

Method for establishing human body model based on clothing classification selection parameter in 3D fitting

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Abstract

This article is mainly based on clothing classification, to choose the parameters for the establishment of the mannequin, on the basis of theory, through experimental method, respondents experience the virtual fitting platform and fill out the questionnaire, getting real user demand for virtual fittings, combining theory with reality, and finally propose improvements to existing platforms and application recommendations.

Keywords

VR, Clothing classification, 3D clothing fitting, 3D human body.

1. Introduction

VR has many applications in the field of marketing, and the clothing field is no exception. With the increase in the frequency of online shopping, users are increasingly demanding information symmetry. Every two pieces of online clothing transactions will have one was returned because of the user's unsatisfied, resulting in a waste of economy and energy, in order to enable users to master more clothing information, to understand the effect of wearing this clothing in advance, can greatly improve customer satisfaction, reduce return rate, improve economic efficiency, so put forward 3D fitting--users build their own mannequins on the Internet, instead of fitting clothes in the store, to achieve the effect of real fitting. At present, 3D fitting has been widely used in clothing marketing, but through investigation, users know very little, most people said that I have never heard of it, or I have never used it.

There are two main types of 3D fitting platform available, a 3D fitting mirror. Users only need to stand in front of the mirror to directly obtain the user's body data, and the hand can be changed. The effect is realistic and convenient. The experience is good, but the price is high, the popularity is low, and it is limited by location. It is temporarily unable to be applied to major shopping platforms. At present, its entertainment is more practical than practical. The other one is combined with major shopping platforms, which can be directly The 3D fitting shopping platform for creating a user's personal model on the Internet, the model replaces the user in the online fitting, the technical operation requirements are low, and the use range is wide. The user only needs to enter the platform, input personal body parameters, and can also popularize faster. Protect the privacy of users.

Through the existing literature research, a very important step in 3D fitting is to build a human body model, the existing method of building a human body model, common modeling of 3D modeling software, human body modeling based on 3D scanner, image based Sequence human body modeling, parametric human body modeling, from the effect point of view, the first three are better, but because the first three are particularly high on the equipment and operators professional technical requirements, so the existing 3D fitting platform Parametric human body modeling is widely used. Based on the comparative study of existing platforms, it is found that the established human body models are unreal, inconsistent, and unnatural. On this basis, it is proposed to establish a relative Perfect and easy to popular 3D fitting shopping platform. It has the advantages of protecting customer privacy, reducing costs, ease of use, and high popularity.

2. Literature review

2.1 VR

The definition of VR was originally based on technology, and was later revised. When further defining VR, many scholars first emphasized that VR is a kind of reproduction. Hills(1999)[1] defined that VR is a technical representation of the perceived real process; VR is the science of illusion, to create an "acceptable" reproduction of the real environment or object. VR experience is also a term repeatedly mentioned, (Gutiérrez A. et al, 2008)[2]: VR is an experience first of all compared to machine equipment. Steuer(1992)[3] thought that VR is a personal experience built on a technical level that combines the technological world and its natural manifestations by broadly overlaying multiple layers of social relationships and meanings.

Domestic research has also achieved certain results. Zhang Zhanlong et al. (2005)[4] concluded that in terms of the technology of virtual reality itself, it mainly involves three research fields: establishing real-time 3D visual effects through computer graphics, establishing an observation interface to the virtual world, and using virtual reality technology to enhance such as Applications in scientific computing technology, etc. Shu Jianhua (2008) [5] mentioned that the research of VR technology in the future will continue the principle of low cost and high performance. From the aspects of software and hardware, the development directions are mainly summarized as follows: Dynamic environment modeling technology, real-time 3D graphics generation and display The development of technology, new interactive devices, intelligent voice virtual reality modeling, and the prospect of distributed virtual reality technology. Hu Damin et al. (2012)[6] focused on the technical elements of VR systems and technologies in explicit knowledge of tacit knowledge, and combined with various practical application cases of VR systems to explore some applications of virtual learning communities in tacit knowledge management. Gao Hongbo (2017)[7] believes that the main problems facing the development of virtual reality in China's VR industry are as follows: (1) VR technical standards; (2) VR content short board issues; (3) VR user experience issues; (4) VR Equipment homogenization issues.

