Research and Analysis on the Aesthetics of Folk Dance Based on the Background of Big Data

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Abstract. This paper analyzes a secondary school dance teaching example based on the theory of "four-stage teaching method", which enriches the teaching content and explores the depth of knowledge by constructing knowledge links and using multimedia-assisted teaching; it adopts a combination of words, paintings and dances to refine the action elements and broaden the latitude of knowledge; it integrates the commonality of "four-stage teaching method" with the characteristics of dance, and explores a new method of secondary school dance teaching from the perspective of improving teaching efficiency and enhancing students' learning quality, so as to make the teaching interlocked and guide students to help each other teach and express their emotions freely, so as to apply what they have learned. The "four-stage teaching method" applied to secondary school dance teaching strengthens secondary school students' self-efficacy beliefs, enhances their sense of autonomy and competence, improves their learning efficiency, and promotes their overall development. In recent years, with the breakthrough development of computer technology, computer-aided diagnosis has made rapid progress in the field of medical image processing, and it has played an important role in improving work efficiency and reducing missed diagnoses. Meanwhile, convolutional neural networks have been widely used in the field of image processing because of their good self-learning ability and prediction capability. To address the above problems, this paper proposes a computer-aided diagnosis method for meniscus using convolutional neural networks to help doctors make fast and accurate decisions using MRI images of patients' knee joints provided by the First Affiliated Hospital of Anhui Medical University.

Keywords: Convolutional Neural Networks · Four Segment Teaching Method · Instructional Design · Secondary School Dance Teaching

1 Introduction

According to my observation, I found that dance teaching is mainly based on the oral and physical method, and teachers emphasize more on the movement itself when teaching, and less on the combination of practice and theory; while "General Pedagogy"

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compiled by Herbart put forward the theory of "four teaching methods", which focuses on students' ontology and psychology, and follows the science of education and teaching, combining theory, practice and psychology to improve teaching efficiency, broaden students' learning horizons, and promote students' overall development [1]. Because Herbart's "four-stage teaching method" has universal guidance, it is difficult to be fully applied to the teaching of secondary school dance without individuality, and in view of the actual situation, the author believes that the "four-stage teaching method" should be combined with secondary school dance teaching to explore a new design of dance teaching [2]. Therefore, this paper takes the author's dance teaching design in Xiamen Shuangxie Middle School in Fujian Province as an example to testify the feasibility of implementing the "four-stage teaching method" in secondary school dance teaching, summarize the experience from teaching practice, propose constructive teaching strategies to improve students' learning efficiency, strengthen students' self-efficacy beliefs, enhance students' sense of competence and autonomy, and promote students' all-round development, so as to contribute to secondary school dance teaching [3].

2 Preliminary Knowledge of Deep Learning Algorithms

2.1 Composition of Convolutional Neural Network

(1) Convolutional layer

The convolutional (Convolutional) layer is the most central part of the convolutional neural network [4]. The convolutional kernel is a generalized linear model for the underlying local image, which is used to extract features when the features of the target are linearly differentiable [5]. As the convolutional layers go from shallow to deep, the extracted features go from low-level to high-level. If the convolution kernel is understood as a weight matrix, the convolution operation can be regarded as a weighted summation of matrices, as shown in Fig. 1.

In the figure, the black box is the matrix of the input image, and the red box is the matrix of the convolution kernel [6]. The process of convolution operation is to superimpose the elements in the red box sequentially on the elements in the corresponding black box one by one, and then linearly, and this process realizes the weight sharing [7].

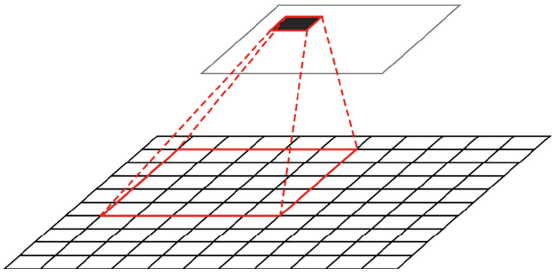

Fig. 1. Convolution schematic

(2) Convergence layer

The common forms of convergence are Max Pooling and Average Pooling [8]. The propagation method of Max Pooling is to divide the input image into multiple sub-regions and use the maximum value in each sub-region instead of the current region, while the propagation method of Average Pooling is to use the average value used in each sub-region instead of the current region, and the convergence process of the two forms is shown in Fig. 2.

(3) Activation layer

With the activation function, the network can fit various curves. The commonly used activation functions are shown in Fig. 3.

