Quality Evaluation Model of Preschool Art Education Based on Deep Learning Theory

Lijuan Zhong(✉)

Xianyang Normal University, Xianyang 712000, Shaanxi, China
holyzhong@163.com

Abstract. In order to solve the problem that the expression ability and generalization ability of shallow learning network to complex functions are limited, and to improve the accuracy of preschool art education quality evaluation, a preschool art education quality evaluation method based on deep learning network is proposed. Starting from the creation of preschool art education environment, the quality of preschool art education and children's development, this paper constructs a preschool art education quality evaluation index system including three primary indicators and nine secondary indicators. Take the secondary index in the evaluation index system as the input of the deep learning network, optimize the weights of each layer of the deep learning network by using the unsupervised pre training model, determine the conditional probability distribution and joint probability distribution of each layer in the restricted Boltzmann machine based on the bottom-up unsupervised learning process, and the output layer optimizes the parameters of each layer according to the input DMOS value, Build a regression model between the abstract primary index and DMOS value, and predict and obtain the objective evaluation results of the quality of preschool art education according to the regression model.

Keywords: Deep learning network · Preschool art education · Quality assessment · Index system

1 Introduction

With the development of the times, people increasingly realize the importance of preschool education to children. Preschool art education is related to children's future development. Enlightening children's artistic talent is the first and key step in children's art growth. Nowadays, the development of psychology and physiology is no longer a new product, and gradually makes early childhood education perfect. People have a further understanding of children's art education. The educational goal of early preschool art takes professional skills as this standard and ignores children's development in other fields, which is reflected at home and abroad. Art class is not simply to let children draw and cultivate children's imagination and aesthetic ability [1]. For example, some parents believe that art can calm ADHD children. These art classes can be done, but the real art class is more than that. Until the end of the 19th century and the beginning of the

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20th century, some people began to pay attention to children's preschool art education. With the continuous efforts of educators studying children's art, children's preschool art class was gradually valued, and then began to pay attention to children's imagination and creativity. Today's preschool art education is not only a single subject, but also applicable to other fields, and can help children in need. Children's art education can also treat autistic children, and has a certain effect. In foreign countries, art learning has been regarded as a means of treating autism. The performance of autistic children is to close themselves and do not communicate with the outside world, but they can express their hearts and convey their inner world to the outside world through painting.

The basic goal of preschool art in kindergarten is to "learn and master simple art knowledge and skills, cultivate children's preliminary expressiveness, and make children germinate aesthetic interest". Mastering art knowledge and painting skills is a necessary condition for art teachers to engage in art teacher profession. Through preschool art education, children's cognitive ability, emotion and attitude have been developed [2]. In the outline of the national medium and long-term education reform and development plan, it is pointed out that it is necessary to guide kindergartens and families to implement scientific education, promote the comprehensive and harmonious development of children's body and mind, and formulate the learning and Development Guide for children aged 3–6, which is referred to as the guide, which lists in detail what goals should be achieved at each stage.

Preschool art education includes aesthetic perception and expression education, creativity education, aesthetic culture education, social and life education and personality growth education. The purpose of setting up art courses in preschool art education major is to train preschool teachers and students to make full use of the art knowledge and skills learned in the future education and teaching work to guide children to feel and create beauty and stimulate the all-round development of children's mind [3]. The teaching quality of art education of preschool art education specialty directly affects the overall level of early childhood education in the future, and is the premise and guarantee for the all-round development of children in the future.

At present, the worldwide attention to preschool art education has generally increased, the development speed and school scale of preschool art education have continued to increase, and the construction modes of preschool art education institutions are more diverse. The national guidance direction for preschool art education becomes clearer with the increase of attention. On the basis of improving the development speed of preschool art education and improving the difficult problems of preschool art education for preschool children, we pay more attention to the quality of preschool art education [4]. Therefore, it is of great significance to study a systematic, scientific and complete evaluation method for the educational quality of preschool art education institutions.

As an important part of machine learning, deep learning network is based on the neural network description data of constructing and simulating human brain analysis and learning. Its main advantages are strong modeling ability and high representation accuracy. It can effectively solve the problem that the expression ability and generalization ability of the commonly used shallow learning network for complex functions are limited under the condition of limited samples and calculation units. Based on this, this paper studies the quality evaluation method of preschool art education based on deep learning network.

