolution

(2) Non-autonomous learning features

The machine learning algorithm performs the mapping from input to output, and mathematical theory shows that it can perform any complex nonlinear mapping. This feature makes machine learning algorithms very suitable for solving problems with complex internal mechanisms; machine learning algorithms can learn a set of examples of correct answers, and then automatically derive appropriate solving rules, that is, self-learning ability; machine learning algorithms have better promotion And promotion capabilities. Due to these

advantages of machine learning algorithms, it is very suitable for various classification scenarios and solves the problems of fuzzy weight patterns and complex assumptions in machine learning algorithms. Use the above functions to solve anxiety disorder. Some problems that may arise in the prediction, get a better performance and higher accuracy machine learning model to better predict the occurrence of anxiety disorder。

Table 1. Basic statistical data analysis table of the research sample

Age	Number of people	Percentage(%)
21~30	126	31.34
31~40	56	13.93
41~50	114	28.36
51~60	78	19.40
61~70	28	6.97

3. Experimental Preparation Research in Anxiety Disorder Prediction Model

3.1 Experimental Method

The artificial neural network algorithm needs to use the error signal of each unit of the output layer and the output of each unit of the hidden layer to adjust the weight of the output layer and the hidden layer, and use the error signal of the hidden layer unit and the input of the input layer to adjust the connection weight:

(1)Artificial neural network algorithm

$$E = \frac{1}{2m}\sum_{k=1}^{m}\sum_{O=1}^{q}(\mathrm{d_o}(k) - y_o(k))^2 \qquad (1)$$

d(k) and y(k) represent expected output and actual output. They are both functions of weight and deviation, k represents the k-th weight adjustment, and m represents the number of samples input to the network at a time.

(2) The transfer functions of the input layer and output layer of the model used in this article are linear functions, and the hidden layer is a tangent sigmoid function, which is continuous with its derivative, which is very suitable for situations that require frequent derivative calculations., For example artificial neural network model. Hidden layer transfer function such as formula:

$$L_P(G) = \frac{1}{N(N-1)}\sum_{i\neq j\in G} L_{ij} \qquad (2)$$

Among them, Lij represents the characteristic path length between node i and node j in network G.

3.2 Experimental Data Collection

The data used in this study comes from the 2020 physical examination data set of a regional hospital in a certain city, which records the physical signs and clinical characteristic values of the population in the hospital. Including 402 samples, 216 characteristic variables. By analyzing various data of hospital patients, we can analyze the best anxiety disorder prediction model.

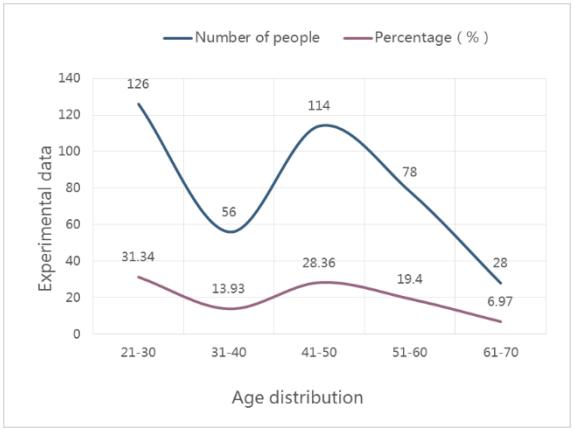

Figure 1. The basic statistical data analysis diagram of the research sample

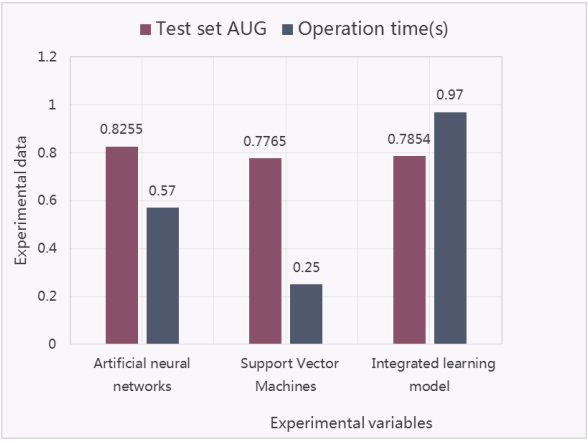

Figure 2. Comparison and analysis diagram of prediction experiment results

4. Experimental Preparation Research of Anxiety Disorder Prediction Model

4.1 Analysis of the Basic Statistical Data of the Research Sample

First, perform descriptive statistics on experience sample data. It is mainly through statistical data such as individual gender, age, body weight index, percentage, and number of people to understand the structure and distribution of the survey sample. The test results are shown in table 1

As shown in Figure 1, in the overall test sample data, from the perspective of age distribution, in the experience data, there are 126 people aged between 20 and 30, accounting for 31.34% of the total number, and between 31 and 40 years old There are 56 people, accounting for 13.93 of the total number of people, 114 people between the ages of 41 and 50, accounting for 28.36% of the total, 78 experience data from 51 to 60 years old, accounting for 19.40% of the total number of people, 61 to There are 28 experience data for 70-year-olds, accounting for 6.97% of the total number.

4.2 Comparative Analysis of Prediction Experiment Results

The results of the three models on the independent sample set are shown in Figure 2. The AUC of the independent sample set is used to evaluate the accuracy of the three models.

As shown in picture 2. The AUC of the independent sample sets of the three machine learning models are all above 0.75, indicating that the prediction accuracy of the three are relatively good, and they can better predict anxiety disorder based on experience data. Among them, the AUC of the artificial neural network model is the largest, reaching 0.8255, indicating that it is superior to the other two models in terms of prediction accuracy. In terms of running time, the time of the three models is less than 1 second, which is within the acceptable range. Among them, the artificial neural network model has the shortest running time, only 0.25 seconds, indicating that it has the highest efficiency. On the whole, the artificial neural network model has high prediction accuracy, short running time, and the best fitting effect

5. CONCLUSIONS

This article uses machine algorithms combined with anxiety disorder prediction models to analyze, and aims to use artificial neural networks, support vector machines, and concentrated learning three artificial intelligence methods to create a anxiety disorder prediction model. The model uses the best model in this research based on artificial intelligence. Neural network, support vector machine algorithm and built-in learning algorithm to create a anxiety disorder prediction model. From both theoretical and experimental perspectives, the influence of parameter changes on the adaptive effects of test set samples not participating in model training is studied. Choose the best predictive model in this research: artificial neural network model. Use independent sample sets to compare and analyze anxiety disorder prediction models based on artificial BP neural networks, vector support machines and integrated learning algorithms. From the perspective of theory, efficiency, precision and efficiency, the accuracy of the three models all meet the accuracy requirements, but the artificial neural network model has the highest prediction accuracy, short calculation time and the best adjustment effect. Therefore, the artificial neural network model is selected as the best predictive model for this study.

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