Hindawi
Scientific Programming
Volume 2022, Article ID 4239474, 12 pages
https://doi.org/10.1155/2022/4239474

Research Article

Technology Based on Interactive Theatre Performance Production and Performance Platform

Xiuzheng Xia[1,2] and Chen Tian[3]

[1]Sichuan Normal University College of Music, Chengdu 610101, Sichuan, China
[2]Department of Dramatic Literature, Cheongju University, Cheongju, Republic of Korea
[3]Geely College Performance Teaching and Research Section, Chengdu 641423, Sichuan, China

Correspondence should be addressed to Chen Tian; tianchen@bgu.edu.cn

Received 14 July 2022; Revised 25 August 2022; Accepted 10 September 2022; Published 21 September 2022

Academic Editor: Juan Vicente Capella Hernandez

Drama refers to a comprehensive art that realizes the purpose of narrative through language, movement, dance, music, puppets, and other forms. From the pre-Qin period⟶the Han and Wei periods⟶the Tang, Song, and Jin periods⟶the Yuan Dynasty⟶the late Yuan Ming and Qing periods⟶modern times, the art of opera has been welcomed and recognized by a vast audience since its birth, but it is difficult to inherit the art of Chinese opera. The fundamental reason is that there is no good platform for performance. It should be said that since the beginning of the performing arts, there has also been academic thinking on the practice of this artistic creation, so in the academic field of drama, there is actually drama performance science. Due to the changes of the times, Chinese drama art cannot keep up with the pace of the Internet. Therefore, this article proposed a technical research based on the interactive drama performance production and performance platform. This article mainly talks about face recognition technology and its algorithm, and applies it to theatrical performances and productions. In the following experiments, this technology is also used to create a network platform, and its user experience evaluation effect is good. The theatrical performances and productions of young people were also scored, and the final experimental results showed that: at the minimum required level, which is at least three (or more) dramatic materials in the class, scores are high at both levels. Among them, 94.4% of the classes in the first-level kindergarten and 86.1% of the classes in the second-level kindergarten meet this standard. Most of the two levels are qualified, that is to say, in the performance area, at least three people can perform at the same time, which is enough to show that theatrical performance has been passed down.

1. Introduction

Drama is a popular folk art in China and has high artistic value and collection value in China and even the world. Every drama in ancient and modern China and abroad has its ups and downs plots and characters with different styles, all of which are gripping and fascinating. However, the survey has shown that dramatic art in China is rapidly dying out, mainly because of its complex production techniques and performance forms, which are generally difficult for ordinary people to master. At the same time, its performance and dissemination methods are relatively simple, mostly concentrated in some remote places such as rural areas and mountainous areas. For many reasons, the dissemination and development of this ancient folk art have been greatly restricted. The major of drama performance is a special major in the Chinese art education system, with the main teaching goal of cultivating artistic talents specializing in drama and film and television actors. At present, in addition to well-known institutions such as the Central Academy of Drama and the Shanghai Academy of Drama, many arts and comprehensive colleges and universities are generally opened. Compared with other majors, its history of running a school is relatively short, and its development process has twists and turns. However, after entering the 21st century, it has become more and more popular and sought after by ordinary college students. Therefore, drama teaching plays a very important role in training students' language expression ability and cultivating students' Chinese literacy. Of course, this is inseparable from the great development and prosperity of China's cultural and artistic undertakings. However, its professional connotation and developable educational functions still have great potential and value for exploration.

The article focused on the introduction of face recognition technology and algorithms, and applies them to theatrical performances and productions. It was applied to theater performances and productions, used this technology in subsequent experiments, achieved a better user experience, and scored young actors' performances and movies. The innovation of this article is that after the algorithm is used in the previous article, the article immediately conducts experiments and a questionnaire survey, which are linked together, making the logic of the article stronger. The performance-based teaching is applied to the teaching of drama works on the network platform, and the operational level research on the implementation strategy and evaluation of the performance-based teaching of dramatic works is carried out, in order to provide some feasible experience and methods for the performance-based teaching of drama works in China.

2. Related Work

Performance-based teaching is a teaching method that allows students to further understand the language and contradictions of characters in dramatic works through role-playing on the basis of reading texts and teachers' explanations. At present, theatrical performance production has attracted much attention. McCoy introduced CommeilFaut (CiF), an artificial intelligence system that matches character performances to appropriate social contexts, the goal of which is to enable authors to write high-level rules to govern expected character behavior in a given social context, rather than a specific fixed choice point in a carefully curated narrative structure [1]. A relatively well-established theory of performance is the theory of dramatic spectacle. The above does not imply that his purpose is to enjoy sports performances because of its connection to drama. Kosiewicz pointed out one of the many possible aspects of sports spectacle, which are hypotheses of the contingent nature contained in its structure [2]. In the theatrical performance, the human avatar transforms into an active and engaged body, "opening to the world and projecting the performance," which is visually brilliant. A phenomenologist might say that this kind of performance expands hermeneutics so that reality can be presented to people, constituting the relationship between people and reality. Gill proposed that on this basis, reality can be presented in a specific way [3]. Although they all described the history of theatrical performance and its significance, they did not introduce human-computer interaction technology, nor did they study its algorithm.

Human facial expressions are the core carrier of feedback. Facial Expression Recognition (FER) has been introduced into medical assistance, safe driving, marketing assistance, distance education, etc. Based on the convolutional neural network (CNN), Shi introduced FCM to optimize the feature extraction (FE) capability of the model, and proposed a novel FER algorithm using an improved CNN (F-CNN) [4]. Emotions are of great significance in the communication and interaction between people and between people and computers. Sharma proposed an efficient and novel approach to recognize emotion using facial expressions by fusing dual features [5]. Among emotion recognition (ER), automatic facial expression recognition (FER) is actually a dynamically emerging research. Banerjee proposed the crow search algorithm of Brownian Motion-Based Adaptive Neuro-Fuzzy Inference System (BMCSA-ANFIS) for FER on human images [6]. The use of machine vision software to automatically assess facial expressions opens up new opportunities to assess facial expressions in an astute and economical way in psychological and applied research. Beringer investigated the evaluation quality of a machine vision algorithm (FACET) in a study using a standardized database of dynamic facial expressions under different conditions (angle, distance, lighting, and resolution) [7]. They all introduced the facial expression classification algorithm, but did not analyze it in combination with theatrical performance, let alone build a theatrical performance platform.

