DBSCAN Algorithm in Creation of Media and Entertainment: Drawing Inspiration from TCM Images

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***Abstract*—This study proposes a TCM culture communication data clustering division and classification method that is based on an enhanced DBSCAN clustering algorithm and an ELM model. The objective is to address the issue of Traditional Chinese Medicine (TCM) culture communication image role product design. Firstly, for the problem of extracting feature vectors of TCM cultural communication, we analyse the path of communication role product design, design the product design scheme of TCM cultural communication image role, and extract the feature vectors of TCM cultural communication; secondly, for the problem of clustering and classifying the health data of TCM, we propose a method of clustering and classifying the health data of TCM based on the SCSO-DBSCAN clustering algorithm by combining the DBSCAN clustering algorithm with the sandcat swarm optimization algorithm. Finally, the TCM cultural dissemination data clustering classification and classification methods are tested and analyzed using TCM cultural dissemination data. This problem of TCM health data clustering classification is addressed by combining the ELM network algorithm, and a classification method of TCM cultural data dissemination based on the ELM model is proposed. The experimental results demonstrate that the method proposed in this study enhances the accuracy of TCM health data clustering division and also improves the accuracy of TCM cultural data communication classification, in comparison to other algorithms used for TCM cultural communication data clustering division and classification.**

***Keywords*—DBSCAN algorithm; TCM cultural communication; picture character product design; sand cat swarm optimization methodology**

I. Introduction

Hospitals have developed a system by creating a basic database that focuses on Traditional Chinese Medicine (TCM) electronic medical records and electronic prescriptions. This has been done under the backing of the "Internet + TCM health service action" program. A vast number of TCM data resources are accumulated as a result of this procedure, which links the data of every hospital diagnostic and treatment connection [1]. Inaccurate diagnostic data may result in cancer patients being misdiagnosed as healthy, leading to a delay in their treatment and missing the optimal moment for intervention. This can potentially pose life-threatening risks [2]. Traditional Chinese Medicine (TCM) has played a significant role in the advancement of medical science for thousands of years. It has made important contributions to the flourishing of the Chinese people and has had a positive impact on the progress of world civilization. TCM also plays a crucial role in promoting health and healthcare by providing valuable health data. The division of health and error TCM data in TCM data resources is an important trend in the development of TCM cultural communication image role product design. This not only enhances the high-quality development and revitalization of TCM but also encourages individuals to change their perception of healthy living and behavior [3].

The development of TCM cultural communication image role product design study primarily focuses on data clustering, health data classification optimization, health data communication application, product design assessment, and other related areas. Some examples of data clustering division algorithms include K-means, DPC, DBSCAN, and others. Health data categorization optimization often involves techniques such as LSSVM, BP, deep learning, and others. The study primarily focuses on evaluating the design of health data dissemination applications and products. This is done by constructing an indicator system for health data dissemination applications and utilizing an agent model to characterize the link between the indicator value and analysis level. Lu et al. [4] analyzed China's Traditional Chinese Medicine (TCM) health communication model from social, economic, political, and cultural perspectives. Xie et al. [5] explored the challenges of TCM communication in the era of rapidly changing media and proposed a new approach to communicating TCM culture. Lei et al. [6] conducted a study on selecting and classifying data features in the field of TCM to enhance classification accuracy for imbalanced data. Wang et al. [7] analyzed TCM-related data through literature analysis to inform TCM business management, TCM practices, acupuncture, and ancient books. Eckman and Guo [8] investigated a method for dividing TCM data using the K-means clustering algorithm. Novikov et al. [9] examined strategies for improving the effectiveness of TCM health information dissemination based on an exhaustive likelihood model. The current research on the image role product design of TCM cultural communication has identified several problems. Firstly, there is a lack of comprehensive analysis on the impact of TCM health information dissemination, an incomplete index system, and a lack of theoretical guidance. Secondly, there is a scarcity of quantitative research on TCM health information. Lastly, there is limited research on the integration of intelligent algorithms and TCM health data.

Due to advancements in intelligent algorithms and computational arithmetic, experts and scholars in the field are increasingly focusing on the research of TCM health data clustering division, health data classification optimization, health data dissemination application, and product design evaluation combined with intelligent algorithms [10, 11]. This study introduces a technique for analyzing TCM health data using the DBSCAN algorithm, with a specific focus on using intelligent algorithms in the product design of TCM cultural communication picture characters. Initially, we examined the role of communication in product design and developed a product design plan for the representation of TCM cultural communication using machine learning algorithms. We also introduced a clustering method based on an enhanced DBSCAN algorithm for organizing TCM health data and a classification method based on the ELM model for disseminating TCM cultural data. The suggested technique is used in the examination of TCM health data, and alternative models are assessed and scrutinized to validate the efficacy of the proposed method.

The study is organized as follows: First, we analyze the significance and design strategy of TCM image role product creation. Then, we propose a clustering method based on the SCSO-DBSCAN algorithm to effectively divide TCM health data into healthy and unhealthy categories. This is followed by a preprocessing and annotation module to standardize and prepare the data. Next, we develop a classification model using the ELM algorithm to map health data features to communication product types. Finally, we validate the proposed methods through comparative experiments with multiple algorithms, demonstrating improvements in clustering accuracy and classification performance. The results confirm the effectiveness and practicality of the proposed approach in enhancing TCM cultural communication.

II. Design of TCM Cultural Communication Image Role

A. Significance of the Product Design Process

The product design of its communication image character plays a crucial role in enhancing the worldwide impact of Traditional Chinese Medicine (TCM) and strengthening the cultural identity [12]. When designing, one can consider the following aspects (Fig. 1): 1) incorporating cultural symbols; 2) recreating historical characters; 3) blending modern aesthetics with tradition; 4) incorporating storytelling and interactivity; 5) designing for multiple platforms; and 6) incorporating educational and science popularization functions.

