

## *Retraction*

# **Retracted: Evaluation and Analysis of Multimedia Collaborative Building Design Relying on Particle Swarm Optimization Algorithm**

### **Advances in Multimedia**

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their

agreement or disagreement to this retraction. We have kept a record of any response received.

### **References**

- [1] T. Yang, "Evaluation and Analysis of Multimedia Collaborative Building Design Relying on Particle Swarm Optimization Algorithm," *Advances in Multimedia*, vol. 2021, Article ID 7843828, 7 pages, 2021.

## Research Article

# Evaluation and Analysis of Multimedia Collaborative Building Design Relying on Particle Swarm Optimization Algorithm

Tao Yang 

*School of Civil Engineering and Architecture, Shaanxi University of Technology, Hanzhong, Shaanxi 723001, China*

Correspondence should be addressed to Tao Yang; [owilson@mail.greenriver.edu](mailto:owilson@mail.greenriver.edu)

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This article proposes improvements to the placement, organizational structure, and adaptability of the evaluation model and proposes a comprehensive evaluation model for the multiattribute scheme of the particle swarm optimization algorithm. The structure table of the multimedia building design plan evaluation index, the plan evaluation table, and the standardized model of the plan evaluation value of the common method was proposed. It also proposes the import of “with tutor” type data of particle swarm optimization algorithm as well as the self-organizing neural network evaluation model and calculation method of “no tutor” type resource import. According to the complexity of architectural design evaluation and the nonlinear relationship between related influencing factors, we have studied the principles and methods of applying system analysis, designed comprehensive evaluation models, and comprehensively evaluated architectural design schemes.

## 1. Introduction

There are many types of buildings in multimedia, various functions, and big differences. These characteristics will be more prominent in subsequent development. When the multimedia collaborative architectural design plan is being evaluated [1, 2], we have learned about the modern architectural culture of our country. This series of problem solving is the key to how to carry out the evaluation of the multimedia collaborative architectural design scheme [3, 4]. Expert review and qualitative evaluation are dominant in the current program evaluation method, and the Delphi method and analytic hierarchy process are used to clarify the evaluation index weight method, and the effect is obvious [5, 6]. Of course, there are shortcomings, which will lead to subjective errors in the evaluation results. This error is unavoidable and will gradually increase with the rating level [7, 8]. Therefore, the use of fuzzy upper and lower level functions to evaluate the feasibility of the plan requires further research [9, 10]. Based on the difference of architectural design evaluation and the nonlinear relationship of corresponding elements, the theory and method of system analysis are proposed, a comprehensive evaluation model is

established, and the architectural design plan is comprehensively evaluated. In recent years, in the application of the situation, researchers have also proposed a nonlinear comprehensive model that quickly digests the knowledge and experience of experts [11, 12].

The theory of particle swarm optimization calculation method is easier to implement and has the characteristics of optimization. This is the reason why it can develop rapidly in a short period of time. It has been used in many areas, such as optimizing power systems, solving TSP problems, neural network training, traffic accident work, parameter identification, and model optimization. This paper explored the characteristics of swarm intelligence, the model characteristics of collaborative design system, and the application of particle swarm optimization calculation method in architectural design.

## 2. Particle Swarm Optimization Algorithm

### 2.1. Determination of Indicator Weight

**2.1.1. Construct a Judgment Matrix.** The three-dimensional visualization of the real scene of a building, generally

speaking, must maintain the structure of the house and transfer the building from the old site to the new site based on the premise of a complete appearance, including longitudinal, lateral displacement, and rotation. The technical concept basis of the overall transfer is the independent individual based on the building. Behind the heightened building, it is necessary to overcome the friction of movement and the integrity of overcoming the interference of shaking. Real-life 3D visualization is simply called translation, and as the name suggests, it moves while maintaining a level at home. The main steps of the 3D visualization of the real scene of the building can be incorporated into the separation and displacement from the original position [13–15]. The general process is to cut off the building from the previous foundation and transfer it to the commission structure, install a mobile device under the transaction structure to form a movable whole to move the building to a predetermined location, and request the location to connect the AHP method and the evaluator about each evaluation. The relative importance of elements is judged. These judgments are expressed as judgment matrices with numerical values. The specific form of constructing the decision matrix is as follows through the comparison and evaluation elements such as the brain raid method and the expert survey method.