3. Interactive Facial Expression Classification Algorithm

3.1. Facial Expression Classification Algorithm. Classifier is a general term for the methods of classifying samples in data mining, including decision tree, logistic regression, naive Bayes, neural network, and other algorithms. From tens of thousands of features, selecting a low-dimensional feature subspace is the key to the successful classification of the classifier, which further validates the importance of feature extraction for classifier and recognition accuracy. Various algorithms have their own advantages and disadvantages, and it is necessary to select a classifier according to different research topics and the number of samples [8, 9]. According to the size of the public database samples and the real-time requirements of the algorithm, the support vector machine is used as the expression classification algorithm in this article. On the one hand, it is considered that relevant research has verified the excellent performance of support vector machines under the condition of small samples; on the other hand, other algorithms such as deep learning methods have higher requirements for the number of samples and longer training time [10, 11].

The related basic theory of support vector machine (SVM) will be described in detail: SVM is mainly based on VC dimension and structured risk minimization method in statistical theory. It has good classification performance and generalization ability, can solve high-dimensional classification problems, and avoid the overfitting problem in traditional machine learning classification [12]. Similar to neural network, support vector machine is a learning mechanism, but unlike neural network, SVM uses mathematical methods and optimization techniques. Support vector machines evolved from the optimal hyperplane classification model. As shown in Figure 1, taking a simple linear binary classification problem as an example, if the

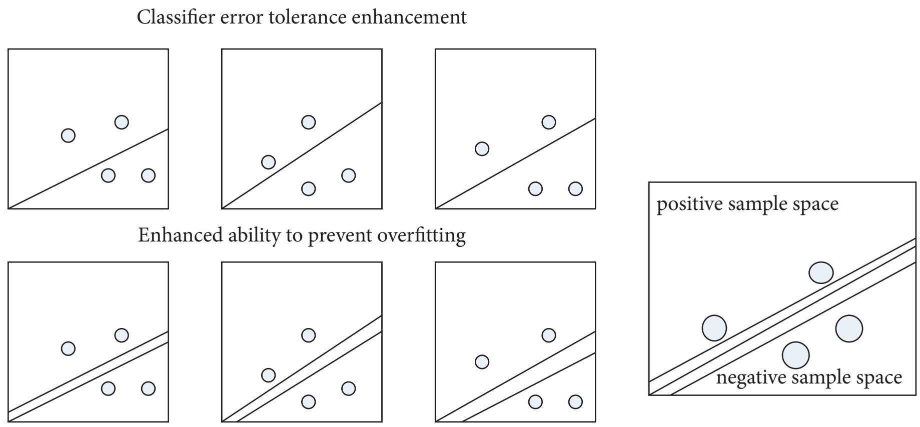

Figure 1: Schematic diagram of dividing line tolerance and robustness and optimal dividing line.

width of the hyperplane is small, there may be multiple classification hyperplanes under the condition that the two types of data are correctly classified. However, by maximizing the hyperplane width (classification spacing), the data error tolerance of the hyperplane can be guaranteed, thereby reducing the actual error [13].

SVM correctly classifies two types of data by finding an optimal hyperplane [14, 15]. As shown in the figure, for example, binary classification problem, the two types of data are represented by circles and crosses, respectively, and the H line is the obtained optimal separation line. All data points, circles are represented by positive class +1 and crosses are represented by negative class −1, then the sample data points satisfy the formula

$$b \in \{-1, 1\}, b_j\left[s^D \cdot a + y\right] \geq 1, j = 1, 2, 3 \ldots m. \quad (1)$$

To generalize the problem, in high-dimensional space, in order to facilitate the quadratic programming solution, through the Lagrange multiplier method, its purpose is to ask how to allocate and utilize manpower and raw materials under the condition of a certain cost, so as to maximize the production volume. The problem can be transformed into the formula by the Lagrange multiplier method:

$$Z(y, s, x) = \frac{1}{2}\|s\|^2 + \sum_{j=1}^{m} x_j\left(1 - b_j\left(s^D l_j + y\right)\right). \quad (2)$$

In the formula, x_j, $j = 1, 2, \ldots m1$ is the Lagrangian parameter, and the partial derivatives of s and y in the above formulas are calculated, respectively, and set equal to 0, and the following formula is obtained:

$$\begin{cases} \dfrac{\phi Z(y, s, x)}{\phi s} = s - \displaystyle\sum_{j=1}^{m} x_j b_j l_j = 0, \\ \dfrac{\phi Z(y, s, x)}{\phi y} = -\displaystyle\sum_{j=1}^{m} x_j b_j = 0. \end{cases} \quad (3)$$

Bringing it into the above formula, through the transformation of the dual problem, the problem becomes the maximum value of the following formula:

$$\begin{aligned} &\max_x \sum_{j=1}^{m} x_j - \frac{1}{2}\sum_{j=1}^{m} x_j x_j b_j b_j \left(l_j \cdot l_i\right), \\ &\text{w.d.} b_j\left[\left(s \cdot l_j\right) + y\right] - 1 \geq 0, \\ &\sum_{j=1}^{m} b_j x_j = 0, x_j \geq 0, j = 1, 2, 3 \ldots m. \end{aligned} \quad (4)$$

Under the condition of KKT (Karush–Kuhn–Tucker), the above formula must satisfy the formula

$$x_j\left\{b_j\left[\left(s \cdot l_j\right) + y\right] - 1\right\} = 0, j = 1, 2, 3 \ldots m. \quad (5)$$

It can be seen that this method greatly simplifies the calculation process of Lagrangian parameters, and solving the above quadratic programming problem will get the final result.