2 Overview of Deep Learning Algorithms

Deep learning was first proposed in 1986. It extends from the field of machine learning. Its powerful representation learning ability and automatic feature mining ability can get good results. Therefore, it is widely used in computer vision, natural language processing and other fields, and has developed rapidly in recent ten years.

In natural language processing tasks, more and more studies use deep learning to represent text, and apply the training results to downstream tasks. Traditional natural language processing tasks often represent words by means of independent hot coding. This high-dimensional representation method is very easy to cause dimensional disaster when there are many kinds of words in the corpus. Because deep learning abstracts the original data such as multilinear and nonlinear changes, its representation learning ability is much stronger than the traditional representation method, which can greatly improve the problem of dimensional disaster. In recent years, in the research of natural language processing, the use of deep learning for distributed representation is more widely applicable than the traditional single hot and word bag representation [5]. At the same time, using deep learning to pre train word vectors for a large number of texts such as Wikipedia has also been verified to speed up the training convergence and improve the universality of word vectors in natural language processing tasks.

As the basic unit of neural network, neuron plays an important role in understanding the concept of neural network. Neurons, also known as perceptrons, were very popular in the 1950s and 1960s and successfully solved many problems at that time. The mathematical model of a neuron is shown in Fig. 1.

As can be seen from the above figure, a neuron consists of the following three parts:

Input weight: a neuron can receive multiple inputs, each input corresponds to a weight, and there is also a bias term.

Activation function: there are many kinds of activation functions of neurons. The neurons in Fig. 1 choose step function. In addition, relu function and sigmoid function are often used as activation functions of neural networks.

Output: the output of neurons can be calculated by the following formula

$$y = f(w \cdot x + b) \tag{1}$$

where W is the weight, X is the input, B is the offset term, and F is the activation function.

2.1 Artificial Neural Network

The development history of artificial intelligence can be summarized as three waves, and the first wave can be called artificial neural network. Artificial neural network is the cornerstone of deep learning. Its original inspiration comes from the work of mathematician Pitts and psychologist mccullochl26) in biological neurons. Hopfield put forward the neural network model and the application of back propagation in training and learning in the 1920s, which solved the problem that the neural network perception layer can

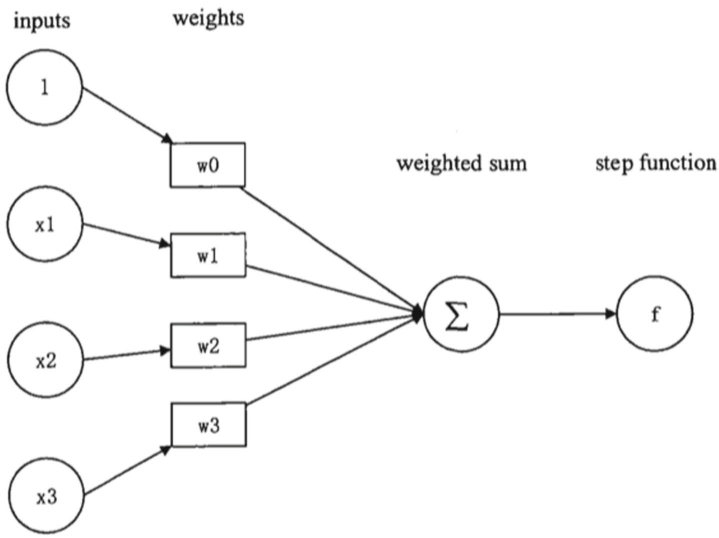

Fig. 1. Neuron mathematical model

not be trained and the linear propagation information gain is poor, and greatly promoted the development of neural network [6]. This is the second wave of artificial intelligence, as shown in Fig. 2.

However, artificial neural networks also have many fatal problems, which are mainly divided into: the nonlinear propagation of multi-layer perception leads to a large number of local optima, and the gradient descent becomes extremely difficult; With the accumulation of network layers, the memory consumed by model training is too large, and the training time is difficult to accept; The gradient dissipation of multilayer neural network leads to the failure of complete back propagation of error, and the model iteration lacks the most critical gradient descent direction, which makes it difficult to converge to the stable value [7]. The development of artificial intelligence fell into silence due to the harsh hardware environment and the bottleneck of mathematical computing research at that time.