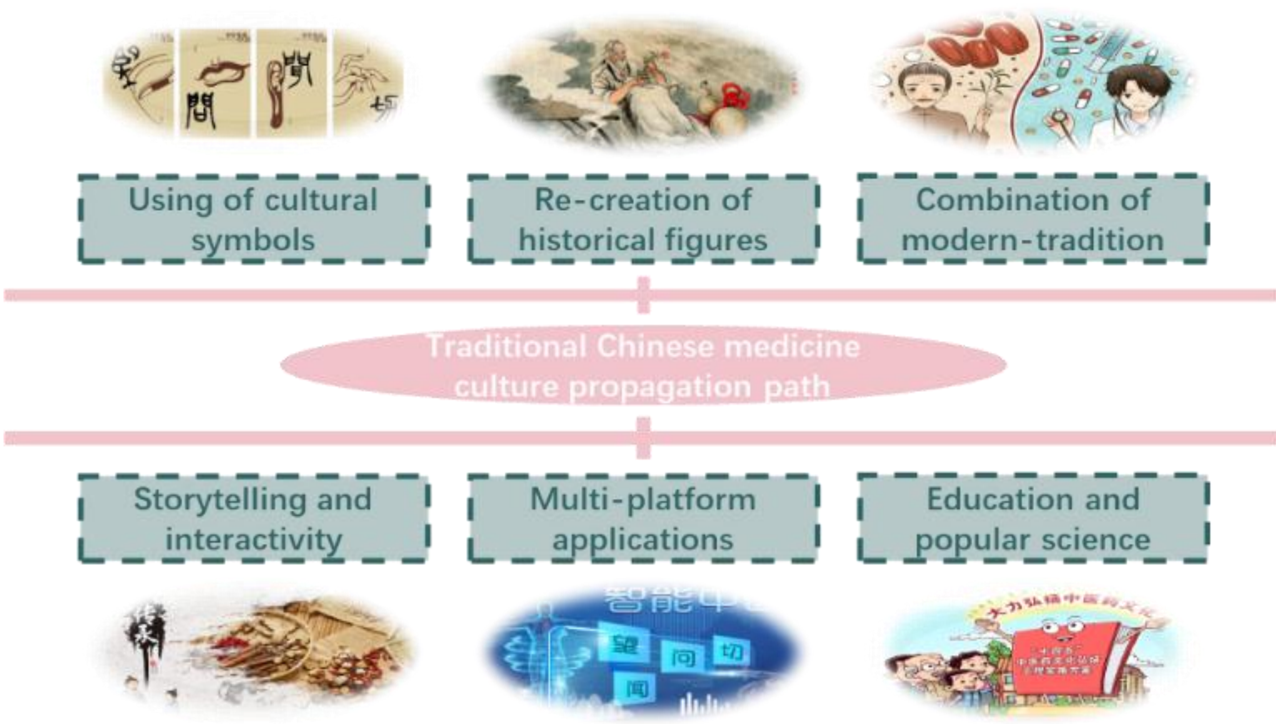

Fig. 1. TCM cultural communication role, product design pathway

B. Program Design

Following the principles of practicability, scientificity, systematicity, expandability, and open compatibility (as shown in Fig. 2), this study proposes a product design scheme for TCM cultural communication image using intelligent algorithms, as depicted in Fig. 3. The program examines the issue of product design in TCM cultural communication, explores the role of product design in communication, develops a TCM health data analysis program, extracts the feature vector of TCM information, clusters and categorizes the health and unhealthy data, preprocesses and annotates the categorized data, creates a learning and training dataset, and establishes a classification system for TCM cultural data communication through learning and training. The TCM dissemination categorization model is designed to accomplish intelligent spread of TCM culture by facilitating the product creation process.

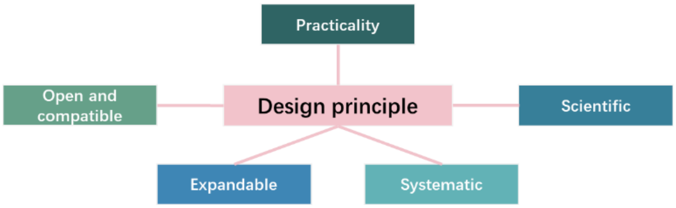

Fig. 2. Principled design.

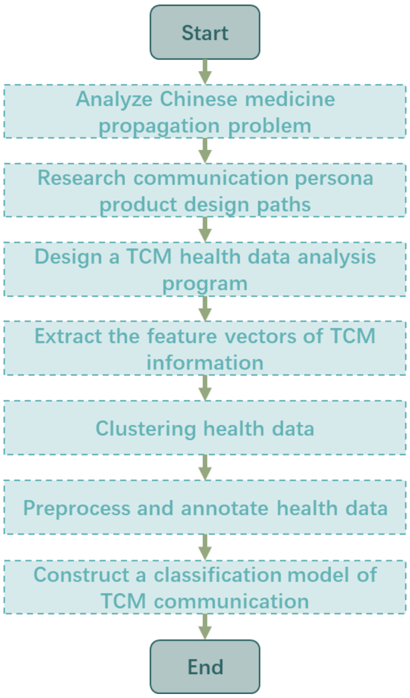

Fig. 3. Flow chart of intelligent algorithms

The proposed method in this study for designing TCM cultural communication image characters is based on an intelligent algorithm. It includes several modules such as data analysis, feature extraction, health data clustering division, data preprocessing annotation, and cultural communication classification. These modules are represented in Fig. 4.