Slack variables, mathematical term, if the constraints of the linear programming model under study are all less than types, then M nonnegative slack variables can be introduced through the normalization process. The example is discussed for the case where the multidimensional space is linearly separable. However, in real life, due to the defects in completeness and accuracy of data, it often leads to the linear inseparability of practical problems. In response to this situation, the problem can be transformed into the formula by introducing a nonnegative slack variable:

$$\min_{s, y, \varphi_j} \frac{1}{2}\|s\|^2 + E\sum_{j=0}^{m} \varphi_j. \quad (6)$$

Among them, $E > 0$ is the penalty coefficient, which represents the punishment for the wrongly classified samples, which can also be obtained by duality transformation of the Langrangian multiplier method:

$$\begin{aligned} &\max_x \sum_{j=1}^{m} x_j - \frac{1}{2}\sum_{j=1}^{m} x_j x_j b_j b_j \left(l_j \cdot l_i\right), \\ &\text{w.d.} b_j\left[\left(s \cdot l_j\right) + y\right] \geq 1 - \varphi_j, \\ &\sum_{j=1}^{m} b_j x_j = 0, 0 \leq x_j \leq E, \varphi_j > 0, j = 1, 2, 3 \ldots m. \end{aligned} \quad (7)$$

In addition to the linear inseparability, practical problems are often complex in dimension space, so the sample data often does not conform to the linear distribution [16, 17]. The introduction of the kernel function can just solve this problem. By introducing the kernel function, the data space is transformed from low-dimensional to high-dimensional, and then the linear decision-making of the high-dimensional space is used to solve the optimal hyperplane:

The solution of the following formula is solved by the problem transformation after high-dimensional space transformation:

$$\max_{x} \sum_{j=1}^{m} x_j - \frac{1}{2} \sum_{j,i=1}^{m} x_j x_i b_j b_i \eta\left(a_j\right) \eta\left(a_i\right). \quad (8)$$

In order to simplify the problem, the concept of kernel function is introduced [18]. The kernel function satisfies the Mercer condition, that is, for any $\eta(a) \neq 0$ and $\int \eta^2(a) ta < \infty$.

$$\iint R\left(a, a'\right) \eta\left(a'\right) \text{tata}' > 0. \quad (9)$$

There are problems such as determining the form and parameters of the nonlinear mapping function and the dimension of the feature space, and the biggest obstacle is the "curse of dimensionality" in the operation of the high-dimensional feature space. The use of kernel function technology can effectively solve such problems. Kernel functions to solve special problems can be constructed through Mercer conditions, thereby simplifying the operation process. Finally, the discriminant function of the support vector machine is obtained as

$$g(a) = \text{sgn}\left(\sum_{j=1}^{m} x_j b_j R\left(a_j \cdot a\right) + y^*\right). \quad (10)$$

The discriminant function of SVM is only related to the inner product of the support vector machine and the number of samples, and is not constrained by the dimension of the feature space. This feature makes the SVM algorithm reduce the computational difficulty of high-dimensional space through the kernel function method, and has a stronger generalization ability [19, 20]. In short, the original binary support vector machine has been well broadened and strengthened by introducing slack variables and kernel functions, which enables it to find the optimal hyperplane to separate the data in a high-dimensional space, thereby obtaining classification results.

3.2. Virtual Face Modeling. In order to complete the interaction between the operator and the virtual face in the virtual environment, it is necessary to model the face to generate the virtual face. Bone skinning is to add a physique modification command to the model and combine it with the skeleton object, so that the model will follow the movement of the skeleton object to achieve the effect of skinning. The modeling process can be divided into two steps: geometric modeling and bone skinning. In terms of geometric modeling, according to the composition of the skeletal structure and muscle structure of the human face, the polygonal modeling method is used to model the main shape feature changes of the human face through the combination of several polygonal surfaces. In the modeling process, the method of "shape first, then refine" is adopted, using the symmetry of the face and the multi-view pictures of the reference data to build a rough head shape, and then gradually add head details. This method effectively avoids the problem of dead corners or faults in the modeling process.

The human face can be seen as a combination of skin, bones, and muscles, where the skin determines the visual appearance of the face, the bones determine the main contours of the face, and the muscles are used to connect the skin and bones to produce the main movements and expressions of the face [21, 22]. Therefore, if the virtual face is to produce a more realistic and natural expression, it is particularly important to complete the modeling of the muscle model. However, in practical applications, it is found that the linkage relationship between skin, bones, and muscles is quite complex, and there are specific and nonuniform configuration relationships between different muscle groups and skin textures. Therefore, in most applications, the method of skeletal skinning is used to replace the method of muscle modeling, which reduces the difficulty of processing complex configuration relationships, and the established model can also meet the requirements of various expressions.

The skeletal skinning technology follows the similar structure of human skin, bones, and muscles, omitting the complex linkage relationship of the muscle layer, and uses "bone" to drive "skin," where the concepts of "bone" and "skin" have been strengthened. "Bone" is not strictly the skeletal structure of the human body, it actually represents the way the skin is driven, but in most cases, it is similar to the skeletal structure of the human body. Making skin meshes, laying out bones, and skinning are the three major steps of skeletal skinning. In shape modeling, a detailed skin mesh can be obtained by polygon modeling. Since the bones in the skeletal skinning technology replace the driving function of the original muscles, in order to complete the conditions for expression generation, the facial bones need to be arranged according to the facial muscle structure.

Skinning, the term for 3D animation, is also used in 3D games. A production technology of 3D animation, adding bones to the model based on the model created in 3D software. Skinning technology is also known as bone skin binding technology and bone subspace deformation technology because it determines how bones drive and influence the skin. In real life, there are differences in the way bones drive skin, which often leads to dull expression animations and even skin knots, such as

$$U' = N_j Z_j^{-1} U. \quad (11)$$

Compared with the singleness of the rigid binding algorithm, the flexible binding algorithm better simulates the muscle-skin transmission mechanism of the human body. The motion of defining skin grid points is determined by multiple arranged bones, which is more in line with the biological laws of human face motion. The formula of the flexible binding algorithm is as follows:

$$U' = \sum_{j=1}^{m} \phi_j N_j Z_j^{-1}, \quad \sum_{j=1}^{m} \phi_j = 1. \tag{12}$$

Similar to the rigid binding algorithm, the local coordinate points of the skin mesh are determined by the coordinates before the change, the coordinate system transformation coordinates, and the motion transformation coordinates. The difference from the rigid binding algorithm is that the coordinates after skin movement need to be determined according to the weighted sum of multiple bones. It is worth noting that to realize the natural movements of the eyes and mouth and the twisting of the neck in face modeling, it is necessary to model these three positions individually and specifically.