2.2 Deep Confidence Network

At the end of last century, the classical machine learning algorithm SVM (support vector machines) was born. The algorithm has the advantages of low training complexity, low parameter adjustment requirements and high discrimination ability of small samples. The algorithm has quickly become the mainstream research direction of machine learning and guided the deep learning to rise again.

In 2006, with the development of machine learning and the improvement of mathematical theory, the training algorithms of deep belief network (DBN) and restricted Boltzmann machine (RBM) were proposed. The founder Hinton made use of the advantages of supervised learning and unsupervised learning to coordinate the advantages and disadvantages of supervised and unsupervised learning during initialization parameters

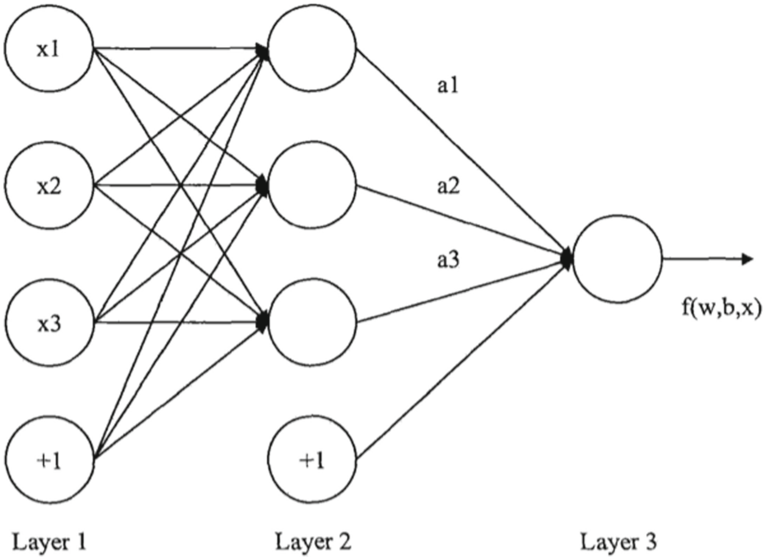

Fig. 2. Neural network diagram

and network training, which made the model converge rapidly, and solved the problems that the iteration of the model left over by artificial neural network in the last century lacked the most critical gradient descent direction, resulting in difficulty in converging to the stable value [8]. At the same time, people have gradually found the importance of data for training network. Scholars in the early 20th century began to accumulate a large amount of data silently, and artificial intelligence is waiting for his third climax.

2.3 Deep Convolution Neural Network

With the rise of the big data era and the vigorous development of basic matrix computing hardware GPU, artificial intelligence finally shines brightly in the Imagenet competition in 2012. Krizhevsky et al. Won the competition with convolutional neural network and beat other traditional image processing algorithms and traditional machine learning algorithms, For the first time, the interactive shallow model training and learning algorithm is greatly developed. Four years later, alphago, developed by Google, was invincible in the go competition with a variety of in-depth learning algorithms. It successively challenged the top go players and won results, and even changed the pattern and competition mode of the whole go competition. So far, artificial intelligence has become a household name. Major business circles, industrial circles and academic circles have made every effort to develop in-depth learning algorithms [9]. At the same time, people outside the industry began to pay attention to and look forward to the improvement of life brought by artificial intelligence.

Because the structural characteristics of cyclic neural network and long-term and short-term memory network can solve most of the problems of processing language sequences, most of the current research work adopts this chain structure neural network.

However, because their state at each time depends on the input at that time and the state at the previous time, they can only process language sequences serially, which greatly reduces the efficiency [10].

As a typical parallel feature processor, convolutional neural network is widely used in image processing tasks, but it was first proposed for natural language processing tasks in 2014.186. The network structure of convolutional neural network includes convolution layer, pooling layer and full connection layer. The changes to its network structure when processing language sequences are shown in Fig. 3.