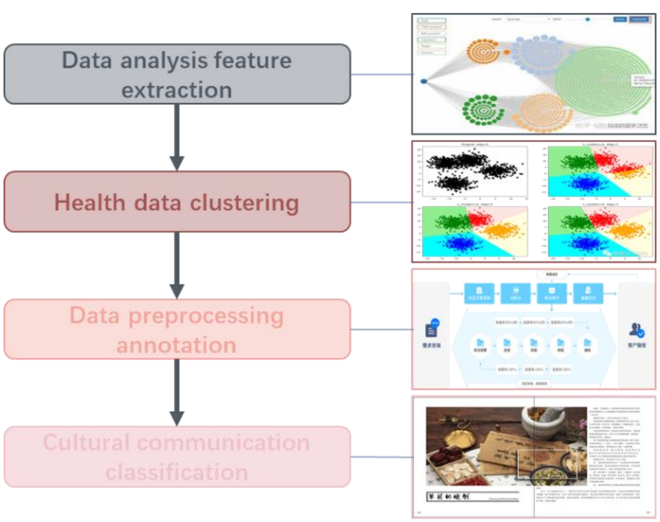

Fig. 4. Model representation of key issues.

1) Module for extracting features from data for analysis. The primary purpose of the data analysis feature extraction module is to develop a scheme for analyzing TCM cultural health data and extracting input feature vectors by examining the challenge of designing TCM cultural communication image role products from Fig. 5.

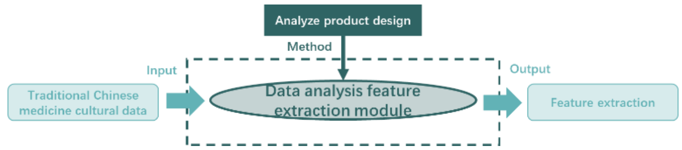

Fig. 5. Data analysis feature extraction module

2) Module for grouping health data. The health data clustering and division module primarily employs a clustering method to partition the Traditional Chinese Medicine (TCM) data into two categories: healthy data and unhealthy data. The input to this module is the feature vector data, and the output is the dataset that has been clustered and divided, as seen in Fig. 6.

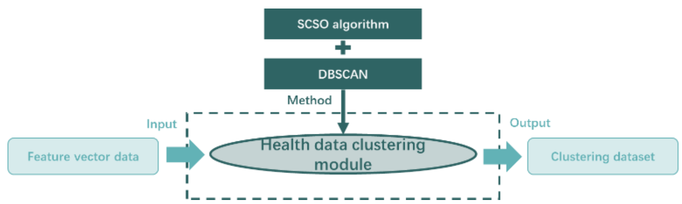

Fig. 6. Schematic diagram of the health data clustering and segmentation module

3) Data preprocessing labelling module. The primary function of the data preprocessing annotation module is to use the clustered data for performing tasks such as anomalous data processing, quantitative standardization, and annotation. The input to this module is the clustered data, and the output is the standardized TCM health information dataset, as seen in Fig. 7.

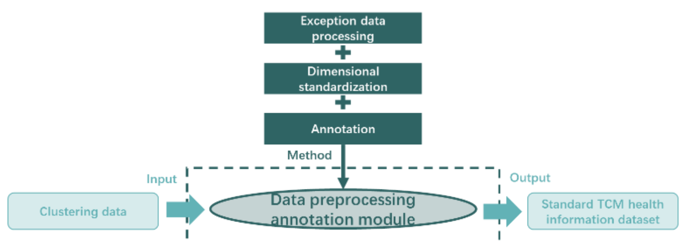

Fig. 7. Data preprocessing annotation module.

4) Cultural communication classification module. The primary purpose of the cultural communication classification module is to take in the TCM health standard dataset and utilize it to train the TCM cultural communication classification model. The input for this module is the TCM health standard dataset, and the output is the cultural communication classification model, as depicted in Fig. 8.

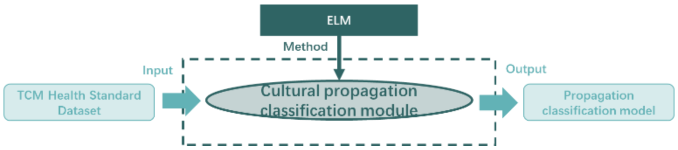

Fig. 8. Cultural communication classification module

III. Clusters using SCSO-DBSCAN

This part employs the sand cat swarm optimisation technique to enhance the DBSCAN clustering algorithm for the purpose of clustering and splitting TCM health data, hence addressing the issue at hand.

A. *SCSO-DBSCAN Clustering Algorithm*

1) DBSCAN clustering algorithm. DBSCAN, short form of Density-Based Spatial Clustering of Applications with Noise, is an algorithm used for clustering in a multidimensional space. It is capable of identifying clusters of various forms and effectively handling noise points. The algorithm does not necessitate the user to predefine the number of clusters, but instead identifies the cluster boundaries by examining the density of the data points.

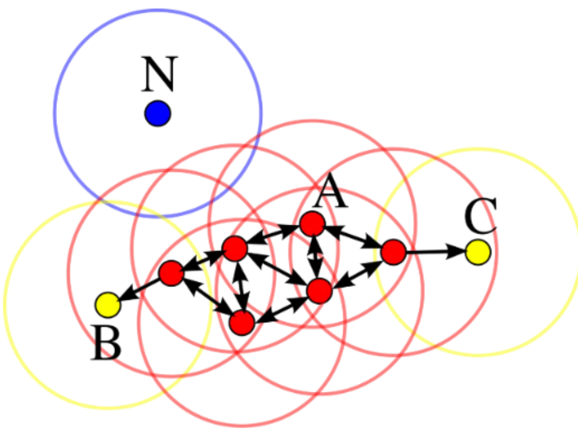

Fig. 9. DBSCAN clustering algorithm

The fundamental principles of DBSCAN encompass core, boundary, and noise points [13]. A core point is a point that is encompassed by an adequate number of neighboring points. A boundary point is a point that does not entirely meet the criteria of a core point but is situated in the vicinity of a core point. A noise point is neither a core point nor an isolated point, as depicted in Fig. 9.

a) Theory of DBSCAN algorithm: DBSCAN leverages a collection of neighborhoods to quantify the proximity of a set of samples, and the parameters (ϵ, MinPts) are used to characterize the proximity of the sample distribution inside the neighborhood [14], as seen in Fig. 10. ϵ is the distance threshold for a certain sample's neighborhood, whereas MinPts represents the threshold for the minimum number of samples in the neighborhood of a given sample within the distance ϵ.