The skin of the above-mentioned nonspecific facial positions is mostly composed of linear muscles, and the strip bones are similar in structure to them, which can simulate facial muscles well. However, the movement of the eye includes blinking and eyeball rolling, which is not suitable for the driving method of the strip bone, and needs to be driven by a spherical bone mechanism. Likewise, the musculature of the mouth dictates the use of a ring structure for its skeletal structure. In real life, the generation of expressions often involves the rotation of the head and neck. In order to ensure the vividness and naturalness of the virtual face, a neck movement bone is added to complete the head rotation requirement. Figure 2 shows the resulting skeletal skinning model.

3.3. Face Motion Capture. Capturing and manipulating the shape, appearance changes, and facial movement of a human face is a core technology in the field of modern computer animation. The virtual 3D characters commonly seen in movies often go through multiple complex steps such as detailed 3D scanning, skin texture processing, and detailed motion capture to realize the wonderful moments in the movie. The above process also often requires sophisticated 3D image acquisition equipment or long post-processing, which makes it time-consuming and labor-intensive to create a virtual person or virtual face with high quality and high restoration characteristics. With the rapid development of the commercial game field, major game manufacturers have correspondingly developed low-end 3D image acquisition devices with high-cost performance, enabling users to capture the facial movements of human faces through these devices. Microsoft Kinect is one of the acquisition devices that fulfill such a requirement. Although Kinect saves the wearing of the original artificial feature points of traditional image acquisition equipment, but due to the high noise generated by the depth image, it is generally necessary to twist the head in advance to collect a face model with specific expressions to complete the subsequent facial motion capture.

In this article, the Kinect sensor is used to complete the expression and motion capture of dynamic face images in the FaceShift software, and then the captured expression parameters are transferred to the virtual face model to complete the facial expression interaction in the virtual environment. The steps mainly include 2D/3D image acquisition, model positioning, and determination of deformer weights. Figure 3 shows the processing steps of facial motion capture.

Kinect collects the depth images of the above facial actions within a certain time window, uses the nonrigid ICP 3D registration algorithm to generate a 3D model of a specific expression and determines the weights of the deformer, and then performs bone skinning operations with the general facial model, which produces a user-specific face deformer model. The specific face deformer generation process is shown in Figure 4. The process is mainly divided into three steps: data acquisition, expression reconstruction, and deformer reconstruction. In the process of data acquisition, since the single-channel depth image acquired by Kinect has more noise, the acquisition process adopts the method of multiple scans to reduce noise and improve accuracy. In the process of expression reconstruction, the face model is first used to align neutral expressions, and then the nonrigid ICP algorithm is used to register other specific expressions, and the registration accuracy of the algorithm is improved by adding restrictions on the mouth and eyes; in terms of deformer reconstruction, the general facial expression deformer model based on FacialActionCodingSystem (FACS) is used, and the deformer weights of specific expressions are determined by the special skeleton binding method. The number of deformer bones during reconstruction is 39.

The generic face deformer model treats the face as a linear convex combination of n base vectors, where each vector is a face shape deformer. Each deformer contains the shape and texture of the face model. For a given design model, all deformers share the same topology. The coordinates of a vertex of the deformer can be expressed as

$$U = \sum_{j=1}^{m} x_j U_j. \tag{13}$$

The mixed weights must satisfy the following convex constraints:

$$x_j \geq 0, \sum_{j=1}^{m} x_j = 1. \tag{14}$$

The texture information of each deformer also satisfies the above-mentioned linear convex combination structure.

Generating a wide range of expression animations can require a large number of deformers. For example, the

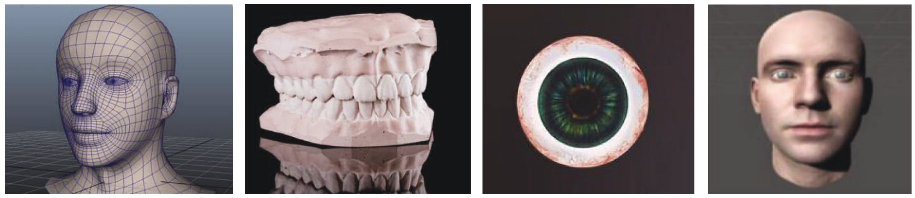

Figure 2: Schematic diagram of the face mesh model and skeletal skinning model.

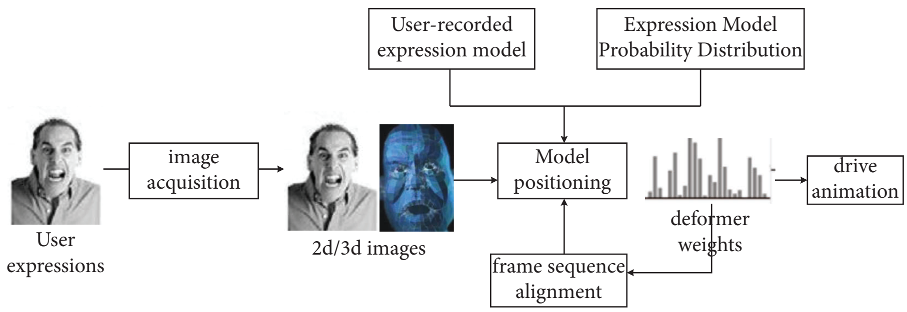

Figure 3: Facial motion capture processing steps.