2.2 3D fitting

3D fitting is a new marketing method that utilizes virtual reality technology in the field of clothing. A method of building a virtual human body model by using the user itself instead of the user's online fitting method is convenient for users to buy clothes, try on clothes, and reduce user returns.

Hinds (1990)[8] and so on in the system to obtain the relevant three-dimensional space points of the human body model through the three-dimensional digital measuring instrument, and then use the double 3 times B-spline surface fitting to generate the digital human body model.

Cheng Yixuan (2011)[9] proposed that the 3D fitting system is based on web3.0 technology, providing consumers with a virtual reality shopping platform. Consumers manually input body data to generate a human body model, can also adjust skin color, hair style, synthetic facial appearance, etc., through the system online simulation try-on, so that the human body model is closer to the real situation; Cai Yueyan et al (2014) [10] summarized the problem of 3D fitting system is that the accuracy of the model is not high. There is still a certain difference between the human body model and the real person established by manual input of human parameters or automatic extraction of human parameters from photos, even if it can be adjusted by the circumference of each part and the whole The adjustment is to better fit the human body, but it is not perfect. After using the system, users still feel that they need to be further improved, but now the domestic system has no way to fully meet the needs of users. Second, the immature technology is not mature enough. The effect of the fitting show is not realistic and the system is running slowly. It is impossible to simulate the texture of the costumes realistically. The drape effect is a problem existing in all fitting systems. The fitting effect is too single, it is static display, and can not simulate the fluctuation of the fabric. The current system is slow, and the replacement of clothing takes a long time to respond; Lu Jianjun (2017)[11] defines three-dimensional fitting technology based on personal data, synthetic 3D model.

2.3 3D human body

Belleville (1995) [12] describes three-dimensional space design companies using real-world data from photos, photo CDs, or digital camera images to simplify construction tasks. In the study of Abteu (2018)[13], the three-dimensional space was established using the adaptive volume method. Li Jian et al. (2008) [14] proposed an offset-based skeleton adjustment algorithm to improve the flexibility of personalized adjustment. For the abrupt noise and local anomaly deformation that may occur during the adjustment process, a proportional difference boundary search method and an improved median filtering algorithm are proposed to smooth it; Cui Shuqin (2009)[15] discusses the computer aided design in the paper. From the point cloud data, the method of reconstructing the human body surface with triangular pieces can realize the function of small data volume and rapid generation of human body model; Wang Jianyi et al. (2011) [16] concluded in the research that the human body in the mature three-dimensional fitting system is built. There are three methods of modeling, but there are problems such as high requirements for operators' professional skills, high cost, and difficulty in commercialization. Du Jiang (2018)[17] proposed that face 3D model editing is one of the important means of face modeling, and For the face parameter model research, the parameter model is used to semantically control the face shape deformation, and the face semantic parameter model is constructed.

Based on the existing research and analysis, the method of establishing a model in three-dimensional fitting is based on certain equipment and models. Firstly, the implementation is high and difficult to achieve commercialization. Secondly, the implementation cost is high, the cycle is long, and it is difficult to put into use. This article intends to optimize the parametric input of the model through a new perspective, simplifying the model building process and maximizing the user's need for fitting.

3. Research design

3.1 Research ideas and methods

The research situation of this paper is the 3D fitting platform. The research object is the consumer who used the 3D fitting platform to build the human body model and perform the fitting. However, through investigation, there are very few people who have used the 3D fitting platform, and the used consumption. Because of the time relationship, there is not much impression. In order to improve the authenticity, timeliness and pertinence of the research, this study is divided into two parts: platform operation and questionnaire filling. Platform operation is an indicator of sample selection. In the selected samples, the next step was to study the consumer demand for 3D fitting platforms and the influencing factors.

The platform operation specifically includes selecting platforms, screening respondents and scene settings. First, the respondents performed the fitting on the 3D fitting platform according to the operation guide. After completing the fitting experience, they immediately filled out a questionnaire about the experience. The purpose was to obtain the user's demand for the 3D fitting platform. The data obtained through the questionnaire survey method will obtain the relevant data of the parameter adjustment through qualitative and quantitative analysis, and draw the relevant conclusions. The research route is as shown below.