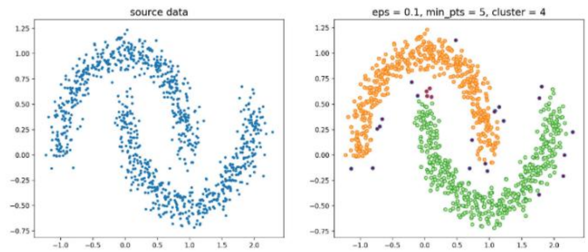

Fig. 10. Theory of the DBSCAN clustering algorithm

Assuming the sample set $D=(x_1,x_2,\cdots,x_m)$, the DBSCAN specific density is described as follows [15]:

- ϵ-neighbourhood: for $x_j \in D$, its ϵ-neighbourhood contains the subset of the sample set D whose distance from x_j is not greater than ϵ, i.e., the number of this subset is denoted as $\left|N_{\epsilon}(x_j)\right|$.
- Core object: for any sample x_j, if its ϵ-neighbourhood corresponding to $\left|N_{\epsilon}(x_j)\right|$ contains at least MinPts each sample, i.e. if $\left|N_{\epsilon}(x_j)\right| \geq MinPts$, then x_j is a core object.
- Density Direct: x_i is said to be density direct from x_j if x_i is in the ϵ-neighbourhood of x_j and x_j is a core object.
- Density reachable: for x_i and x_j, x_j is said to be density reachable by x_i if there exists a sample sequence $p_1,p_2,\cdots,p_T$ that satisfies $p_1=x_i$ and $p_T=x_j$ and p_{t+1} is density direct from p_t.
- Density connected: For x_i and x_j, x_i and x_j are density connected, i.e., symmetry is satisfied, if there exists a core object sample x_k such that x_i and x_j are density reachable from x_k.

b) DBSCAN algorithm pseudo-code: According to the principle of DBSCAN algorithm, its detailed pseudo-code is shown in Fig. 11.

```
Algorithm 1: DBSCAN clustering algorithm
Initialize core objects set: Ω=Ø
For j=1,2,···,m do
    Determine xj ε neighborhoods;
    If |Nε(xj)|≥MinPts then
        Add xj to core objects set: Ω=Ω∪{xj}
    End if
End for
Initialize clustering number: k=0
Initialize sample no-visited set: Γ=D
While Ω≠Ø do
    Record sample no-visited set: Γold=Γ;
    Select randomly a core object o∈Ω, initialize queen Q=<o>;
    Γ=Γ\{o};
    While Q≠Ø do
        Select first sample q of queen Q;
        If |Nε(q)|≥MinPts then
            Δ=Nε(q)∩Γ;
            Add sample of Δ to Q;
        End if
    End while
    k=k+1, and generate clustering Ck=Γold\Γ; Ω=Ω\Ck
End while
Output clustering results.
```

Fig. 11. Pseudo-code of the DBSCAN clustering algorithm.

c) Evaluation of DBSCAN algorithm parameters: The effectiveness of the DBSCAN algorithm relies heavily on two crucial parameters (Fig. 12): eps (ϵ-neighbourhood radius). The ϵ-neighbourhood refers to the set of points that are believed to be closely linked to a given point. It helps identify the range of neighbors for that point. On the other hand, the min_samples parameter specifies the minimum number of sample points required for a point to be classified as a neighbor. Defines the minimal number of adjacent points necessary for a point to be classified as a core point.

d) Application of the DBSCAN method: The DBSCAN technique is well-suited for many data analysis situations, particularly when the dataset includes noise or clusters with irregular shapes [16]. The technology has a diverse variety of uses in the study of geographical data, picture segmentation, and anomaly detection [17], as seen in Fig. 13.

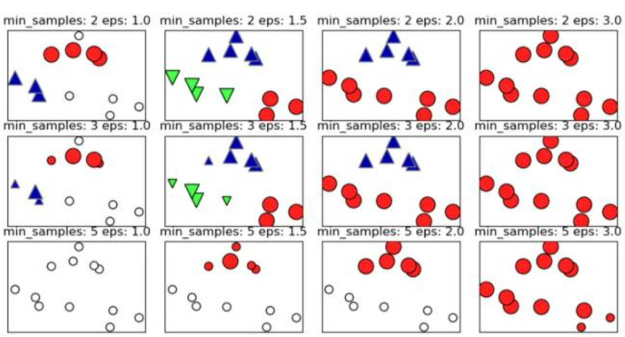

Fig. 12. Optimisation scheme for key parameters of DBSCAN clustering algorithm

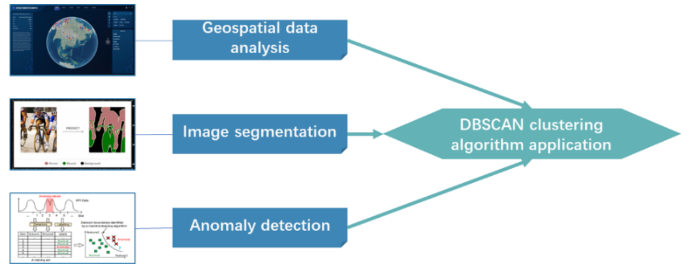

Fig. 13. Application of the DBSCAN clustering algorithm

2) SCSO-DBSCAN clustering algorithm

3) SCSO algorithm: Sand Cat Swarm Optimization (SCSO) is a recently developed optimization technique inspired by nature. The SCSO algorithm is based on the hunting behavior of sand cats, specifically their skill in detecting low-frequency noise to locate prey above or below ground. This algorithm effectively solves optimization problems by simulating the sand cats' ability to explore globally and exploit local opportunities [18].