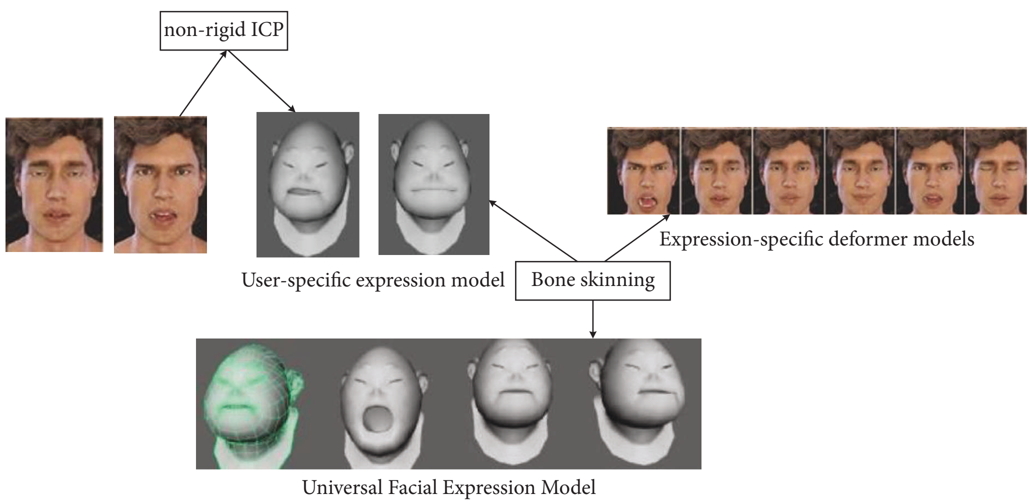

Figure 4: Feature expression modeling process.

Grunts in The Lord of the Rings: the Two Towers each have 675 face shapers, however, a small number of deformers used in related fields at home and abroad can also generate complex and real facial expressions. The physical model structure of the deformer determines that it can drive a variety of expressions. The simplest physical model for deforming objects is the linear elastic force model, which defines that the deformation of an object can be represented by the displacement field of the current point and the remaining points. The governing equation of the motion of the linear elastic force model can be expressed by the Lamé formula:

$$\lambda x = \gamma \Delta t + (\gamma + \eta)\nabla(\nabla \cdot t). \tag{15}$$

In order to find the deformer blend weight of x_j, the problem is transformed into a minima problem:

$$\sum_{i=1}^{n}\left[N_i - \left(\sum_{j=1}^{m} x_j U_{ji}\right)\right]^2. \tag{16}$$

4. Theatrical Performance Production and Construction of Performance Platform

4.1. Design Experiments. This study observed and measured the development of drama performances in a total of 72 classes in three key university classes at the provincial level and the provincial level in *H* city. Before the observation, the principal and relevant teachers made it clear what the researchers want to observe is a theatrical performance.

The scale uses a nine-point scoring method, with 1 being the "inappropriate" level, 3 being the "minimum requirement" level, 5 being the "qualified" level, 7 being the "good" level, and 9 being the "excellent" level. "Role/Drama" in subscale 5 "Drama Performance" includes three subitems: Material and Space, Opportunity and Time, Design and Guidance.

The two raters are both postgraduates in higher education who have undergone systematic training, have actually applied the scale to evaluate multiple classes, and are proficient in operating evaluation tools. Two raters entered a class at the same time to independently rate their same drama performance activity, and after the independent scoring, a discussion was held to arrive at a discussion about the activity.

The researchers made a consistent analysis on the overall average score of the project, subitems: Material and Space, Opportunity and Time, and Design and Guidance scores of the two raters. Through Spearman correlation analysis, the results are shown in Table 1. The overall average score of the two raters was $r = 0.94$, $p < 0.01$, which was significantly correlated. In the three subitems of Material and Space, Opportunity and Time, Design and Guidance, the correlation coefficients are: $r = 0.91$, $p < 0.01$; $r = 0.97$, $p < 0.01$; $r = 0.91$, $p < 0.01$, all significantly correlated, and the inter-rater agreement was high.

The researchers coded and organized the collected data, and applied SPSS 17.0 for analysis.

4.2. Data

(1) Descriptive analysis of the quality of drama performances in the first-class gardens

The researchers made descriptive statistics on the overall average score and each subitem of the drama performance project of the 36 classes in the first-level garden.

As shown in Figure 5, the overall average score of the provincial level drama performance project is 4.8 points, which is at the minimum required level. A score of 6 in Materials and Space, between pass and good; in Opportunity and Time, an average of 4.7, between minimum and pass; in Design and Instruction, an average of 3.8, at the minimum required level.

(2) Descriptive analysis of the quality of drama performances in the secondary gardens

The researchers made descriptive statistics on the overall average score and each subitem of the drama performance program in 36 classes in the provincial second-level kindergarten.

As shown in Figure 6, the overall average score of the children's drama performance project in the 36 classes in the provincial second-level is 4 points, which is at the minimum required level. In the Material and Space items, the average is 5 points, reaching the qualified level; in the Opportunity and Time items, the average is 4 points, between the minimum required level and the qualified level; in the Design and Guidance, the average is 3.1 points, in the minimum required level.

Comparing Figures 5 and 6, it can be seen that the overall average score and the scores of the three subitems of the first-level gardens are higher than those of the second-level gardens, and the performance quality of the first-level gardens is slightly higher than that of the second-level gardens. Both grades are at the minimum required level in terms of overall quality. Qualified in both Material and Space programs, that is, the theater performance area has material available for at least three students. Both are at the minimum required level of Opportunity and Time, that is, at least 1 opportunity per week to play theatrical performances. The minimum required level of Design and Instruction has just been achieved, that is, the teacher will provide a simple drama performance activity.

In order to specifically study whether there is a statistical difference in the quality of drama performances at different levels, the researchers conducted independent sample *t*-tests on the quality of drama performances at different levels, as shown in Table 2:

In terms of the overall average score of the project, the average scores of the first-class park and the second-class park are 4.8 and 4, both of which are between the minimum required level and the qualified level. $t = 2.2$, $p < 0.05$, the overall level of first-class gardens was significantly higher than that of second-class gardens.

In terms of Materials and Space, the quality of the first-level garden is 6 points, the quality of the second-level garden is 5 points, and both grades have reached the qualified level. $t = 2.2$, $p < 0.05$, the quality of Materials and Space items in the first-class garden is significantly higher than that of the second-class garden.

It can be seen from Figure 7 that the percentages of the first-class gardens are higher than those of the second-class gardens in all other indicators except that the percentages of the unsuitable level and the excellent level *A* are lower than those of the second-class gardens. There are relatively few classes in the two grades of kindergartens at the unsuitable level, and most of the classes provide students with materials and furniture for drama performances. However, there are slightly more classes at this level in the second-level garden than in the first-level garden, which may be one of the reasons for the difference in the quality of the two levels.

