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## Based on clustering analysis, the research development of Chinese martial arts in northern Europe

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### ABSTRACT

Today's China is playing an increasingly important role in the world. China's traditional culture by the attention of the world. Because the Chinese wushu has a broad mass base and xingshenjianbei national style, it is very popular in the countries all over the world. However, Chinese martial arts in the world development degree is not high. To make the spread of Chinese martial arts is wider, this paper takes the martial arts development of the five Nordic countries, for example, by using clustering analysis in the layered analysis will be divided into five countries generally good development degree and development degree of two classes, and the results were analyzed. Development degree of good country a total of two, Norway and Iceland, development degree generally there are three countries, Denmark, Sweden and Finland. Countries according to the geographical position, good development in the coastal areas, the development of general country is in inland.

### KEYWORDS

Chinese martial arts; Cluster analysis; Nordic countries; Development degree.



## INTRODUCTION

With Chinese national strength promotion, Chinese traditional culture has also become popular. Confucius institutes continue to organize in global. Until 2010, global has already 500 Confucius institutes and Confucius schools<sup>[1]</sup>. Chinese traditional culture passes along in global, and the traditional culture's impact on traditional sports is also deep-rooted. Such as, Hu Jian in 2003 "Discuss Chinese traditional sports ideology contents and features", he stated Lao Tz, Chuang Tz, Meng Tz's agreement on Qi constitutes life such thought<sup>[1-5]</sup>. Chinese traditional sports is particular about vigor, Qi, spirit and form four things integration<sup>[6-9]</sup>. Tai Chi is honored as first brand in world fitness. Tai Chi is a branch of Chinese martial arts, is fusion between Chinese classical philosophy and traditional medicine theory. It refines internally and externally, gentle and flexible, which has skillfully deflected state<sup>[10-13]</sup>.

In 2012, Liu Xiu-Ping in the article "Local cultural policies and regional martial arts development research", he stated "the fourth world traditional martial arts festival left one glorious page in world traditional martial arts sports history, which had positive and profound impact on impelling world traditional martial arts development<sup>[2]</sup>". In 2011, Xu Chun-Yi in the article "Chinese martial arts cross-cultural communication research", he pointed out "Martial arts barrier in international development<sup>[4]</sup>". In 2012, Liu Yong in the article "Chinese martial arts cultural international transmission status and development strategic research", he adopted "Frequency analysis and multiple dimensional frequency, correlation analysis and other methods to sort and make statistics on data<sup>[5]</sup>". Wang Lu-De in the article "Cluster analysis application into sports", he stated "Cluster analysis application into sports research, such as research on sports textbooks classification and select some representative classical events from many events and others<sup>[6,14]</sup>". In 2004, Yang Hui in the article "Principal component analysis and cluster analysis application in football competition comprehensive evaluation", use cluster analysis "verify main factors to football competition scientific comprehensive evaluations<sup>[7]</sup>".

After consulting lots of relative documents, it finds that cluster analysis hasn't appeared in Chinese martial arts transmission field. Chinese martial arts are representative in Chinese traditional sports, which is famous overseas as early as last century. Chinese martial arts transmission plays crucial roles in Chinese soft power promoting. The paper expands cluster analysis to martial arts transmission field. It generated result will produce profound impact on Chinese martial arts transmission.

## MODEL ESTABLISHMENTS

Chinese martial arts have a profound cultural background. It is a crystallization of Chinese previous people labor and wisdom that is Chinese nation excellent intangible cultural heritage, as Figure 1. Nowadays, Chinese martial arts are widely spread in the world. In international, Chinese martial arts have covered a mysterious veil for a long time, which let international friends feel magic. Therefore it leads to internationally Chinese martial arts learning tide. The paper makes cluster analysis of Nordic countries' martial arts clubs as objects, and combines with practical status to make suggestions on martial arts development.



**Figure 1 : The schematic of martial arts action  
DATA PROCESSING**

Nordic countries martial arts club status as TABLE 1, regional distribution is as Figure 2.