$$B = \begin{pmatrix} b_{11} & b_{12} & \cdots & b_{1n} \\ b_{21} & b_{22} & \cdots & b_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ b_{n1} & b_{n2} & \cdots & b_{nn} \end{pmatrix}. \quad (1)$$

In the formula,  $b_{ij}$  is the relative importance of  $B_i$  to  $B_j$  for  $A_k$ .

The text uses a ratio of 19 to evaluate the significance of the numerical value representing the meaning: 1 shows the same importance compared with the two elements. 3 represents the comparison of two elements. 5 represents the comparison of two elements. Obviously, 7 represents two elements. More important than being strong. 9 means two elements. The  $B_i$  number between them is 2, 4, 6, and 8, and  $B_j$  represents the intermediate value of the abovementioned adjacent judgment.

In the formula,  $b_{ij}$  is the relative importance of  $B_i$  to  $B_j$  for  $A_k$ .

The text uses a ratio of 19 to evaluate the significance of the numerical value representing the meaning: 1 means that it has the same importance compared with two elements. 3 represents the comparison of two elements. 5 represents the comparison of two elements.  $B_i$  is obviously more important than  $B_j$ ; 7 means that compared to two elements,  $B_i$  is more important than strong  $B_j$ ; 9 means that compared to two elements, the number of  $B_i$  between them is 2, 4, 6, and 8, which means the abovementioned adjacent judgment median.

**2.1.2. Calculate the Weight of Each Indicator.** The calculation of index weights can be attributed to the calculation of eigenvectors and eigenroots of the determination matrix.

That is, for the judgment matrix  $B$ , calculate the eigenvalues and eigenvectors that satisfy  $BW = \lambda_{\max} W$ , where  $\lambda_{\max}$  is the largest feature root of  $B$  and  $W$  is the normalized feature vector corresponding to  $\lambda_{\max}$ . The component  $W_i$  of  $W$  is the weight corresponding to each index. In this paper, the square root method is used to calculate the characteristic root. The specific steps are as follows:

- (1) Calculate the product  $M_i$  of each row of the judgment matrix  $B$ :

$$M_i = \prod_{j=1}^n b_{ij} \quad (i = 1, 2, \dots, n). \quad (2)$$

- (2) Calculate the  $n$ th root of  $M_i$  to  $\bar{W}_i$ :

$$\bar{W}_i = \sqrt[n]{M_i} \quad (i = 1, 2, \dots, n). \quad (3)$$

- (3) Normalize  $\bar{W} = (\bar{W}_1, \bar{W}_2, \dots, \bar{W}_n)^T$  vector:

$$W_i = \frac{\bar{W}_i}{\sum_{j=1}^n \bar{W}_j} \quad (i = 1, 2, \dots, n), \quad (4)$$

$\bar{W} = (\bar{W}_1, \bar{W}_2, \dots, \bar{W}_n)^T$  is the required feature vector.

- (4) Calculate the largest characteristic root of the judgment matrix  $\lambda_{\max}$ :

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^m \frac{(BW)_i}{W_i} \quad (5)$$

where  $(BW)_i$  represents the  $i$ th element of the vector  $BW$ .

- (5) Consistency inspection

Calculate the consistency index  $CI$ :

$$CI = \frac{\lambda_{\max} - n}{n - 1}. \quad (6)$$

When the judgment matrix is completely consistent,  $CI = 0$ .

In addition, the average random consistency index ( $RI$ ) of the determination matrix is determined, and the value of  $RI$  is shown in Table 1.

Calculate the random match ratio of the determination matrix to confirm its consistency. In the case of  $CR = CI/RI \leq 0.10$ , it is determined that the matrix has a preferred match. Otherwise, the decision matrix will be adjusted according to the inspection requirements.