At the minimum required level, where the class has at least some (3+) drama material available, both grades are scored higher. About 94.4% of the first-class kindergartens and 86.1% of the second-class kindergartens have reached this level. The majority of classes at both levels achieved a qualifying level, that is, there was at least three concurrent theatre performance materials in the performance area.

On the good level, the first-class parks have 72.2%. About 50% of the classes in the second-level kindergarten have drama performance materials for five to six students, and the first-level kindergarten has more materials than the second-level kindergarten. The materials provided by 36.1% of the first-class kindergarten and 16.7% of the second-class kindergarten can form two themes that are popular with the class. The materials of the first-level garden are more thematically oriented than those of the second-level garden, but there are fewer classes at both levels reaching this level. About 61.1% of the classes in the first-class park and 41.7% of

Table 1: Spearman correlation coefficient.

	N	Correlation coefficient	Sig (both sides)
Overall average score of the project	72	0.94^{**}	0.00
Material and Space	72	0.91^{**}	0.00
Opportunity and Time	72	0.97^{**}	0.00
Guidance and Design	72	0.91^{**}	0.00

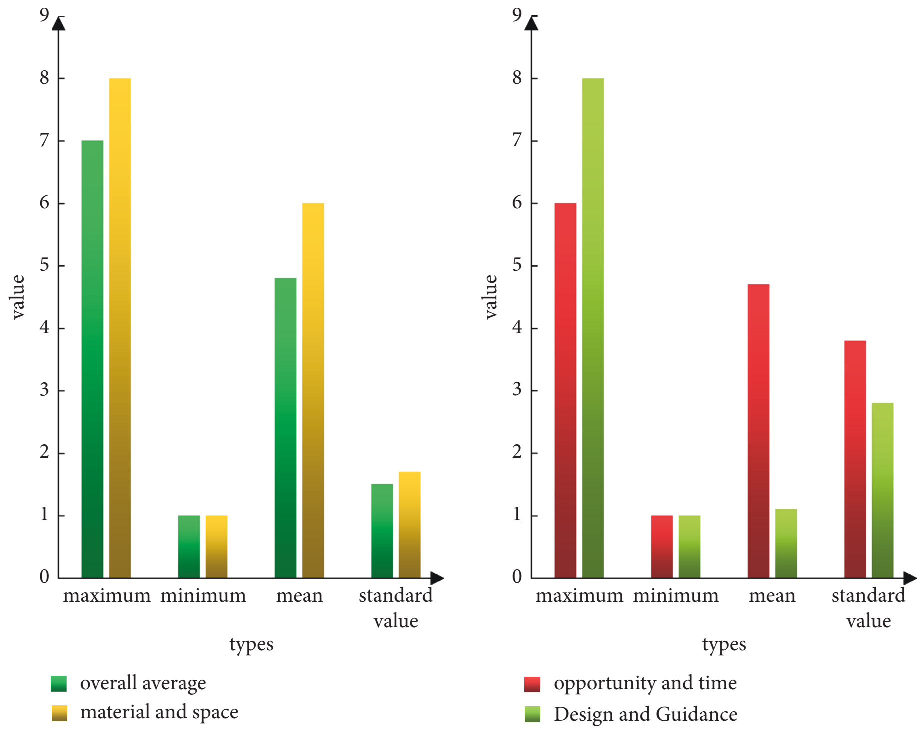

Figure 5: The quality of drama performances in the first-class gardens.

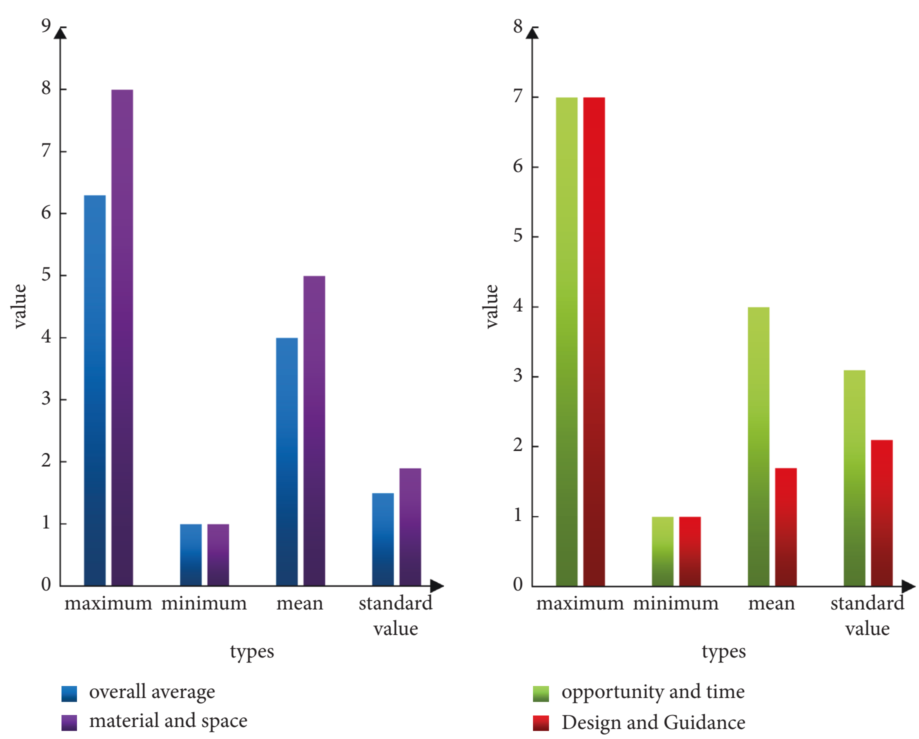

Figure 6: The quality of drama performances in the secondary gardens.