The SCSO algorithm has two primary stages: global exploration, which involves looking for prey, and local mining, which involves assaulting prey. These stages are shown in Fig. 14. During the global exploration phase, the algorithm identifies prospective locations of high quality by imitating the thorough search behavior of a sand cat. In the local mining phase, the algorithm refines the search route to identify the best possible answer by mimicking the focused assault strategy of a sand cat. The objective of this algorithm design is to achieve a balance between the capacity to search globally and the ability to optimize locally. This will enhance the efficiency of the search process and prevent early convergence to a suboptimal solution.

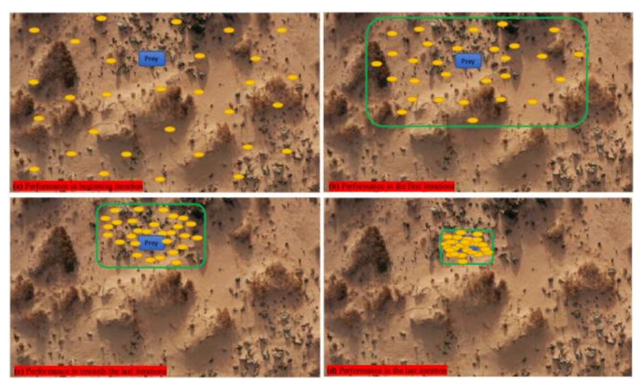

Fig. 14. Role of SCSO algorithm stages.

a) Initialisation: From Fig. 15, the SCSO algorithm generates some random solutions, i.e., sand cat individuals, in the problem space, which are computed as follows:

$$X_{ij} = lb_j + rand\left(ub_j - lb_j\right) \tag{1}$$

where, N is the population size; D is the dimension of the problem; ub_j and lb_j are the upper and lower bounds of the jth dimension variable, respectively; X_{ij} denotes the jth dimension variable for the ith sand cat; $i=1,2,\cdots,N$, $j=1,2,\cdots,D$.

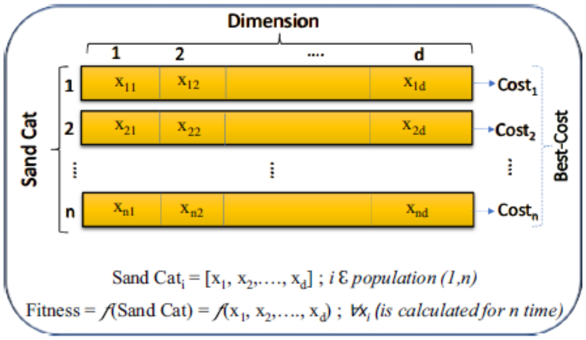

Fig. 15. Schematic diagram of the initialisation of the SCSO algorithm.

b) Parameter setting: The search for prey by sand cats relies on the release of low-frequency noise. R is used to control the search and attack phase of the sand cat swarm algorithm, which is mainly guided by the sand cat's sensitivity range r_G , which is calculated as follows:

$$R = 2 \cdot r_G \cdot rand - r_G \tag{2}$$

$$r_G = s_M - \left(\frac{s_M \cdot t}{T_{\max}} \right) \tag{3}$$

$$r = r_G \cdot rand \tag{4}$$

Among them, s_M indicates the auditory characteristics of sand cat, which is generally set to 2; t is the current iteration number; $T_{\max}$ is the maximum iteration number; the sensitivity range r_G decreases linearly from 2 to 0 with the increase of iteration number, so that the individual sand cat gradually approaches the prey it is searching for; r indicates the sensitivity of girl paper sand cat; rand is a random number.

c) Searching for prey: When $|R|>1$, the sand cat starts searching for prey and keeps approaching to the prey based on the best candidate position in the current population $P_{bc}(t)$, the current position $P_c(t)$, the sensitivity range r and the random number of updated sand cat individuals. The specific update mathematical model is:

$$P(t+1) = r\left(P_{bc}(t) - rand \cdot P_c(t)\right) \tag{5}$$

d) Attacking prey: When $|R| \le 1$, the sand cat carries out the attack on the prey, based on the random position of the optimal position and the current position, and then randomly chooses the angle by roulette method to achieve the attack on the prey. The specific model is as follows:

$$p = \left| rand \cdot P_b(t) - P_c(t) \right| \tag{6}$$

$$P(t+1) = P_b(t) - r \cdot p \cdot \cos(\theta) \tag{7}$$

Assuming that the sand cat sensitivity range is a circle, the position is updated during the iteration process as shown in Fig. 16.

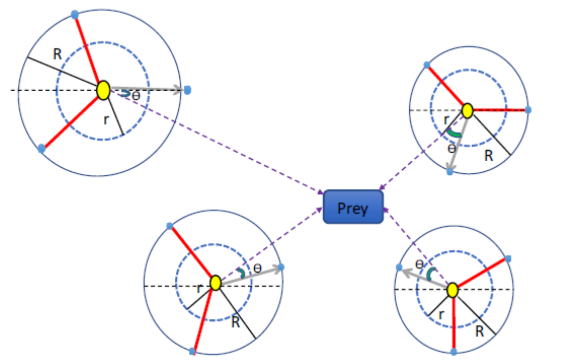

Fig. 16. Diagram of SCSO algorithm search

The optimization method of the SCSO algorithm is shown in Fig. 17, which displays the pseudo-code of the algorithm.

```
Algorithm 2: SCSO algorithm
Initialize sand cat swarm population;
Initialize r, rG, R;
Calculate the fitness function based on the objective function;
While t<=Tmax
    Get a random angle based on Roulette Wheel Selection;
    If abs(R)<=1
        Update search agent position based on searching prey strategy;
    Else
        Update search agent position based on attacking prey strategy;
    End
    t=t+1;
End
```

Fig. 17. Pseudo-code of the SCSO algorithm.

The SCSO method has been used in several domains, such as engineering optimization issues, multi-objective optimization problems, and particular data processing tasks like wind power data forecasting and load data forecasting [19-20] (Fig. 18). Researchers have empirically shown that the SCSO algorithm exhibits superior performance and competitiveness in addressing these issues.