**TABLE 1: Nordic countries martial arts club status table**

Country	Population (ten thousand)	Amount of Budo clubs	Amount of Chinese martial arts clubs	Proportion accounts for total clubs%	Project occupied proportion per ten thousand people	Website has Chinese martial arts cultural introduction	Proportion%
Denmark	545	898	118	13.14	0.22	47	39.83
Norway	460	417	16	3.84	0.03	5	31.25
Finland	530	1388	115	8.29	0.22	88	76.19
Iceland	31	19	3	0	0.1	1	33.33
Sweden	910	1141	85	7.45	0.09	36	42.35
Total	2476	3863	337	0	0.14	177	0



**Figure 2 : The map of Nordic countries**

**CLUSTER ANALYSIS**

Cluster analysis also calls group analysis; it is a kind of multiple statistical methods in researching classification problems. Class actually is a set of similar elements. If it wants to cluster similar elements as one class, generally it should combine qualitative and quantitative analyses to make classification. In general, it selects elements numerous common indicators, analyzes elements indicators values to distinguish gap among elements, and so arrives at the purpose of classification. Because in real life, there are many classification problems, cluster analysis researches also become very important. Cluster analysis includes fast cluster, hierarchical clustering, and two step cluster. The model uses herarchical cluster.

Propose that set  $G$  has  $n$  pieces of samples  $X_1, X_2, \dots, X_n$ , firstly every sample independently forms into one class, calculate distance among samples in class, cluster nearest distance two classes into

one class. Then calculate new classes distances, and cluster nearest two classes variables into a class. Circulate in this way, till all classes variables cluster into a class variable. Correlation parameters explanation is as TABLE 2, analysis steps are as Figure 3.

TABLE 2 : Symbol explanatory table

Symbol	Explaining significance
$K$	Number of expected cluster centers
$\theta_n$	In a cluster, minimum sample amount that less than the number will not be used as an independent cluster
$\theta_s$	Cluster's sample single component standard deviation upper limits, if one cluster's samples single component standard variance maximum value is above the number, then it may break into the cluster center
$\theta_c$	Minimum distance between two cluster centers, if less than the number, combine two clusters
$L$	In one iteration process, maximum available combined cluster center's logarithms
$I$	Maximum iteration times

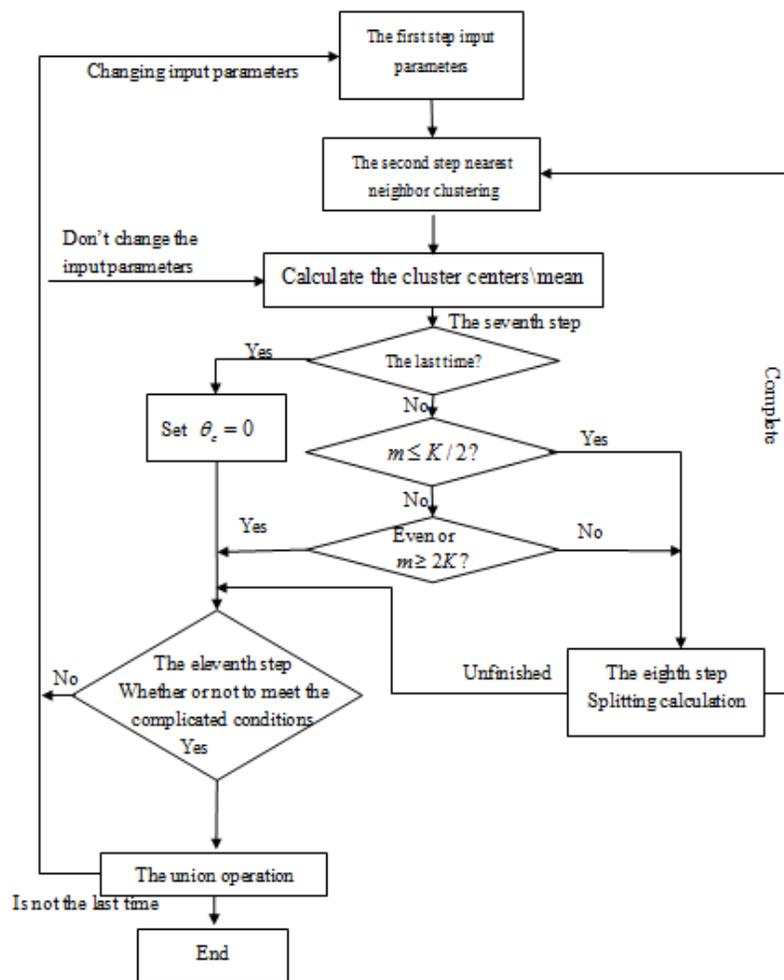


Figure 3 : Cluster analysis steps

Cluster analysis general steps ( $Q$  type classification) :

- (1) Every sample independently forms into class,  $G_i = \{X_i\}$  ( $i = 1, 2, 3, \dots, n$ ).