Table 2: Provincial 1 and provincial 2 theatrical performance quality *t*-test.

	t	df	Sig (both sides)	Mean difference	Standard error value
Overall average score	2.2	70.00	0.03	0.81	0.36
Material and Space	2.2	70.00	0.03	0.94	0.43
Opportunity and Time	2.1	60.60	0.04	0.72	0.34

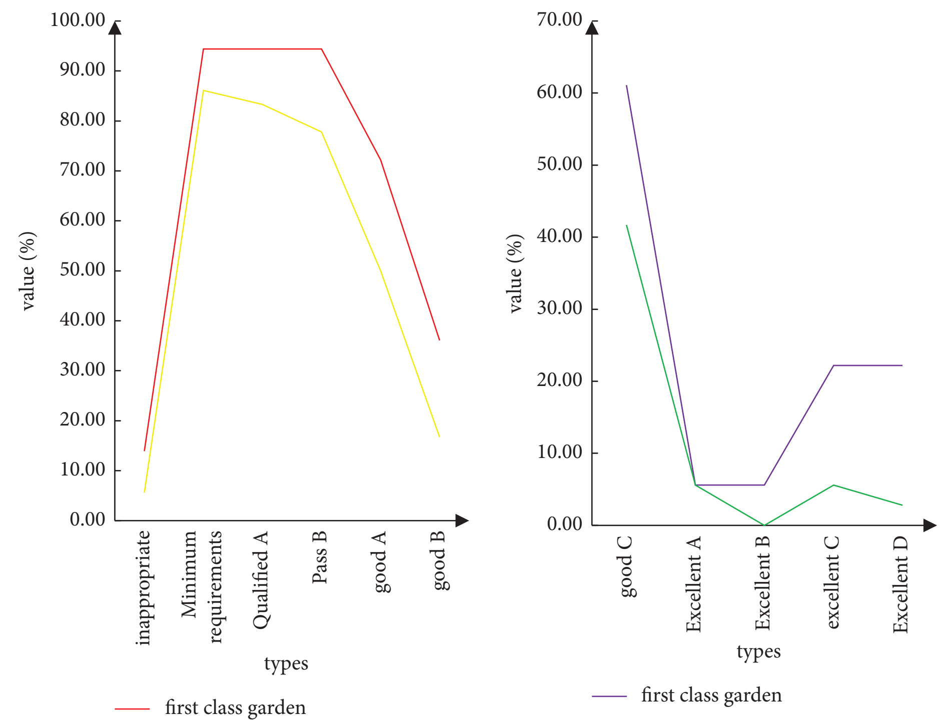

Figure 7: Comparison of two grades of material and spatial finesse.

the classes in the second-class park have clearly planned theatre space, and the materials are stored and maintained in good condition. There are more classes in the first-class park reaching this standard than in the second-class park.

The percentages of the classes that reach the excellent level of each indicator are less than 30% in both grades. In terms of materials, both grades lack drama materials reflecting multiculturalism, special drama rooms, and less rotation of materials according to various themes.

In terms of Opportunity and Time, the quality at the provincial level is 4.7; the quality at the provincial level is 4. Both are between the minimum required level and the qualified level, and the Opportunity and Time to perform are significantly less, $t = 2.1$, $p < 0.05$, the difference between the two is significant.

As can be seen from Figure 8, 2.8% of the classes in the first-class kindergarten and 11.1% in the second-class kindergarten are at an unsuitable level, that is, they have no chance to play drama performances within a week. Level 2 gardens have more classes at this level than level 1 gardens. Most classes at both levels meet the minimum required level, which guarantees at least one play opportunity per week. There is a certain gap between the first-class kindergarten and the second-class kindergarten in the qualified level. About 83.3% of the first-class kindergarten and 50% of the second-class kindergarten have reached this level. There are more classes in the first-level kindergarten than in the second-level kindergarten, which can guarantee at least one to two special opportunities (at least 30 minutes each time) for drama performances per week: both grades of kindergartens achieve a good level, and there are fewer classes that guarantee at least three to four special opportunities for drama performances per week. No class in the first-class kindergarten reached the standard, 11.1% of the classes in the second-class kindergarten met this standard, and the second-class kindergarten was higher than the first-class kindergarten in this index. There are no classes in both grades that reach the excellent level, that is, there is sufficient time (accumulated more than 60–80 minutes) each day for drama performances, and one of them can be played continuously for more than 45 minutes.

4.3. Establishment of the Theatrical Performance Platform. The model adopts a theoretical framework of interactive narrative based on dramatic metaphors, providing a computational framework that supports the dynamic generation, management, and conflict resolution of interactive plots, allowing users to act as the protagonist of the opera to determine current behaviors and actions. The core modules

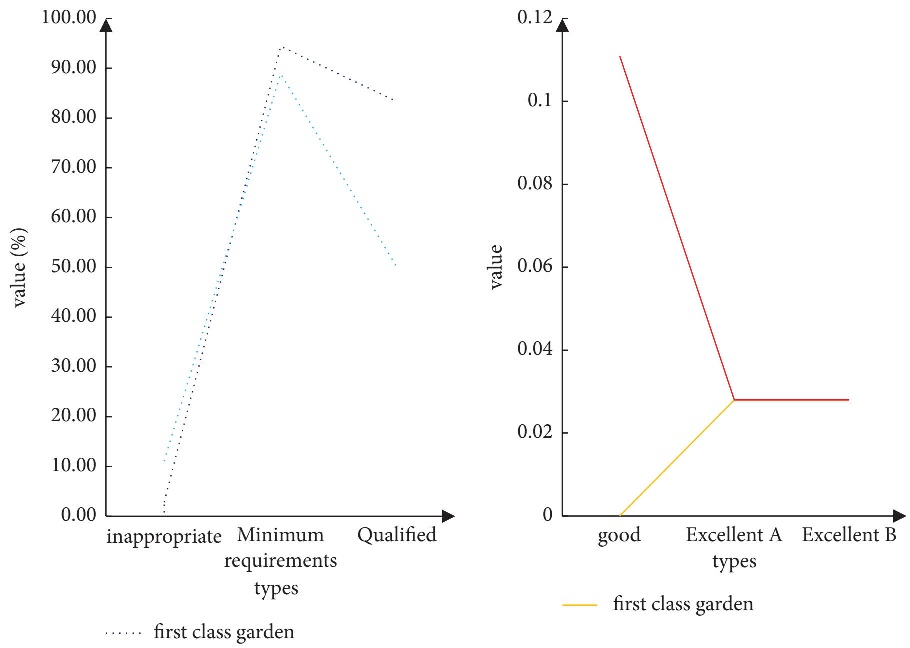

Figure 8: Comparison of temporal and spatial fine-grained metrics for two levels.

include user interface; event management; action management; scene management; story management; and data management; as shown in Figure 9.