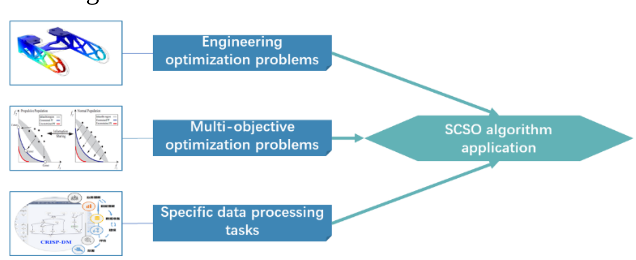

Fig. 18. Application of SCSO algorithm

4) SCSO-DBSCAN algorithm. To enhance the accuracy of clustering division for TCM health data, this part utilizes the SCSO algorithm to optimize the parameters of the DBSCAN clustering algorithm. The optimized method is then used for clustering analysis of TCM health data. The specific structure diagram is shown in Fig. 19. The DBSCAN clustering algorithm first processes the eps (ϵ-neighbourhood radius) and min_samples (minimum number of sample points) using the real number coding technique [21]. The fitness value function is then determined by calculating the distance of the data samples to the cluster center.

$$F(x, c_i) = \sqrt{\sum_{j=1}^{d}\left(x_j - c_{i,j}\right)^2} \tag{8}$$

where, x is the sample of TCM health data and c_i denotes the ith clustering centre.

According to the SCSO algorithm coding method and fitness value function, the specific pseudo-code of SCSO optimised DBSCAN clustering algorithm is shown in Fig. 20.

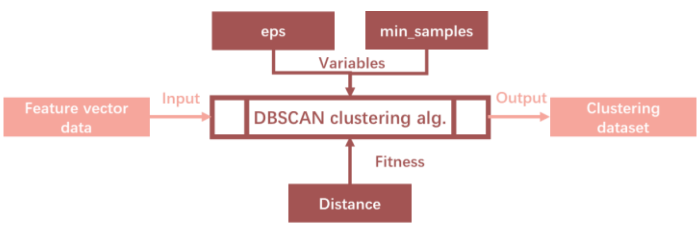

Fig. 19. Structure of the SCSO-DBSCAN algorithm

Algorithm 3: SCSO-DBSCAN clustering algorithm
Determine optimized variables, including eps, min_samples;
Set SCSO algorithm parameters;
Encode sand cat population based on real number encoding method;
Calculate fitness using distance, and update best sand cat position;
While t<=Tmax
Get a random angle based on Roulette Wheel Selection;
Update sand cat position using searching and attacking prey strategies;
t=t+1;
End
Output best parameters of DBSCAN clustering algorithm;
Build SCSO-DBSCAN clustering algorithm.

Fig. 20. SCSO-DBSCAN algorithm pseudo-code.

B. *TCM Health Data Clustering*

In conjunction with SCSO-DBSCAN technology, this study suggests a clustering and division method for TCM health data that is based on the SCSO-DBSCAN model. Fig. 21 illustrates the process of application. The approach uses the TCM cultural communication image role product design issue analysis to extract the indicator feature vector. It then utilizes the SCSO-DBSCAN algorithm to cluster and categorize the TCM health data into healthy and unhealthy data.

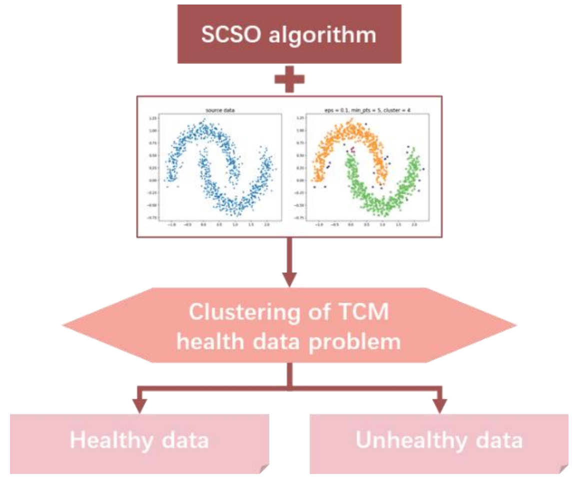

Fig. 21. Application of SCSO-DBSCAN algorithm in clustering and segmentation of TCM health data

IV. Data Dissemination Combined with ELM Models

A. *ELM Modelling*

1) Principles of the ELM model. ELM (Extreme Learning Machine) [22, 23] is a single hidden layer feed-forward neural network model, which is known for its fast learning ability and good generalisation performance. The core idea of ELM is to introduce random weights between the hidden layer and the output layer, and to achieve efficient training through the least-squares approximation method (Fig. 22). In the ELM model, the weights and biases of the hidden layer are randomly initialised and do not require iterative training like traditional neural networks, which greatly speeds up the training of the model. The weights of the output layer can be calculated by parsing formulae, which further simplifies the training process of the model.

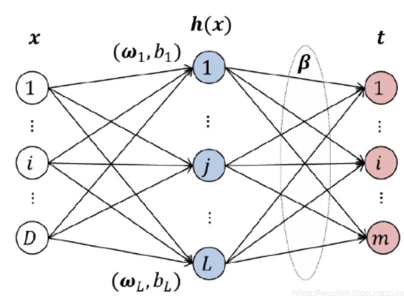

Fig. 22. ELM model structure.

2) ELM application analysis. ELM models have a wide range of applications in several fields, including but not limited to data regression prediction, classification tasks, signal processing, image recognition, financial prediction, medical diagnosis, etc [24] (Fig. 23). Due to its fast training and strong generalisation ability, ELM is particularly suitable for handling large-scale datasets and complex nonlinear problems.