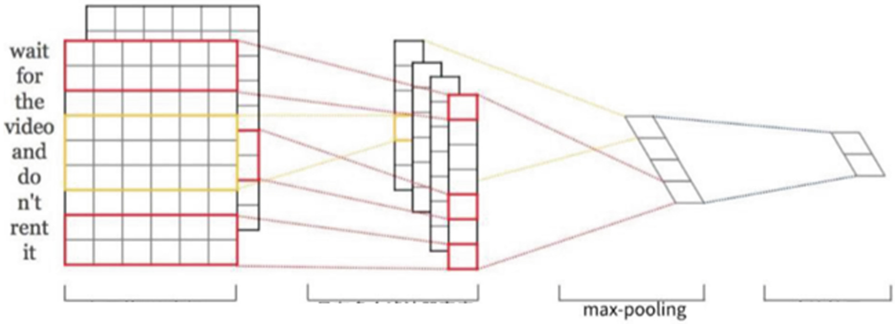

Fig. 3. Convolutional neural network structure

Compared with cyclic neural networks and long-term and short-term memory networks, convolutional neural networks have the following advantages: 1) because convolution operations can be carried out in parallel, its parallel ability is higher; 2) Due to the structural characteristics of sliding window, it can capture more context information; 3) Due to the characteristics of sequential sliding of sliding window, it can record the information of relative position in text. However, because the size of the sliding window directly determines the distance to capture word dependencies, dependencies between words beyond the window cannot be captured. In order to break through the limitation that convolutional neural network can not capture long-distance dependence characteristics, relevant studies have improved convolutional neural network from two aspects: one is to change the sliding window of continuous coverage into discontinuous coverage without changing the depth of convolution layer, that is, void convolution [11]; The second is to deepen the depth of the convolution layer so that the upper and lower coverage windows are superimposed. At present, in addition to text classification, convolutional neural network is also widely used in natural language processing tasks such as relationship extraction and sentence repetition recognition.

3 Evaluation Method of Preschool Education Quality Based on Deep Learning Network

3.1 Construction of Quality Evaluation Index System of Preschool Art Education

The construction of preschool art education quality evaluation index system is the basis of preschool art education quality evaluation. Build a preschool art education quality evaluation index system composed of three primary indicators: the creation of preschool art education environment, the quality of preschool art education and child development, as shown in Fig. 4.

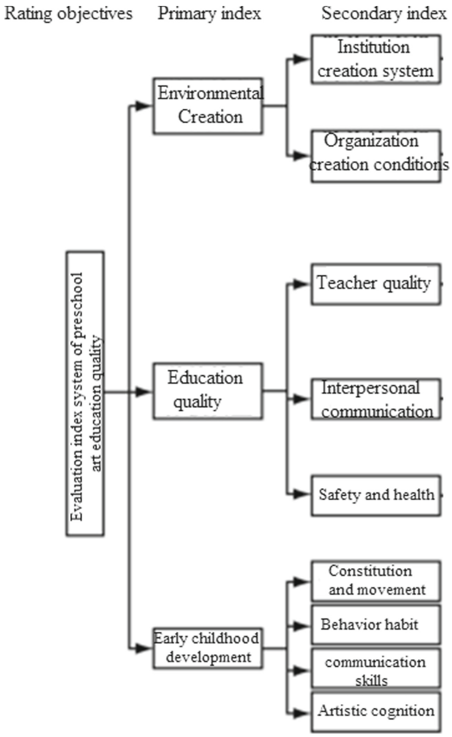

Fig. 4. Evaluation index system of preschool art education quality

The creation of preschool art education environment includes two secondary indicators: the creation system of preschool art education institutions and the creation conditions of preschool art education institutions, which respectively describe the school running mode adopted by preschool art education institutions and the hardware and software facilities used in preschool art education and teaching activities. The establishment system of preschool art education institutions includes two main contents: the establishment thought and management mechanism of preschool art education institutions; The establishment conditions of preschool art education institutions include three main contents: infrastructure and equipment, staffing, scale and class [12].

The quality of preschool art education includes three secondary indicators: Teachers' quality, interpersonal communication and safety and health. Teacher quality refers to the working ability of preschool art educators, including teacher qualification, teaching skills, professional ethics and curriculum management. Interpersonal communication refers to the ability of pre-school art educators to communicate and interact with pre-school children and parents. Safety and health refers to the ability of preschool art education institutions to meet the most basic physiological and safety needs of preschool children, including education/health care management, traffic safety management and meal management. Early childhood development includes four secondary indicators: physique and movement, behavior habits, communication skills and artistic cognition. Physique and movement refer to the normal development level of physiological function of preschool children; Behavior habit refers to the self-care ability of preschool children in their daily life; Communication ability refers to the ability of preschool children to convey their emotions through their accumulated vocabulary; Artistic cognition refers to the ability of preschool children to appreciate the beauty and artistic expression of simple natural phenomena around them based on the mastery of basic knowledge.