Select platform: This experiment selects Good match 3D fitting platform, the main reasons are as follows. First, the platform is stationed in WeChat, and the experiment is easily carried out. No need for experimenters to perform APP download or web page search, which reduces the entry to a certain extent. Cost; Second, the number of clothing companies that cooperate with the platform is very large. It is not too narrow in terms of general platform selection, and can more satisfy the shopping needs of various users.

Screening personnel: Since the clothing stores that the test platform cooperates are all women's clothing, this experimenter chooses girls. In addition, this experiment takes into account the online shopping frequency of girls, so in order to make the sample representative, the network age and shopping frequency can be effective. To screen the conditions of the experimenter, the experimenter

has at least an online shopping habit and has had a shopping experience, otherwise it is considered as an invalid sample.

Setting the scenario: This experiment intends to use a user experience to experience a platform. From the experience, satisfaction or dissatisfaction of the platform, the corresponding requirements are put forward. By solving the existing problems, a new perspective is proposed to meet the needs of users.

Finally, the experimental data is collected by filling out the questionnaire.

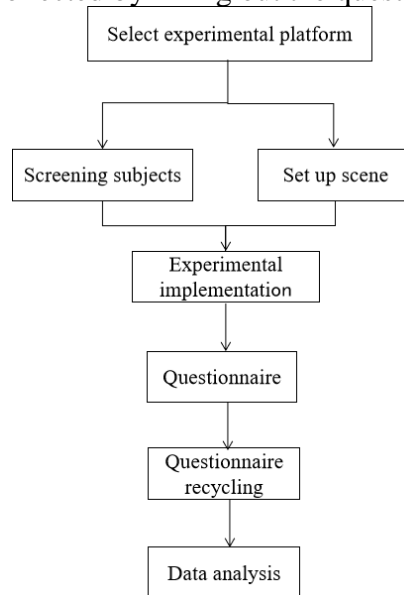


Figure 1. Research circuit diagram

3.2 System model establishment

3.2.1 Define parameters based on clothing classification

In view of the fact that the previous research on building human body models is based on specific algorithms and models, it is very time-consuming and costly. This study intends to use the perspective of clothing classification. Firstly, the selection of model parameters is used as a new perspective by classifying clothes. By classifying different clothes and finding out the key parameters that are needed respectively, people's daily needs are less demanding than the clothing they wear on specific occasions. Through this discovery, we only need to try everyday clothes. In the case, a model that inputs some commonly used body parameters is created, and in the case of a special scene clothing, more detailed parameters are input, and finally, the user can also make individual adjustments according to his own characteristics.

From this conjecture, this paper proposes to classify parameters based on clothing classification. The classification results and definitions are as follows.

Table 1. Classification and definition of parameters established by human body model

Parameter classification	Parameter definition
General parameters	Applicable to the general population, parameters that reflect the average level of physical characteristics of the population
Optional parameters	Personalized parameters, different from the public, can highlight the parameters of personalized body characteristics
Refined parameters	The subtle and fine adjustment of the parameters of the model can not be measured by the scale, and the unique parameters that are completely adjusted by the personal visual impression make the model closer to the real person.

3.2.2 Building a human body model based on parameter classification

After the parameter classification and definition, combined with the existing 3D fitting platform, the 3D fitting system under the parameter classification perspective is established. The system selects the parameters to establish the model through the classification of the clothing, and finally the fitting, the user finally returns it. There is an evaluation system. If you are satisfied, you will end the parameter input. If you are not satisfied, enter the parameter again or exit directly.