## 2.2. Particle Swarm Optimization Algorithm Steps

- (1) Algorithm selection: select the particle group optimization algorithm, that is, ALGRIM = PSO.
- (2) The size of the microparticle group:  $N$  is the total number of microparticles in the microparticle group.
- (3) The information set INFORM: INFORM (QP) includes all the information about each particle, such as the position, speed, time, and other information of

TABLE 1: Values of RI for different orders.

Order $n$	1	2	3	4	5	6	7	8	9
RI	1.00	0.02	1.57	1.01	1.13	1.15	1.01	1.42	1.04

the individual particle, and also includes the non-executable information obtained by the optimization objective constraint and the output by the algorithm sequence of instructions. The detection information set DETECT ( $\Omega P$ ) for detecting individual particles is a subset of INFORM ( $\Omega P$ ).

- (4) Determine the objective optimization function AIM to be solved: based on the characteristics of the actual application problem, establish or transform the corresponding objective optimization function.
- (5) Command set for modifying particle parameters: the particle group algorithm provides the operation instruction set INSTRUCTION (QP) corresponding to each particle individual by adjusting the flying speed (size and direction) of the individual particle and moves the individual Pi of the particle to all-dimensional coordinates.
- (6) CHARACTER: to determine the characteristic parameter—the characteristic parameter mainly refers to some main parameters in the algorithm. For example, the acceleration constants c1 and c2, etc.: these parameter values are usually determined by experimental methods.

### 3. Multimedia Collaborative Architectural Design Evaluation Model

*3.1. Comprehensive Evaluation Mathematical Model of Multimedia Collaborative Building Design Scheme.* The evaluation of multimedia joint architectural design schemes was studied in depth. In the comprehensive design evaluation mathematical model, based on the principles of architectural technology economics and system analysis theoretical methods, the multimedia joint architectural design schemes are constructed by considering the nonlinear relationship between the evaluation elements. Functional comprehensive profit evaluation model is as follows:

$$\max y = f(V, X). \quad (7)$$

Here, the index weight vector is evaluated.  $V = (v_1, v_2, \dots, v_n)^T$ . In the application, in order to determine the weight of the indicator, methods such as AFP are required. Because this method uses nine-level calibration standards, it produces unavoidable weighting errors.

Comprehensive evaluation of multimedia collaborative architectural design based on particle swarm optimization algorithm:

- (1) Neural network theory and the design of its comprehensive evaluation model:

After in-depth analysis, I believe that we can study the multimedia joint architectural design plan and

comprehensively evaluate this complex problem [11, 12].

The neural network evaluation model can be written as

$$y = f(\text{net}, W, X) \quad (8)$$

- (2) Comprehensive evaluation of multimedia collaborative architectural design based on the particle swarm optimization algorithm.

*3.1.1. Comprehensive Evaluation of Multimedia Collaboration Structure Model.* Based on the nonlinear characteristics of the evaluation of the multimedia cobuilding design scheme and the sequential transferability of the index system, a three-layer particle group optimization algorithm is designed. The network includes an input layer, an implicit layer, and an output layer. The input layer has 21 nodes, and the corresponding input vector corresponds to 21 evaluation indicators such as the land use environment of the multimedia joint architectural design evaluation index system  $X = (x_1, x_2, \dots, x_{21})^T$ . The implicit layer has three nodes. The output layer has a node, the corresponding output variable is  $y$ ,  $y$  corresponds to the comprehensive evaluation value of the multimedia cobuilding design, and the network structure is shown in Figure 1.