The system integrates interactive technology, network technology, and digital animation technology, and strives to be in line with traditional artistic expressions, providing users with a network platform that can independently design and perform shadow puppets. Rich in content, simple in interaction, and easy to learn, users can easily complete the production, and can experience the fun of shadow puppetry in the process of operation, and develop users innovation and creative ability.

The main interface of the system is the main interface of drama production, which provides a series of function buttons and menu buttons. The right side of the interface provides a series of function buttons such as select the scene, select the character, select the background music, select the action (simple actions provided in the system can be directly selected by the user), preview (can preview the completed action), etc. The top of the interface provides a series of action menus, including the file menu (providing functions such as saving and submitting), the editing menu (providing the user to undo the previous action, zoom in and zoom out of scenes and characters, etc.), my plays (save user's unfinished and completed shadow puppets), links, etc.

The production process of the user using the system is mainly divided into the following stages:

Scene design stage: the user selects the characters and props in the opera scene, uses the mouse to drag the scene layout, and at the same time, the characters and props in the scene can be enlarged or reduced arbitrarily.

Action design stage: the key point of the system is to provide users with a function that can interactively design character actions and plots. During the action design process, the user can choose some simple actions provided in the system database, or freely design the actions of the characters. The various parts of the drama characters can be flexibly controlled by the user, and the user designs the actions and postures of each two adjacent key points of the character's bones, that is, the initial state and the end state of each action. In the design process, it needs to use the mouse to drag the various parts of the character's body to achieve the desired position, body posture, inclination angle, etc., and save it. The system automatically generates action sequences to complete the designed action. By selecting Preview, it is possible to see the smooth motion between these two states, and to control the progress and stop the motion in real time. If the user is not satisfied with the current design action, he can undo the current action and redesign it. During the action design process, the system automatically records the time node and saves the record, which is convenient for users to watch the scene animation designed by themselves.

The stage of submission and play after the completion of the opera: the completed play can be submitted after the production is completed. After the submission is complete, the user can enter the playback interface to search for previously saved plays to watch, or search for other plays to watch, and interactively control the playback of animations on the page. After the playback is completed, the evaluation of the opera can be given to realize network interaction.

A good software product must have good usability, and to reflect whether a software product is easy to learn, use, safe, effective, and satisfactory, the software must be evaluated for usability. Especially when designing interactive products, the system development process has to go through the iterative stages of "design-evaluation-re-design," so that problems in the software can be found, the software can be continuously improved, and finally, products that satisfy users can be released. Therefore, this section will conduct

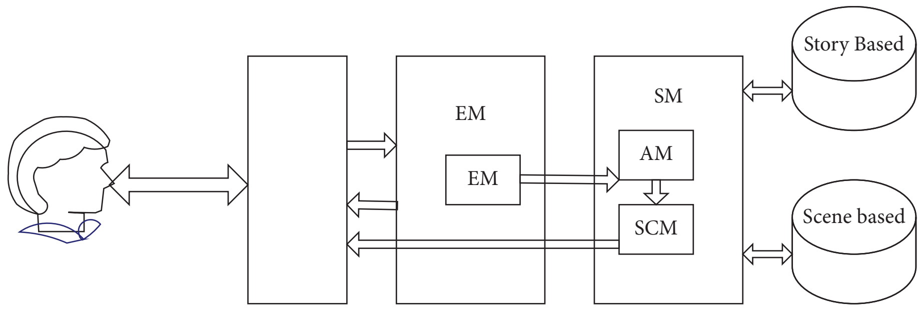

Figure 9: Interaction model diagram.

Table 3: Feasibility test data statistics table.

	Number of errors executed	Task completion time (minutes)	System response time (seconds)
Average value	3.3	11.17	3.5
Standard deviation	1.1	2.71	1.2
Maximum value	5	17	6
Minimum	1	7	2

Table 4: User experience survey.

Operation accuracy	64 (%)
Naturalness	75 (%)
Ease of use	80 (%)
Interactive experience	90 (%)
Overall satisfaction	82 (%)

usability testing and evaluation of the system prototype to verify and illustrate the feasibility of the system design and implementation.

It can be seen from Table 3 that the system can basically meet the needs of users, but due to time reasons, the function of the system is not perfect. Therefore, further improvements in execution efficiency, robustness, and fault tolerance are needed in the follow-up work. From Table 4, it can be concluded that the interactive experience value is the highest. In the survey, this article found that users have great interest and enthusiasm for the interactive production provided by the system and the character action plot design of the system for commenting and performing dramas. By using the system they gained a new understanding of drama and provided better ideas for improvement in this article. However, the manipulation accuracy of the system needs to be further improved. Users generally feel that when designing character actions, the instructions for selecting various components are not clear enough, which affects the accuracy and flexibility of the operator's actions. Therefore, further improvement is needed in the follow-up work. From the overall user experience, most users affirm and support this new form of dramatic performance and dissemination. Therefore, the system prototype designed and realized based on the research of this article is reasonable, effective, and has a certain promotion value, which can provide new ideas for the development of digital drama.

5. Conclusion

Through the measurement of the quality of theatrical performances of the two levels, it is known that the overall quality of theatrical performances of the two levels is between the minimum required level and the qualified level. The quality of drama performance in the first-level gardens is significantly higher than that in the second-level gardens. Specifically, there are significant differences between the two levels in the items of "Material and Space" and "Opportunity and Time," but not in the items of "Design and Guidance." In terms of Materials and Space, most of the classes of both grades have reached the qualified level, that is, there are at least three drama performance materials in the performance area that can be used at the same time. In terms of Opportunity and Time, the score of the first-level garden is higher than that of the second-level garden, both of which are at the minimum required level, which can guarantee the opportunity to perform drama performance once a week. This is also enough to show that the drama culture has been passed down and will shine in subsequent performances. The scale is designed from the dimensions of external environment: "Material and Space," "Opportunity and Time," and "Design and Guidance," although it can also reflect the quality of drama performance, but it cannot understand the development level of drama performance.

Data Availability

No data were used to support this study.

Conflicts of Interest

The authors declare that there are no conflicts of interest.

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