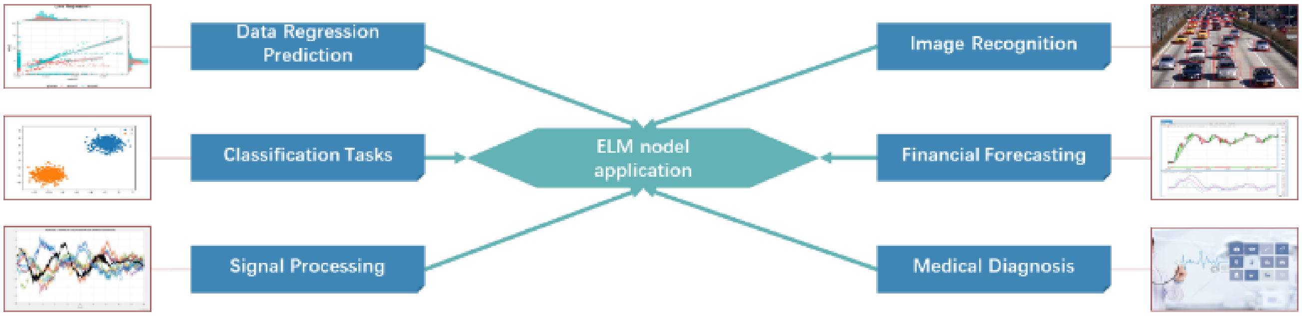

Fig. 23. Application of ELM in the dissemination of data classification of TCM culture.

B. Classification of Cultural Data Dissemination in TCM

In order to design TCM cultural communication image role products and improve the accuracy of TCM cultural data communication classification, this study proposes a TCM cultural data communication classification method based on the ELM model, and the specific application process is shown in Fig. 24. The method obtains the TCM cultural health communication classification model by learning to train the TCM cultural health dataset (which has been annotated), and constructing the mapping relationship between the TCM cultural communication feature values and the communication product types using the ELM model.

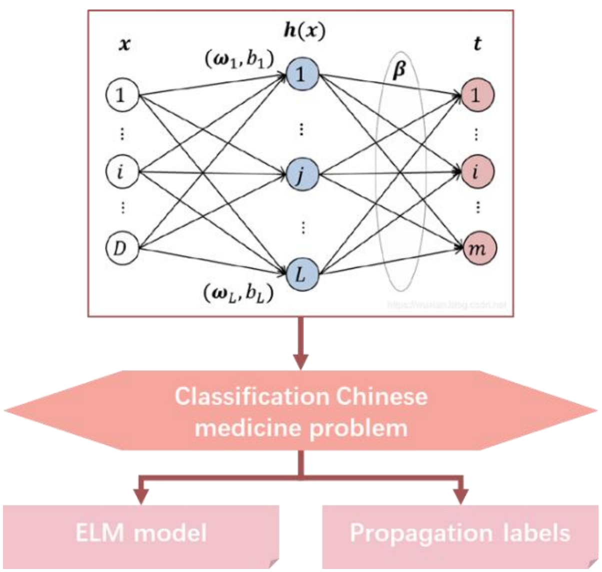

Fig. 24. Application of ELM in the dissemination of data classification of TCM culture

V. Verification Analysis

A. Experimental Setup

In order to verify, this study proposed TCM culture communication image role product design algorithm and application. This study experiments in the Win11 system environment running software Matlab2021a programming software on the literature [4] in the TCM data for clustering analysis and communication product classification model construction.

In the experiment of clustering division of TCM data, this study uses K-means [25], fuzzy clustering [26], Gaussian hybrid clustering [27], DBSCAN, and SCSO-DBSCAN clustering algorithms for comparative analysis, and the comparative algorithms' parameter settings are shown in Table I. The maximum number of iterations of the SCSO algorithm is 1,000, the number of populations is 100, and the range of the sensitivity is from 0 to 2. The stage control range is $\left[-2r_G, r_G\right]$.

TABLE I PARAMETER SETTINGS OF THE ALGORITHM FOR COMPARISON OF CLUSTERING AND SEGMENTATION OF TCM DATA

No.	Clustering algorithm	Para. settings
1	K-means	N_cluster=4
2	FCM	N_cluster=4
3	GMM	Means=0, STD=1, N_cluster=4
4	DBSCAN	Eps=0.5, Min_samples=5
5	SCSO- DBSCAN	No

In the classification experiment of TCM cultural data dissemination, SVM [28], BP [29], and ELM models are used for comparative analysis in this study. The number of hidden layers of the ELM model is 100, and the number of hidden layers of the BP network is 50.

In order to verify that the SCSO algorithm can improve the clustering delineation accuracy of TCM data based on the DBSCAN algorithm, this study adopts the SCSO algorithm to optimise the eps (ϵ-neighbourhood radius) and min_samples (the minimum number of sample points) of the DBSCAN clustering model, and the specific optimisation variable range is set as shown in Table II.

TABLE II DBSCAN CLUSTERING ALGORITHM TO OPTIMISE PARAMETER DECISION RANGE SETTING

No.	Variables	Range settings
1	Eps	[0.1, 0.9]
2	Min_samples	[2,10]

B. Analysis of Experimental Results of Clustering and Classification

In this study, K-means, fuzzy clustering (FCM), Gaussian mixture clustering (GMM), DBSCAN clustering, and SCSO-DBSCAN clustering algorithms are used to cluster and divide the TCM data, and the specific results of clustering and division are shown in Fig. 25 and Fig. 26.

Fig. 25 gives a comparison of the results of clustering delineation of TCM data with different clustering algorithms. In

Fig. 25, in terms of accuracy rate (ACC), the accuracy rate of TCM data clustering division based on SCSO-DBSCAN clustering algorithm is the highest, which is 0.876; in terms of true-positive rate (PP), the true-positive rate of TCM data clustering division based on SCSO-DBSCAN clustering algorithm is the highest, which is 0.971; and SCSO-DBSCAN clustering algorithm is the highest in terms of sensitivity (SEN) and F-score (F-Score) is the highest, 0.938 and 0.953, respectively.