*3.1.2. The Main Model of Multimedia Collaborative Computing.* It mainly includes neuron activation function, target error function, and weight correction formula:

$$J = \sum_{p=1}^P J_p, J_p = \frac{1}{2} \sum_{j=1}^n (t_{pj} - Q_{pj})^2. \quad (9)$$

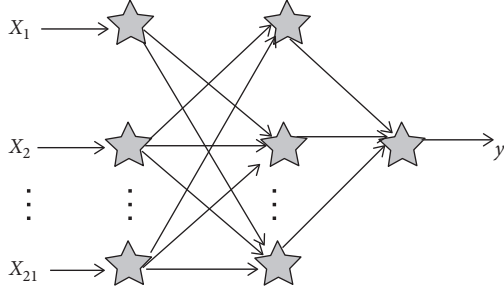
### 4. Evaluation Process of Multimedia Collaborative Architectural Design Scheme

The self-organizing competitive artificial neural network is a network model produced by the unsupervised (leader) adaptation process. “Based on the nonprofessional characteristics, the neural network multimedia joint architectural design evaluation model based on the classification algorithm is separated and designed.

#### 4.1. Self-Organizing Competitive Neural Network Evaluation Model and Algorithm Flow

*4.1.1. Network Evaluation Model.* The self-organizing feature map network model is a typical nonleader particle group optimization algorithm model. There are two main types of network training models.

- ① Measurement formula: Mahalanbris distance formula  $S(X, X') = (X - X' \& \text{expected } 39) \text{ TW-1 } (X - X' \& 337519.39) \text{ } 1/2$ , where  $W$  in the equation is the covariance matrix of the sample characteristics. Min-kesky measure:  $S(X, X') = \sum_{i=1}^n |x_i - x'_i|$ .



Input layer (21 nodes) Hidden layer (3 nodes) Output layer (1 node)

FIGURE 1: Particle swarm optimization algorithm for comprehensive evaluation of multimedia collaborative architectural design schemes.

② Network training formula: input  $X = (x_1, x_2, \dots, x_n)^T$ , output  $A = [a_1, a_2, \dots, a_s]^T$ , and activation function input formula  $s_i = n_i + g_i$ ,  $n_i$  is the input node input sum:  $n_i = \sum_{j=1}^n w_{ij}x_j$ ;  $g_i$  is the intralayer suppression input sum:  $g_i = \sum_{k \in D} w_{ik}a_k$ .

4.1.2. *Algorithm Flow of Network Evaluation Model.* The design process of multimedia collaborative building based on particle swarm optimization algorithm is shown in Figure 2.

4.2. *Analysis of Evaluation Results of Multimedia Collaborative Architectural Design Based on Particle Swarm Optimization Algorithm.* Mark the ideal scheme number as no. 31, participate in the evaluation of the design schemes of 30 theaters, classify the schemes according to the algorithm, and reclassify the separated good schemes. The sorting results obtained are shown in Table 2.

## 5. Case Analysis

This article takes a city government lease area of 96346 m<sup>2</sup>, including a basement building as an example. The building adopts an assembled frame structure design method. The design unit and component unit used are foreign companies, and the design and construction unit is a building in China, units with first-level engineering qualifications. According to detailed analysis, it can be known that related inspections and other related materials of assembled design building projects are used to comprehensively evaluate indicators at all levels with particle swarm optimization algorithms. According to the architectural design plan (hereinafter, referred to as the “architectural plan” solution), There are 30 evaluation plans for the comprehensive evaluation objects, and the evaluation values of qualitative indicators are 1, 2, 3, and 4 levels (qualified, good, excellent, and innovative), and work is carried out according to the multimedia collaborative evaluation procedure (Table 3).

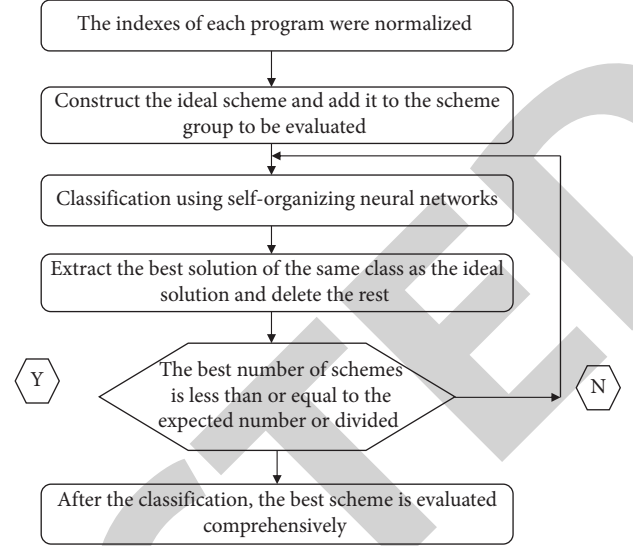


FIGURE 2: Self-organizing competitive neural network multimedia collaborative architectural design flow chart.