Figure 3(a) shows the Sigmoid function, which takes values in the range (0,1) and is capable of mapping continuous real values of the input to an output between 0 and 1. The mathematical form is shown in Eq. (1).

$$Sigmoid(x) = \frac{1}{1 + e^{-x}} \tag{1}$$

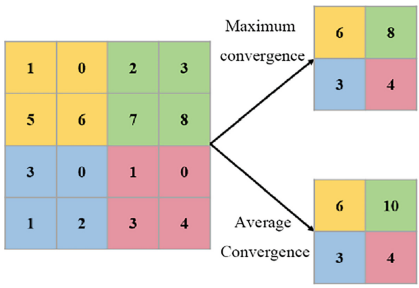

Fig. 2. Schematic diagram of two convergence forms of convergence layer

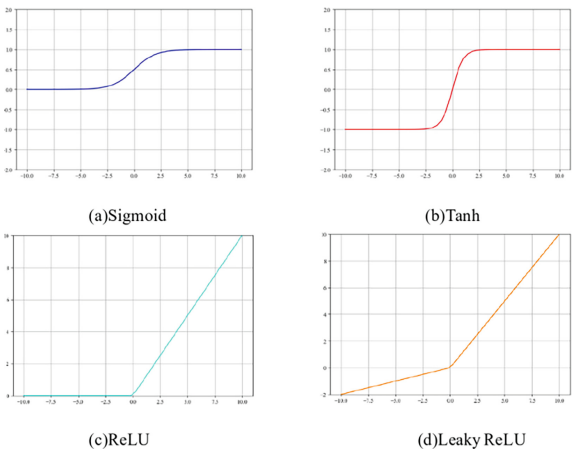

Fig. 3. Schematic diagram of four common activation functions

However, few recent studies have used the Sigmoid function because of its tendency to cause gradient disappearance and the relatively time-consuming power operation process of the function. In addition, the output of the Sigmoid function is not 0-mean, and the network is too deep to cause the original distribution of the data to change [9].

Figure 3(b) shows the Tanh (Hyperbolic Tangent) function, also known as hyperbolic tangent function, with output range $(-1, 1)$, expressed by Eq. (2):

$$\tanh(x) = \frac{e^{x} - e^{-x}}{e^{x} + e^{-x}} \tag{2}$$

Compared with the Sigmoid function, the output of the Tanh function is 0 mean, which does not cause the original distribution of the data to change, but there is still a power operation and does not effectively solve the problem of gradient disappearance [10].

Figure 3(c) shows the ReLU (Rectified Linear Unit) function, also called the modified linear unit function, expressed by Eq. (3):

$$ReLU = \max(0, x) \tag{3}$$

The ReLU function is currently the most commonly used activation function in artificial neural networks. It has the advantage of effectively solving the gradient disappearance problem and improving the computational speed by discarding the complex power operation. In order to prevent such phenomena, a series of improvements have been made to ReLU, of which the more representative one is the Leaky ReLU function, as shown in Fig. 3(d) and expressed by Eq. (4) as:

$$f(x) = \max(\alpha x, x) \tag{4}$$

where α is a constant and is set to 0.2 in the figure. The Leaky ReLU function alleviates the problem that the parameters cannot be updated, but the effect is not stable in practical situations, so usually most studies still use the ReLU function.

2.2 Deep Residual Network Structure

The Deep Residual Network, also known as ResNet, was proposed by He et al. in 2016 and achieved five firsts in the ImageNet competition in one fell swoop. Such a brilliant performance of deep residual network is not only due to the improvement of network depth, but also stems from the innovation of architecture [11]. When the depth of the network reaches a certain level, the accuracy of the network becomes saturated or even decreases, a phenomenon called Degradation Problem of the network. The design of the residual unit in the network can solve this problem, and the structure is shown in Fig. 4.

Two kinds of mappings are proposed for the residual unit, residual mapping and constant mapping. The residual unit creates a connection between the input and the output, which is called a short-circuit connection because its structure is similar to a "short circuit" in a circuit.

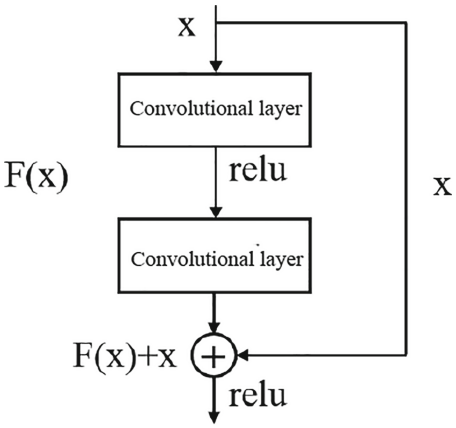

Fig. 4. Residual cell structure

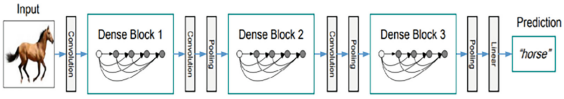

Fig. 5. DenseNet structure schematic

2.3 DenseNet Network Structure

A layer in a neural network is not only influenced by the output of the previous layer, but the output of the previous layers is also positively influenced. The DenseNet network structure, shown in Fig. 5, is uncomplicated yet very effective. The network references a total of three densely connected blocks, with a convolutional layer and a convergence layer transitioning between every two adjacent densely connected blocks.