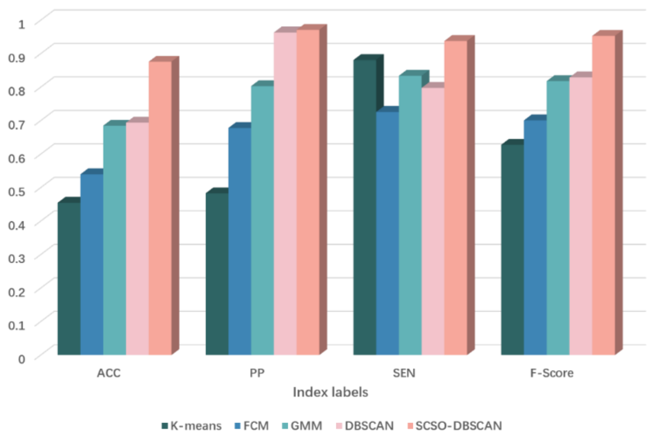

Fig. 25. Comparison of clustering results of different clustering algorithms for TCM data classification

The optimisation iteration curve of the SCSO optimisation algorithm for the DBSCAN clustering algorithm is given in Fig. 26. The SCSO algorithm optimises the DBSCAN clustering algorithm to converge at 800 iterations, converging to about 0.93.

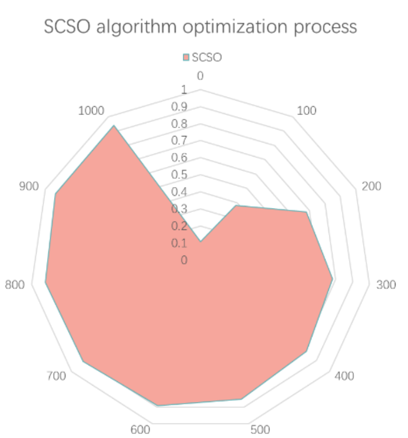

Fig. 26. Optimisation iteration process of SCSO optimisation algorithm for the DBSCAN clustering algorithm.

C. Analysis of the Results of the Experimental Classification

Taking the results of TCM data clustering division as the call-in, SVM, BP and ELM models were used to classify and predict the TCM cultural data dissemination, and the specific results are shown in Fig. 27 and Fig. 28.

Fig. 27 gives a comparison of the results of TCM cultural data dissemination with different classification models. In terms of precision, recall, and F1-score, the ELM model has the highest classification results, which are 0.9527, 0.9299, and 0.9411, respectively.

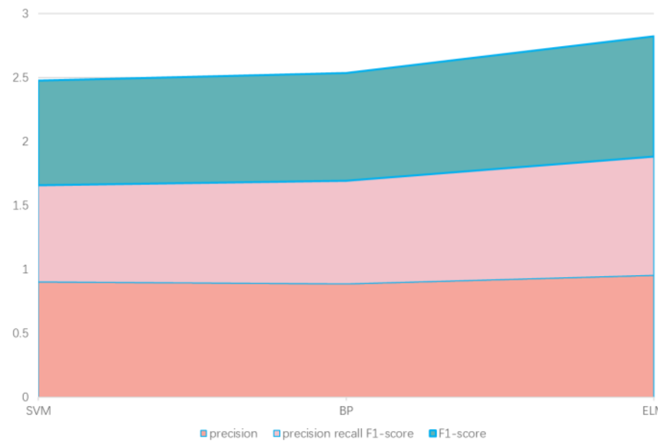

Fig. 27. Comparison of the results of different algorithms for the dissemination of TCM culture data

Fig. 28 gives a comparison of the time-consuming results of different algorithms for TCM cultural data dissemination. The time-consuming data dissemination of TCM culture based on the ELM model is the smallest, and the time-consuming data dissemination of TCM culture based on the BP model has the smallest variance.

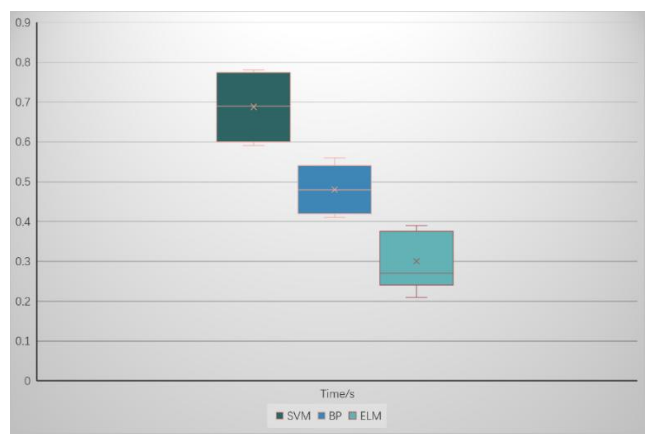

Fig. 28. Comparison of time-consuming results of different algorithms for TCM cultural data dissemination

VI. Conclusion

Aiming at the TCM cultural communication role product design problem, combining the SCSO-DBSCAN algorithm and ELM algorithm, this study proposes a TCM clustering division method based on the SCSO-DBSCAN algorithm and a TCM communication data dissemination classification method based on the ELM model. This method analyses the TCM cultural communication role product design problem, extracts the TCM cultural communication vector, takes the distance from data samples to the clustering centre as the fitness value function, and takes the eps (ϵ-neighbourhood radius) and min_samples (the minimum number of sample points) of the DBSCAN algorithm as the decision-making variant, and constructs the clustering delineation method based on the SCSO-DBSCAN algorithm for TCM; around the TCM clustering delineation results, using the

ELM model to construct classification model; using TCM culture data to validate the SCSO-DBSCAN algorithm and ELM algorithm for analysis. The experimental results show that the method proposed in this study can accurately classify the healthy and unhealthy data of TCM and can quickly and accurately classify the predicted communication products.

ACKNOWLEDGMENT

This research is supported by Ministry of Education Industry-University Co-operation Collaborative Education Project, Grant No.230724445907289；Ministry of Education Industry-University Co-operation Collaborative Education Project, Grant No. 230723434707241；Sichuan UAV Industry Development Research Centre, Grant No. SCUAV22-B010.

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