TABLE 2: Comparison of results between particle swarm optimization algorithm and multimedia collaborative evaluation scheme.

The first classification result(18)	2 3 4 7 8 9 11 12 14 19 20 21 25
	27 28 29 31
Second classification results(9 items)	2 3 7 6 15 18 21 28 31
Multimedia collaborative sorting results(top 10)	27 7 14 4 5 18 3 28 21 20

- (1) Standardize the evaluation data and design a multimedia joint: take 3 hidden layer neural elements, set the activation function to logarithmic S type, train 100,000 times, target error  $1e-5$ , and learning speed 0.6.
- (2) Network training: use 20 samples to train the network, and the process is shown in Figure 3.
- (3) Network verification: use 10 samples to test the network performance, compare the neural network output value with the comprehensive profit value obtained by the comprehensive effect evaluation formula (1), and draw the error curve as shown in Figure 4.  
It can be seen from the figure that the errors of the test samples are all within 10-2, achieving the expected results.
- (4) Analysis of the comprehensive evaluation results of the multimedia joint model (refer to Table 4) The multimedia joint evaluation model was used to rank 30 theater architectural designs. 23, 6, 14, 1, 5, 17, 2, 27, 19, 21, 29, 13, 7, 26, 4, 25, 9, 18, 3, 12, 20, 16, 22, 28, 24, 15, 11, 8, 10, and 30.

TABLE 3: Expert evaluation data table (a brief table of 30 typical theater design schemes).

	Plan 1	Scenario 2	Scheme 3	Scheme 4	Scheme 5	Scheme 6	...	Scheme 30
1	4	3	3	3	2	3	...	...
2	4	3	3	3	2	4	...	...
3	4	4	3	4	3	2	...	...
4	5	4	3	3	4	3	...	...
5	4	4	3	3	2	4	...	...
6	4	3	3	3	2	3	...	...
7	4	3	3	3	3	4	...	...
8	4	3	2	3	2	4	...	...
9	4	3	3	3	2	3	...	...
10	4	5	3	1	1	2	...	...
11	4	3	2	4	3	3	...	...
12	5	4	2	2	2	3	...	...
13	4	3	2	3	4	3	...	...
14	42340	38655	37315	37012	38132	41127	...	...
15	4538	3937	4205	3952	4313	4237	...	...
16	3072	2344	2233	2343	3071	2296	...	...
17	1347	1143	800	1293	1255	1177	...	...
18	10081	9995	9849	10112	11013	9797	...	...
19	12037	12425	11710	12423	12145	11813	...	...
20	7021	6805	9001	9106	9173	7684	...	...
21	651	616	601	635	662	608	...	...

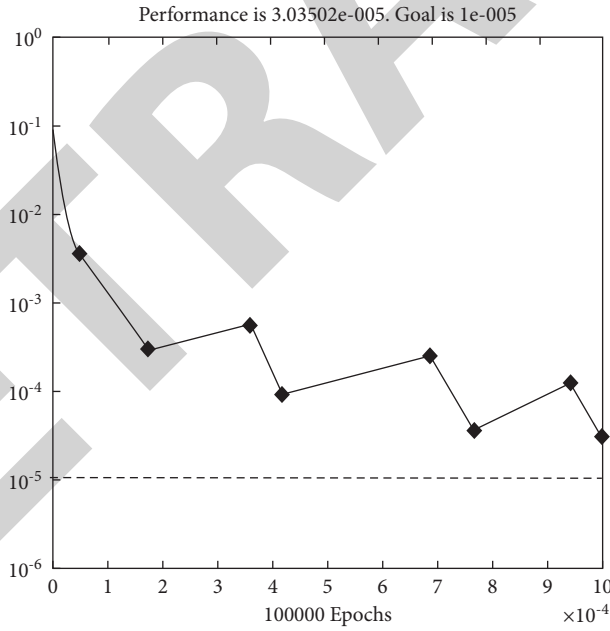


FIGURE 3: Network training result graph.