3.2 Evaluation Method Based on Deep Learning Network

(1) Deep learning network

The deep learning network has an input layer, multiple hidden layers and an output layer, and its hierarchical structure is very similar to that of human brain. In the deep learning network, there is only connection between adjacent nodes, and there is no connection between nodes in the same layer or different layers. Each layer in the deep learning network can be defined as a logistic regression model [13]. The hidden layer in the deep learning network model contains several restricted Boltzmann machines. By superimposing several restricted Boltzmann machines, the deep Boltzmann machine learning network can be constructed, as shown in Fig. 5 (a). When the structure closer to the visual layer and the structure farther from the visual layer are built using Bayesian belief network and restricted Boltzmann mechanism respectively, the constructed network is depth information network, as shown in Fig. 5 (b).

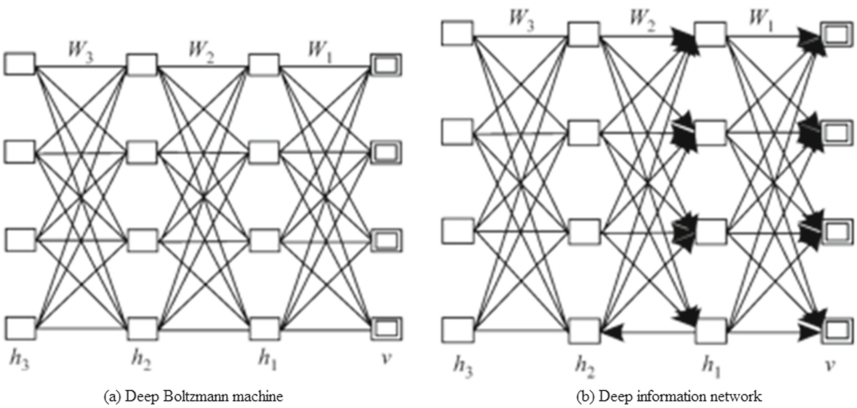

Fig. 5. Depth Boltzmann machine and depth information network structure

In Fig. 5, V and H represent the visible layer and the hidden layer, respectively. The restricted Boltzmann machine is trained layer by layer in a bottom-up manner, the weights w are obtained through pre training, and the weights of each layer of the deep learning network are optimized by using the unsupervised pre training model, which can abstract the simple features. The input of the visual layer is each secondary index a in the preschool art education quality evaluation index system, and the number of nodes of the input layer and the output layer is set. The nodes of the hidden layers H1, H2 and H3 are 100.

In the bottom-up unsupervised learning process, each layer is defined as a restricted Boltzmann machine. The greedy learning method is used to train the weight of each layer layer layer by layer from bottom to top. The first layer and other layers construct Gaussian binary restricted Boltzmann machine and binary binary restricted Boltzmann machine respectively. There is no correlation between the visible layer nodes and the hidden layer nodes in the restricted Boltzmann machine, which describes the conditional probability distribution and joint probability distribution of each layer in the restricted Boltzmann machine.

$$\begin{cases} E(t)\dot{x}_d(t) = f(t, x_d(t)) + B(t)u_d(t) \\ y_d(t) = C(t)x_d(t) \end{cases} \tag{2}$$

(2) Evaluation process

In the training stage, the in-depth learning network is used to abstract describe the input's preschool art education evaluation indicators, and the in-depth learning network of each indicator is constructed according to the input's preschool art education evaluation indicators, using dbna, DBN. And dbnag. In the testing stage, the characteristics of each index of any preschool art education institution to be tested are defined. Dbna, dbna, and DBN obtained through training. Predict and obtain the evaluation results Q *, q "and Q% of each index respectively, and combine the evaluation results of three indexes to obtain the evaluation results of preschool art education quality of preschool art education institutions to be tested.