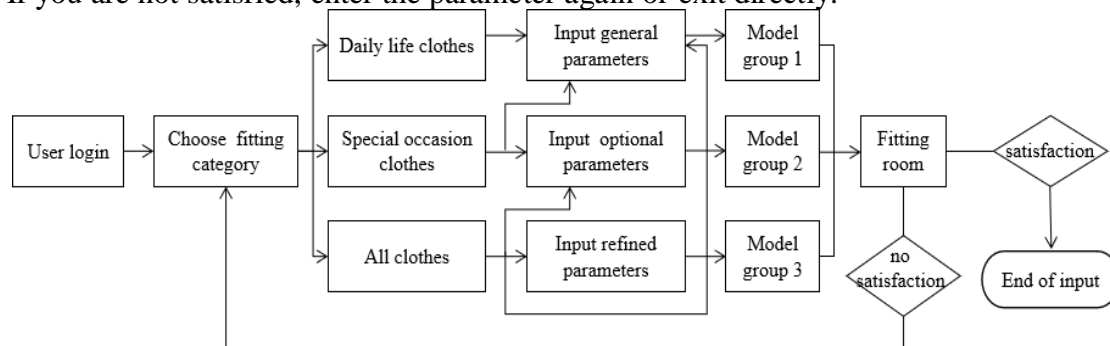


Figure 2. 3D fitting platform system structure

However, the classification of parameters is based on the classification of clothing. In order to make the research more realistic, it is intended to combine theory with reality. After proposing theoretical hypotheses, on the other hand, it is intended to adopt experimental methods. Let users experience the 3D fitting platform, and then fill out the questionnaire to obtain the real needs of users for 3D fitting, in order to meet the needs of users, improve the existing platform, improve the implementation and popularity.

3.3 Questionnaire design

3.3.1 Questionnaire design process

Firstly, form the first draft of the questionnaire. By reading and combing relevant literature, summarizing the maturity of the existing literature. Based on this and combined with the actual research results, the table was prepared to fit the scale items of the study and form the first draft of the questionnaire.

Secondly, the questionnaire was further revised. By consulting experts and teachers in the field, the respondents will be asked to fill in the questionnaires, and the accuracy of the measurement questions will be evaluated and revised accordingly.

Thirdly, determine the final draft of the questionnaire. Through the pre-study of the previous period and the analysis of the acquired data, the rationality of the measurement questions is preliminarily tested, and the shortcomings in the writing and design of the questionnaire are discussed, and the research hypotheses and theoretical models are combined to correct them to form the final Questionnaire.

3.3.2 Basic content of the questionnaire

The survey participants of this paper are consumers of 3D fitting platform. The first condition is to scientifically design the questionnaire. Based on the research purpose of this paper, the content of the questionnaire is determined. There are five levels of content:

1. Basic information survey. This questionnaire only needs to be filled out by female users who have had online shopping experience. The first question is whether or not they have participated in online shopping. If yes, they will proceed to the next question, otherwise they will end the answer directly. Subsequent basic information includes age, education, disposable income.
2. The current situation in which consumers purchase clothing online. The main channels through which to buy, and what are the dissatisfaction, mainly to understand the pain points of the current consumer.
3. All parameters of the 'good ride' 3D fitting system were classified and three scales were designed accordingly. Each; the question in the scale is set to a five-point scale, the degree of importance of

the parameters is scored, 1-5 points are very unimportant, less important, general, more important, very important. The parameters are classified as follows:

Table 2. Parameter classification result

Parameter classification	Specific parameters
General parameters	Height, weight, bust, upper body length, lower body, age, face, facial features, hairstyle, skin color, makeup
Optional parameters	Neck circumference, neck length, shoulder width, waist circumference, waist length, hip circumference, arm length, arm thickness, thigh circumference, thigh length, calf circumference, calf length, knee circumference, ankle circumference
Refined parameters	Shoulder type (flat shoulder, wide shoulder, narrow shoulder, shoulder, etc.); thigh type (narrow, normal, wide, etc.); leg type (upper and lower, straight, X, O, etc.)

4. Consumer product adoption willingness. Ask the customer if they would like to use such a 3D fitting platform.

5. Open question: What do you think needs to be added to make the model closer to me? This issue is set up for subsequent system improvements.

4. Empirical analysis

4.1 Experiment procedure

1. Object selection

Randomly select 300 women on the Internet, request mobile phone to have Taobao, have online shopping experience, age, geographical distribution should have significant differences, reflect diversity, avoid the emergence of experimental one-sided, no representative issues.

Send operation guide

Before starting the operation of Good Buy 3D Dressing Platform, send an operation guide to all subjects to guide the customer to complete the operation and ensure that the object has a familiar and comprehensive understanding of the buttons and functions of the platform.

Confirmation of operation completion

In order to verify whether the customer has completed the fitting, the customer is required to send a screenshot of the final state after the fitting, to determine whether the customer has completed the experiment. After completing the fitting, the subject will receive a simple survey of the good match platform. This background data can be used as an important basis for screening.

4.2 Experimental data acquisition

1. Sample selection

In the platform operation background data, the user who completes the fitting process is selected as a sample to fill out the questionnaire. And they have to have online shopping experience, because the platform operation needs to be carried out online, 3D fitting platform is also for online shopping customers, so use this as a basis for screening valid samples.