The use of dense connections in the DenseNet network mitigates the gradient disappearance problem with fewer parameters and lower computational cost, achieving better performance than deep residual networks.

3 Training of Network Models

3.1 Loss Function

The loss function is used to reflect how well the model fits the sample during training. The value of the loss function represents the sum of the errors between the model's predicted sample results and the true value of the sample, and the magnitude of the value of the loss function indicates how well the model fits the sample. Based on the calculated value of the loss function for each iteration of the neural network, the next iteration is guided to train in the correct direction. In machine learning, the following loss functions are commonly used.

(1) Mean Square Error Function

Mean Square Error (MSE) function is mainly used for linear regression, which is relatively intuitive and calculates the Euclidean distance between the predicted and actual values as the error, calculated by Eq. (5) as follows:

$$MSE = \frac{1}{2m}\sum_{i=1}^{m}(z_i - y_i)^2 \tag{5}$$

where m is the total number of samples, z_i is the predicted value of the ith sample, and y_i is the actual value of the ith sample. The advantage of the mean-variance function is that it amplifies the global impact of individual losses in given sample, i.e., it is more sensitive to certain samples with large deviations.

(2) Cross-entropy loss function

The cross-entropy (Cross-entropy) function is commonly used in machine learning for classification problems to measure the distribution gap between the predicted and true sample sets, and the function is expressed in Eq. (6) as follows:

$$C = -\sum_{i=1}^{m}\sum_{j=1}^{n} y_{ij} ln a_{ij} \tag{6}$$

where m denotes the number of samples, n denotes the number of categories, y_{ij} refers to the actual probability that the ith sample is the jth category, and a_{ij} refers to the probability that the ith sample is predicted to be the jth category.

If a binary classification problem is solved then the formula can be reduced to Eq. (7).

$$C = -\sum_{i=1}^{m}[y_i ln a_i + (1 - y_i)\ln(1 - a_i)] \tag{7}$$

4 The Effectiveness of "Four-Stage Teaching Method" in Secondary School Dance Teaching

Based on Herbart's "four-stage teaching method", the design of secondary school dance teaching is based on the psychological level of students, which reflects that students are the main body of learning, pays attention to the influence of psychological factors of students, satisfies the learning needs of students to a certain extent, attaches importance to the independent development of students, and improves the efficiency and autonomy of students' learning. It has a positive effect on secondary school students' learning of dance and has a positive impact on their learning. The author believes that the effectiveness of the "four-stage teaching method" in secondary school dance teaching is positive and effective, mainly in three aspects: students' self-efficacy, sense of competence and sense of autonomy.

4.1 Reinforcing Student Self-efficacy

According to Albert Bandura (1925 - July 28, 2021), "self-efficacy beliefs: influence the course of action people choose to perform, how much effort they put into a given activity, how long they can persist in the face of obstacles and failures, their ability to recover from adversity, the influence whether they think in terms of self-hindering or self-help, how much stress and depression they experience in response to high environmental demands, and the level of achievement they are able to achieve." Reinforcing students' self-efficacy beliefs in the classroom is beneficial to their development.

5 Conclusion

The significance of pedagogy use is to promote the development of teachers and the growth of students. The application of the "four-stage teaching method" is a double-edged sword. If teachers use it properly, they will be able to use it for "me", improve teaching efficiency and promote students' all-round development; if teachers do not learn the theoretical knowledge in depth for practice, they will fall into rigidity and formalism in teaching, which will hinder the development of teaching. In the development of teaching, teachers need to continuously practice to test the effectiveness of teaching methods according to the attributes of the subject, teaching content, students' situation, and other factors, and then make adjustments according to the actual situation. We strive to explore the teaching methods of dance and the "four-stage teaching method" from practice, instead of rigidly applying this method to practice and seeking the results of false practice. After a semester of theoretical study and teaching practice, the author applied the "four-stage teaching method" to the teaching of secondary school dance and achieved certain results in exploring effective teaching methods, which proved its effectiveness and feasibility.

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