As shown in Table 4, the results of multimedia joint evaluation have small errors and achieve the expected results. Based on the existing network evaluation model, if

considering that the expected output value  $y_p$  of the network is difficult to obtain, then design "network comprehensive evaluation model input by noninstructors."

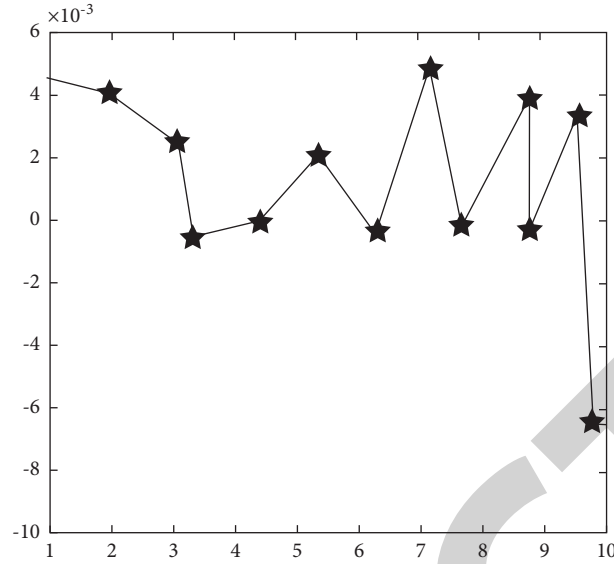


FIGURE 4: Error curve.

TABLE 4: Comparison of calculation results of comprehensive benefit evaluation and multimedia collaborative evaluation.

Project number	Sort	Comprehensive benefit value	Network evaluation value	Project number	Sort	Comprehensive benefit value	Multimedia collaboration evaluation value
1	19	0.5649	0.5704	16	22	0.514	0.5151
2	7	0.6814	0.6869	17	18	0.5791	0.5798
3	4	0.8128	0.8145	18	6	0.6916	0.6932
4	15	0.5877	0.5883	19	9	0.6749	0.6784
5	5	0.7975	0.801	20	10	0.6721	0.6699
6	2	0.9165	0.9162	21	21	0.5288	0.5289
7	13	0.608	0.6147	22	23	0.5067	0.5074
8	27	0.3946	0.392	23	16	0.58	0.5825
9	17	0.5802	0.5852	24	25	0.4898	0.4914
10	29	0.3776	0.3692	25	24	0.4967	0.497
11	27	0.4178	0.4164	26	14	0.5963	0.5997
12	12	0.6151	0.6198	27	1	1.101	1.0689
13	20	0.5383	0.5388	28	8	0.6761	0.6673
14	3	0.8586	0.8603	29	11	0.6518	0.6503
15	26	0.4274	0.4282	30	30	0.101	0.1297

## 6. Conclusions

Based on the evaluation index system of multimedia collaborative architectural design quality, the fault tolerance, and scalability, system security and information delay of wireless multimedia sensor network are evaluated and analyzed in detail to achieve real-time reduction and improve the particle swarm optimization algorithm. Its inherent fault tolerance and scalability are verified. This paper effectively combines the characteristics of the particle swarm optimization algorithm and the multimedia collaborative building itself to evaluate and analyze the domestic multimedia collaborative building design quality. The research we conducted is to combine the intelligence of the group with other evolutionary computing technologies, have independent intellectual property rights, and jointly develop a visual environment that supports innovative design.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The author declares no conflicts of interest.

## Acknowledgments

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