- (2) By distance matrix or similarity coefficient matrix  $D$ , it finds current minimum  $D_{ij}$ , and combine class  $G_i, G_j$  into one class and get a new class  $G_r = \{G_i, G_j\}$ .
- (3) Calculate distance among classes again, it gets new matrix  $D$ .
- (4) Repeat the step (2) till all are combined into one class.

Cluster analysis method divides into sin、com、med、cen、ave、fle、ward eight methods.

Analyze SPSS calculation result is as TABLE 3.

**TABLE 3 : Cases processing summary table**

Case					
Valid		Deficiency		Total	
N	Percentage	N	Percentage	N	Percentage
5	100.0	0	.0	5	100.0

a. Square Euclidean distance has already used  
 b. Average linkage ( among groups)

Hierarchical cluster also calls systematic cluster, the paper systematically clusters into condensed systematic cluster, in order to control variables, all adopt square Euclidean distance. Euclidean distance refers to two individuals' variable differences square sums square root, Euclidean distance formula is as following.

$$d_{xy} = \sqrt{\sum_{i=1}^n (x_i - y_i)^2} \tag{1}$$

Square Euclidean distance is:

$$d_{xy} = \sum_{i=1}^n (x_i - y_i)^2 \tag{2}$$

**TABLE 4 : Proximity matrix**

Case	Square Euclidean distance				
	1: 1.00	2: 2.00	3: 3.00	4: 4.00	5: 5.00
1: 1.00	.000	250754.000	242015.000	1052178.000	193484.000
2: 2.00	250754.000	.000	964431.000	342630.000	732398.000
3: 3.00	242015.000	964431.000	.000	2143275.000	209013.000
4: 4.00	1052178.000	342630.000	2143275.000	.000	2039474.000
5: 5.00	193484.000	732398.000	209013.000	2039474.000	.000

“Proximity matrix” TABLE 4 provides each variable proximity matrix, in Table 4, it uses wire frame to mark larger correlation coefficient some pairs of variables. In further analysis, they should be focused, or directly take proper pretreatment ( such as variable reduction ) to define two or more variables mutual dependent quantitative relations one kind of effective statistical analysis method.

**TABLE 5 : Cluster table**

Order	Cluster combination		Coefficient	Initially appear order cluster		Next order
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	1	5	193484.000	0	0	2
2	1	3	225514.000	1	0	4
3	2	4	342630.000	0	0	4
4	1	2	1197085.000	2	3	0

TABLE 5 description contents are as following:

Firstly combine sample 1 (Denmark) and 5 (Sweden) , their non-correlation coefficient is relative smallest that is 193484. In next combination is in the time of step two, sample 1 (Denmark) 、 5 (Sweden) 、 3 (Finland) compose into one class, it appears cluster, number of samples is 3, the rest can be done in the same manner.

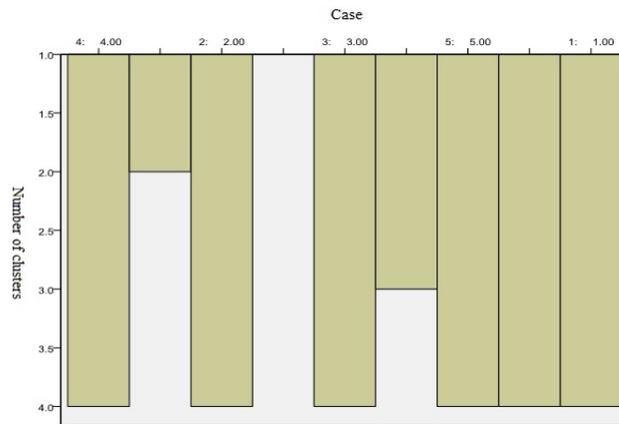


Figure 4 : The icicle figure of hierarchical clustering analysis

Figure 4 is“hierarchical cluster analysis icicle Figure”, is named because its shape is similar to cold winter period water is frozen into icicle. In“ Horizontal axis” Case represents clustered objects; In“ Vertical axis” Number of clusters represents it is clustered into some classes ; Observe “hierarchical cluster analysis icicle figure” should be seen from bottom line. In Figure 5 : clustered indicator 1 (Denmark) 、 2 (Norway) 、 3 (Finland) 、 4 (Iceland) 、 5 (Sweden) , see from bottom to up, when it clusters into 4 classes, 1 (Denmark) and 5 (Sweden) clusters to 1class, other cases self-form into 1 class; when clusters to 3 classes, 1 (Denmark) and 5 (Sweden) as well as 3 (Finland) group into 1 class, other cases self-form into 1 class, use white board to cover 3 classes from the bottom, it can see that as Figure 5.