Ways of issuing questionnaires

Through the questionnaire star, Questionnaires are distributed through online and offline methods. Because it is to investigate the real needs of customers, the object of the questionnaire must be to experience the 3D fitting platform. Before the questionnaire is issued, it is necessary to confirm

whether the customer has completed the 3D fitting. the whole process. A total of 500 people who completed the 3D fitting were sent to them.

Sample description

Excluding incomplete and invalid data, and obtain useful data, the basic information of the sample members is counted by category, including online shopping age, education level and income level, and the number and corresponding percentage of each indicator are obtained, as shown in the following table. You can learn more about the distribution and overall situation of sample members.

4.3 Data analysis

The obtained data is preprocessed, and the unreasonable data is eliminated, and the later analysis is performed. Data analysis, reliability test, validity test, correlation analysis, etc. were performed using SPSS.

The questionnaire was distributed online and offline. The questionnaire was distributed in 500 copies. The questionnaire was issued from February 3 to April 15, and a total of 362 valid questionnaires were collected, with a recovery rate of 72.4%. The relevant statistical results are as follows.

Basic information statistics

Age

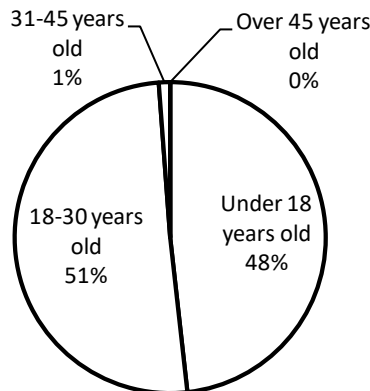


Figure 3. Age statistics

The research object of this paper is mainly college students, so most of them are 18-30 years old. It can be seen from the statistical results that 99% of the respondents are 18 to 30 years old, which is in line with the research purpose of this study, because 3D fitting is itself an emerging network platform, and young and purchasing groups are on the market. More sensitive, so in marketing, pay more attention to their opinions.

Education

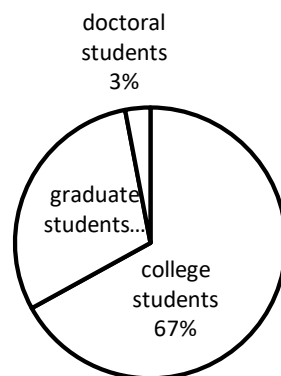


Figure 4. Education statistics

Because this study is mainly aimed at college students, the academic qualifications are college students, graduate students, and doctoral students. The ratios are 67%, 30%, and 3%, respectively.

Therefore, this paper has certain limitations in personnel selection, and the degree of education is generally high, so the sample has great limitations in this respect.

Income.

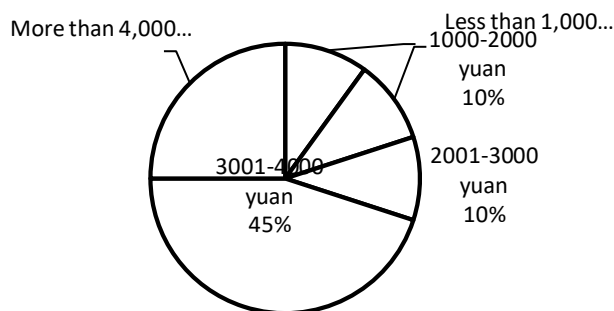


Figure 5. Income statistics

It can be seen from the survey results that 70% of customers have disposable income of more than 3,000 yuan, indicating that customer income has generally increased in recent years, so it is suspected that the demand for emerging shopping platforms will also increase.

Reliability and validity analysis

Reliability analysis

Table 3. Scale data reliability analysis

Parameter category	Cronbach α
General parameters: height, weight, chest circumference, upper body length, lower body length, age, face shape, facial features, hair style, skin color, makeup	0.832
Optional parameters: neck circumference, neck length, shoulder width, waist circumference, waist length, hip circumference, arm length, arm thickness, thigh circumference, thigh length, calf circumference, calf length, knee circumference, ankle circumference	0.959
Refined parameters: shoulder type, squat type, leg type	0.807

It can be seen from the above table that the reliability coefficient values are all greater than 0.8, which indicates that the reliability of the research data is very high, and the reliability coefficient value after the deletion of the item is not significantly improved. The comprehensive description indicates that the data reliability is high and can be used for further analysis.