4 Suggestions on Improving New Preschool Art Education

4.1 Strengthen the Understanding of the Importance of Art Education for Preschool Children

(1) Establish the importance of preschool art education in preschool education

The state pays more and more attention to preschool education and continues to reform, and preschool art has begun to be paid more and more attention. The educational function of preschool art education is unmatched by other educational functions. The concept of preschool art education has two directions, which not only refers to the behavior and process of preschool children using tools and materials to create art works, but also refers to the result of this behavior process - the art works created by children. Preschool children's art is a course different from other education. It really takes children as the main body. Among many disciplines, it is difficult to divide disciplines according to age. Therefore, it is difficult for you to hear children's Chinese, children's mathematics, children's physics and so on. The recipient of children's art is children, and the creator is also children. This is something that other disciplines cannot ignore. Such as children's music, the receiver is children, but the creator is adults; The same is true of children's dance. Although the performers are children, the choreographers are adults. Therefore, the creator of children's art is children, which is different from other children's disciplines.

(2) Increase investment in preschool art education

1) Investment in educational talents. Talents are the most scarce in the 21st century. With the development of science and technology society, talents are becoming more and more scarce. The teacher team of preschool children's art education also needs teachers with certain professional level and teaching quality. Therefore, the key to preschool art is to increase the investment of children's art teachers. Teachers are the foundation of education. A good teacher will affect a child's life. Kindergartens should first carry out subject teaching for teachers, have professional art teachers to teach, introduce art teachers with art skills and educational theory, and try to avoid the phenomenon that one teacher in one class takes all courses. As mentioned above, art courses are different from other courses. The theme of children's art is children, which is the works created by children themselves. Professional teachers are needed for guiding education, which can not be replaced by any other curriculum teachers. Children are at different ages and have different courses, so how to learn and how to teach needs a professional teacher to guide education. To understand the importance of teachers' talents, we should increase investment in time, which can not only improve the teaching quality of kindergarten art education, but also cultivate children's correct art concept and contribute to children's art road in the future.
2) Investment in environmental creation. Through this survey, we know that the amount of art investment in a kindergarten directly affects the teaching quality of children's art. Under the guidance of the idea that the environment plays an educational role in children, kindergartens continue to study and explore how to provide children with a high-quality educational environment. The good art environment provided by the kindergarten should not be simply understood as the simple furnishings of items in the kindergarten. The environment of the kindergarten should be a place to stimulate children's imagination and artistic creation. The creation of environment should be arranged according to different age stages, and timely change according to the changes of four seasons or popular culture, local history and culture or characteristic food, so as to give children a different art atmosphere and imperceptibly edify children's artistic aesthetic ability. The creation of the environment is not only simple and understandable life common sense and theoretical knowledge, but also artistic lines, color blocks and handicrafts. Fully involving children in creation can not only exercise children's subjective initiative, but also promote children's desire to protect handmade and wall paintings. Environmental innovation is not only the personal responsibility of teachers, but also the common responsibility of all children.

4.2 Improve the Strength of Teachers

The role of teachers is the expected behavior of teachers related to their social status and identity. In society, teachers are given a high status. Teachers' educational background, teaching experience and teaching ability are regarded as the capital of teachers' employment. No parents choose teachers without considering these problems. Teachers' words and deeds will affect the development of students. In teaching activities, teachers teach students art knowledge and affect students' understanding of art. At the same time, the emotion, attitude and values of art teachers will imperceptibly penetrate into the classroom. A qualified art teacher should have rich art knowledge and theory, comprehensive art skills, extensive scientific and cultural knowledge, energetic creativity, and certain teaching ability. Schools can take this as a standard to strictly require teachers to keep learning and reading. So as to improve their teaching ability and professional knowledge.

5 Conclusion

Preschool art education is the main part of early childhood education and the basis of art education. It can realize all the educational values contained in art education to the greatest extent and give full play to the educational function of beauty. The comprehensive quality of preschool art teachers directly affects the overall level of early childhood education, so it is particularly important to cultivate the comprehensive quality of preschool art teachers. This paper studies the quality evaluation method of preschool art education based on deep learning network, inputs the quality evaluation index of preschool art education into the constructed deep learning network for training, and uses the trained deep learning network to obtain more accurate quality evaluation results of preschool art education. In the follow-up research process, we will continue to optimize the method in this paper Gradually improve the teaching quality of preschool art education institutions and realize the dream of strengthening education.

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