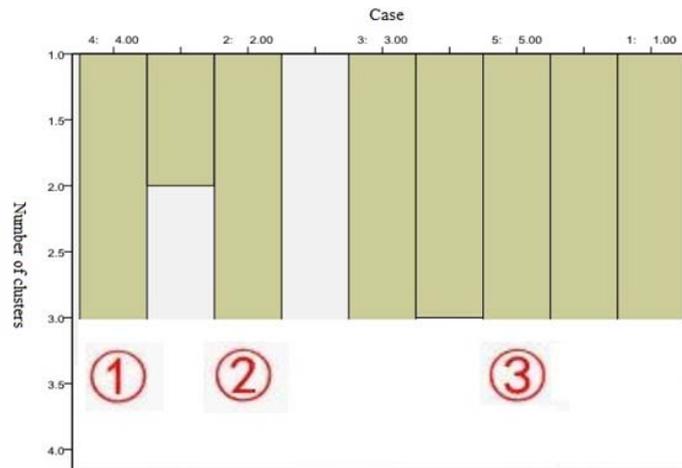


Figure 5 : The handling icicle figure of hierarchical clustering analysis

Cluster analysis tree figure (as Figure 4) provides every cluster analysis combination status, in order to easier describe, Figure 5 makes arrangement again, and it is famous because whole tree figure likes a lying tree.

Combine with cluster analysis tree Figure; it can see the cluster inter-group differences gets bigger, inter-group differences will get smaller. Cluster result is relative reasonable. From Figure 6, it can get that Chinese martial arts transmission impacts on 1 (Denmark) 、 5 (Sweden) 、 3 (Finland) each country is nearly the same. When make iteration for one time, 1 (Denmark) 、 5 (Sweden) 、 3 (Finland) intergroup distance is small that concludes into one class, when iteration order is 4 times, 2 (Norway) and 4 (Iceland) concludes into one class, it shows the two similarity is inferior to that of 1 (Denmark) 、 5 (Sweden) 、 3 (Finland) . When iteration times are 25 times, in Nordic countries, 1 (Denmark) 、 2 (Norway) 、 3 (Finland) 、 4 (Iceland) 、 5 (Sweden) to Chinese martial arts transmission impact problem, it can be concluded into one main class.

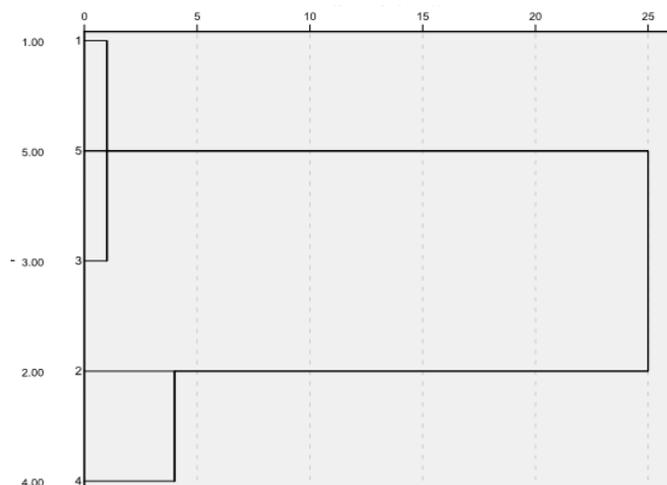


Figure 6 : The tree diagram of cluster analysis

### CONCLUSION

In this paper, clustering analysis method is used in the biggest advantage is intuitive, clear conclusions form, are pointed. In this paper, the use of the relatively small amount of data. But, when

the sample size is larger, want to get the clustering conclusion has the certain difficulty. Because of the similarity coefficient is based on experimental objects reflect, reflect the internal relations between the subjects index. But in real life, though occasionally can from the data obtained from the experimental objects reflect, found that the close relationship between them, but without any internal relation between things, at this time should be according to the professional knowledge to analyze the results of clustering analysis. This paper involves five sample size, small amount of data, so the results high accuracy and strong practicability.

Clustering analysis is based on the study of the characteristics of object according to certain standards of classification of object of study a mathematical algorithm in practical application. This method can make the data within the group with the highest similarity, but between groups of data with a relatively large difference. Clustering analysis of strong operability, wide application field. This paper concluded that developing countries with good levels of a total of two, respectively, Norway and Iceland, development degree, generally there are three countries, Denmark, Sweden and Finland. From Figure. 2 you can see that the development degree of good country in coastal areas, the development degree of general in inland areas. Therefore, in the future wushu dissemination process, need to pay special attention to the spread of the inland areas.

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