Applications Research of Cluster Analysis in Chinese Acupuncture Therapy

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Abstract: It is significant to improve the clinical therapeutic effect of Chinese acupuncture for an acupuncturist. Cluster analysis can classify the patient samples and help the acupuncturist to innovate the traditional acupuncture therapy under the concept of personalized treatment. This paper points out the concrete steps of the cluster analysis application in the improvement of the treatment effect of Chinese acupuncture, which includes indexes selection, data collection and clustering analysis. Then, the paper provides a concrete case of cluster analysis application for thirty patients of lumbar intervertebral disc protrusion. We divided the patients into three categories and adopt different types of patients with different acupuncture treatment to achieve good treatment results.
is used in many data mining processes, because it can be used as a pre-processing of related mining methods, and clustering technology itself is a data mining method. At the same time, clustering analysis technology can be used to deal with the noise in the data and provide pre-processing results for other data mining methods.

2.2 Partition cluster method

The idea of partitioning algorithm is to divide the data objects to be mined into k groups (k < N, N represents the number of objects in the data set), and each group represents a cluster. And to satisfy that any data object can only belong to one cluster, each cluster has at least one data object. This algorithm usually requires the parameter k to determine the number of clusters after the algorithm starts. The algorithm establishes an initial grouping according to the parameter k. Later, the algorithm uses iterative relocation technology to reallocate the data objects in each cluster repeatedly, and then obtains the final relatively satisfactory clustering results. It is a good clustering analysis algorithm to minimize the gap between data objects within clusters and to maximize the gap between data objects among clusters.

\[ E = \sum_{i=1}^{k} \sum_{p \in c_i} (p - m_i)^2 \]

Among the above formula, \( p \) represents an arbitrary data object, \( E \) represents the sum of square errors of all data objects, and \( m_i \) is the mean value of the \( c_i \) of the data \( p \) cluster. At the beginning of the algorithm, k data objects are randomly selected as the initial centre of k clusters in the data set, and the remaining data objects are allocated to the nearest cluster centre according to the distance between them and each cluster centre. Then the average value of all data objects in each cluster is recalculated, and the result is used as the new cluster centre. The above process is repeated gradually until the objective function converges.

2.3 Hierarchical cluster method

The idea of hierarchical clustering algorithm is to decompose a given data set hierarchically until the relevant termination conditions meet the stop. According to the idea of the algorithm, hierarchical clustering method can be divided into two categories, one is bottom-up clustering and the other is top-down decomposition hierarchical clustering. The idea of clustering algorithm is to take each point as a single cluster at the beginning, and then merge two closest data objects or clusters each time, all objects are divided into a cluster, or to achieve the relevant termination conditions to stop. Cluster proximity needs to be defined here; decomposition hierarchical clustering starts with the point containing all data pairs as a cluster, then gradually divides into smaller clusters until each data object is separated in a cluster, or some relevant termination condition is reached. Hierarchical clustering algorithm has the advantages of clear hierarchical structure, simple algorithm ideas, and can dynamically adjust the number of clusters according to the needs of users. But the disadvantages of hierarchical clustering are also obvious. We need to evaluate many clusters or objects before making the decision of clustering or splitting, which leads to the poor scalability of the algorithm in dealing with clusters of different sizes. In the hierarchical clustering process, once the data objects are split or condensed, the processing already done cannot be changed. This leads to the fact that if the choice of merger or split is unreasonable, it cannot be further amended.

3. Application steps of cluster analysis in Chinese acupuncture therapy

To improve the curative effect of acupuncture and moxibustion of traditional Chinese medicine, we should cluster the effects of acupuncture and moxibustion of traditional Chinese medicine. We divided the patients with better acupuncture effect into one group, the patients with moderate acupuncture effect into one group, and the patients with worse acupuncture effect into one group. Different ways can enhance the efficacy of acupuncture and moxibustion.

Specifically, we use acupuncture rehabilitation as an example to treat lumbar disc herniation. Protrusion of lumbar intervertebral disc is a clinical disease caused by lumbar strain, strain or senility leading to intervertebral disc lesions, fibre ring damage or stimulation of nerve roots and blood vessels. With the accelerated pace of life and the increase in the number of people engaged in mental work, lumbar disc herniation has become the primary cause of lumbar and leg pain, directly affecting people's normal life. Acupuncture and moxibustion of traditional Chinese medicine, as a treasure in Chinese history and culture, has obvious effect on the treatment of this disease. It can effectively relieve the lumbar and leg pain caused by lumbar disc herniation, with high efficiency, safety, convenience and other characteristics, can improve the patient's self-care ability and quality of life. The specific steps are as follows:

The first step is to select indexes. To objectively evaluate the therapeutic effect of acupuncture on lumbar disc herniation, the JOA score, McGill pain score, inflammatory factors and LFR were selected to evaluate the
results. The second step is to collect data. Collect the indicators needed to analyse acupuncture efficacy. These indicators need to be obtained by expert scoring and real-time detection. Taking LFR as an example, the shilling patient stands upright, measures the vertical distance from the middle fingertip to the ground, then lets the patient body bend forward as far as possible, measures the vertical distance between the middle fingertip and the ground currently, and finally takes the difference of the vertical distance of the middle finger tip between the states of upright and forward flexion as LFR. Step three: cluster analysis. Cluster analysis can be done easily by using and other professional software, and a genealogical clustering diagram is generated. Step four: results analysis. The results of clustering are analysed, and different methods are adopted to improve the efficacy of Chinese acupuncture.