Validity analysis

Table 4. Scale data validity analysis

Scale data	KMO
General parameters & Optional parameters & Refined parameters	0.867

The KMO value is greater than 0.6, indicating that the design of the measurement items related to the scale parameters is reasonable.

Customer's existing pain points

Table 5. Customer's pain point summary

Customer's pain point	Proportion
Inappropriate size	12%
Color color difference is too large	18%
Bad quality	14%
Upper body is not good	46%

All is satisfied	10%
Not satisfied with other aspects	0%

It can be seen from the statistical results that customers have various problems in online shopping apparel. Due to information asymmetry, many dissatisfaction has arisen. It is precisely because of these dissatisfaction that 3D fitting is very promising, but the system is setting up. In terms of the pain point of the customer, it should be given enough attention.

Parameter sorting result

Table 6. Parameter sorting results under clothing classification

Clothing classification	Parameter sorting (high to low)
T-shirts and Jeans	Height; weight ;body length;; lower body length.
Jumpsuit	Height; weight ;facial features;leg type; makeup; skin;hip circumference.
Suit	Leg type ;shoulder type ;thigh type ; facial features; hair style;makeup ;weight ;height ;face type ; lower body length;upper body length ; skin color ;chest circumference; shoulder width ;waist circumference; neck length ;thigh length; calf length; arm Thickness .

It can be seen from the results that through the classification of clothing, different parameter ordering is obtained, and as the clothing changes, the number of parameter requirements also changes, which highlights the clothing of the body, and the higher the requirements on the parameters, thus confirming the proposed Conjecture, through the classification of clothing, the selective input of parameters is feasible.

Customer's demand willingness

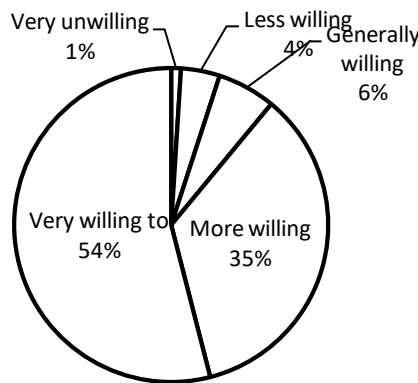


Figure 6. Customer's demand willingness statistics

According to statistics, 89% said they are more willing or very willing to use 3D fitting. It shows that the commercial prospect of 3D fitting is relatively good, and the market is expected to be relatively large.

Customer's advice

From the numerous suggestions, through screening and induction, I sorted out the useful suggestions as follows:

- 1) The model should have a dynamic effect so that the overall feeling is known;
- (2) The fitting environment should be diversified, which will make it irreplaceable;
- (3) It is recommended to increase the question and answer area to buy things more securely;
- (4) Increase the type of shoes, you can choose to match.

5. Conclusion and Outlook

Conclusion :Through the experimental results, the following conclusions can be drawn: 1. The higher the disposable income, the higher the demand for 3D fitting; 2. The customer has different requirements for the parameters when testing different types of clothing, special scenes The parameters are obviously more than the parameters of daily life, which can confirm that the conjecture proposed in this paper is effective and can be executed.;3. The customer is most concerned about the similarity between the model and himself, so the 3D fitting system should be improved. The realism of the model;4.The 3D fitting system should be combined with the customer's pain points and needs to carry out system construction and improvement;5.Customers choose different garments and have different requirements for parameters. Therefore, system construction can consider setting parameters according to clothing classification. For example, the system construction model proposed above can be used for reference.

The new meaning of this paper: 1. Through platform test, questionnaire survey, understand the reasons why the platform is not popular, and the pain point of user experience, solve the problem from the user's point of view, improve the parameter adjustment model with the lowest cost and the least time. User experience, to achieve a wide range of popularization and use; 2 .Existing data and literature are through the improvement of the model, the improvement of the algorithm and other methods, this paper through the change of perspective, only need to optimize the existing technology to achieve Requirements, saving manpower and material resources.

The shortage of this paper: First of all, the sample size of this paper needs to be increased. Secondly, due to the limitation of capabilities, there are still many factors to be considered in the parameter classification. Finally, there are many factors affecting 3D fitting, and other models can be considered later to establish related links for in-depth research.

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