4. Empirical analysis of the effect improvement of Chinese acupuncture therapy

Thirty patients with lumbar disc herniation were selected from The First Affiliated Hospital of Guangxi University of Chinese Medicine from September 2017 to August 2018. We use clustering algorithm to cluster patients into relatively bad efficacy, moderate efficacy and relatively good efficacy of three categories.

4.1 Step 1: indexes selection

According to the analysis of the third part of the paper, the author chooses the following four indicators as basic variables. Their names and meanings are shown in the following table:

Table 1. Index selection of curative effect of lumbar intervertebral disc protrusion

| Index       | Connotation                                                                 |
|-------------|-----------------------------------------------------------------------------|
| JOA score I₁ | Include subjective symptoms, clinical signs and limitation of daily activities |
| McGill pain score I₂ | Include pain rating index, existing pain intensity and visual analogue scale |
| Inflammatory factors I₃ | Tumor necrosis factor (TXB2)                                                |
| LFR I₄      | The difference of the vertical distance of the middle finger tip between the states of upright and forward flexion |

4.2 Step 2: data collection

The data of the selected indexes of 30 patients with lumbar disc herniation obtained by expert scoring and real-time detection is shown as Table 2.

Table 2. Data of the selected indexes of 30 patients of lumbar intervertebral disc protrusion

| Index      | I₁ | I₂ | I₃  | I₄  |
|------------|----|----|-----|-----|
| Patient 1  | 11 | 6  | 36.8| 41.0|
| Patient 2  | 5  | 32 | 37.4| 43.1|
| Patient 3  | 16 | 22 | 32.9| 42.8|
| Patient 4  | 17 | 45 | 30.3| 51.9|
| Patient 5  | 15 | 22 | 31.0| 49.4|
| Patient 6  | 13 | 38 | 38.3| 55.4|
| Patient 7  | 11 | 17 | 35.5| 51.5|
| Patient 8  | 19 | 18 | 36.6| 50.8|
| Patient 9  | 10 | 40 | 30.9| 40.8|
| Patient 10 | 16 | 9  | 31.3| 47.2|
| Patient 11 | 14 | 22 | 30.7| 54.6|
| Patient 12 | 24 | 42 | 31.5| 51.4|
### 4.3 Step 3: clustering analysis

We use the system clustering method to do the clustering analysis with the help of the software of SPSS 24.0. The result of systematic clustering analysis is shown in Table 3.

| Case   | Category | Case   | Category | Case   | Category |
|--------|----------|--------|----------|--------|----------|
| Patient 1   | B        | Patient 11 | B  | Patient 21 | B  |
| Patient 2   | B        | Patient 12 | B  | Patient 22 | B  |
| Patient 3   | A        | Patient 13 | B  | Patient 23 | C  |
| Patient 4   | B        | Patient 14 | B  | Patient 24 | C  |
| Patient 5   | B        | Patient 15 | B  | Patient 25 | B  |
| Patient 6   | C        | Patient 16 | B  | Patient 26 | B  |
| Patient 7   | A        | Patient 17 | B  | Patient 27 | B  |
| Patient 8   | B        | Patient 18 | A  | Patient 28 | C  |
| Patient 9   | B        | Patient 19 | B  | Patient 29 | B  |
| Patient 10  | A        | Patient 20 | B  | Patient 30 | C  |

From the data index features, Patient 3, Patient 7, Patient 10 and Patient 18 are the patients with relatively good efficacy; Patient 6, Patient 23, Patient 24, Patient 28 and Patient 30 are the patients with relatively bad efficacy. The Chinese acupuncture therapy of other patients are moderate.

### 4.4 Step 4: result analysis

For patients with type A, the original treatment can be maintained. Patients of type B have a general therapeutic effect. They are confident in Chinese acupuncture, but they may not be able to guarantee their devotion to time and energy. The potential of patients with type B is enormous. Acupuncturists can adopt the "task driven method"
when improving the treatment level of patients of type B. The acupuncturist worked out a detailed and reasonable acupuncture program for the short board of patients with type B. Most of the patients with class C treatment lack confidence in the treatment of diseases, and they unconsciously do not believe that acupuncture can really play a substantial role in the treatment. In this regard, acupuncturists should actively improve the cognitive level of patients to help patients establish confidence in the treatment of disease. At the same time, acupuncturists can adopt the combination of acupuncture and medicine to enhance the efficacy.

5. Conclusions

Acupuncture and moxibustion can relieve the pain of patients with lumbar intervertebral disc herniation to improve their motor function and quality of life. This paper discusses the feasibility of cluster analysis to classify the patients with lumbar intervertebral disc herniation. The concrete conclusions are as follows:

1. The process of using clustering analysis to classify the patients includes four steps of indexes selection, data collection, clustering analysis and result analysis.
2. The indexes of the treatment effect of Chinese acupuncture for treating lumbar intervertebral disc herniation can be selected as the follows: JOA score I1, McGill pain score I2, Inflammatory factors I3 and LFR I4.
3. We can use cluster analysis to classify patients into the categories A, B and C. For Class A patients, acupuncturists should follow the previous acupuncture methods; for Class B patients, acupuncturists should adopt a project-based approach, focusing on the specific acupuncture points; for Class C patients, acupuncturists should greatly enhance the cognitive level of patients and use a variety of treatment methods to enhance efficacy comprehensively.

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