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Based on the Perspective of Anhui Elderly People: A Study on the Construction of Furniture Ease of Use Evaluation System and the Association of Purchase Decision Making

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Abstract This paper is based on the position of the elderly group in Anhui Province, and combines the performance of the ease of use of furniture products in the interior design of senior living buildings to propose a set of furniture ease of use evaluation system consisting of 4 dimensions of practicality, economy, aesthetics, and sociability, as well as 12 secondary indexes and 36 tertiary indexes. Subsequently, based on the performance data of furniture products in 10 senior living places in Anhui Province, the entropy weight-TOPSIS method was used to calculate the entropy weights and weights of each index, and the furniture was ranked according to its ease of use performance data. Five commonly used furniture products in the 10 senior living places were selected as experimental objects, and the correlation analysis algorithm was used to calculate the confidence level of the rules between the furniture products and the 36 third-level indicators. Among them, the indicators of “ergonomic furniture scale” and “purchase price” have higher confidence level with multiple furniture products, which indicates that the most concerned factors in the purchase decision of elderly furniture products are the comfort of the elderly and the price of the products.

Index Terms furniture ease of use evaluation, correlation analysis, entropy weight-TOPSIS method, purchase decision, confidence level

I. Introduction

Anhui Province is a province in the east of China, and in recent years, the proportion of elderly people aged 60 and above in the total population of Anhui Province has been increasing year by year, which means that the phenomenon of population aging in Anhui Province is becoming more and more serious [1], [2]. Along with the increasingly fast pace of development of social civilization, the pace of life of the elderly in Anhui is constantly accelerating, and the improvement of material and spiritual needs promotes the improvement of their understanding of the environment in which they live [3]-[5]. In contemporary furniture product design, affordability, efficiency, comfort, safety, health and other characteristics of the product, based on the “people-oriented” design concept, explore the functional beauty of the function melted into the form of beauty [6]-[8]. How to further improve the ease of use of furniture products, to bring more convenience and freedom to the elderly, to adapt to the modern society's fast-paced, multi-level consumption patterns, is an issue that we need to continue to study in depth [9]-[11].

In today's society, furniture is not only a necessity of life, but also the embodiment of personal taste and lifestyle, and the advantages and disadvantages of furniture design directly affect the user experience [12], [13]. User experience refers to the feelings and reactions of users in the process of using products or services [14]. In furniture design, user experience covers several aspects, such as the appearance, function, comfort, ease of use, and safety of furniture [15], [16]. A successful furniture design should be able to meet the multiple needs of users and create a pleasant, convenient and comfortable user experience [17]. For the elderly group, the ease of use of furniture directly affects their purchase decision, ease of use refers to the degree of convenience in the use of furniture, the design of furniture should be simple and clear, easy to operate, so that the elderly group can easily use and maintain [18]-[20].

This paper firstly discusses in detail the ease-of-use characteristics of the existing major furniture products in the interior design of elderly buildings, and combines the existing research to construct a set of furniture ease-of-use evaluation index system that is suitable for the needs of elderly groups. Secondly, it explains the specific steps of the entropy weight-TOPSIS method. The indoor furniture products of 10 senior living places in Anhui Province are selected as experimental objects, and a weighting matrix is constructed to determine the weights of each three-level index, and the ease of use is ranked. Analyze the definition formula of support degree and confidence degree in the correlation analysis method again, as well as the operation process of two commonly used correlation analysis methods (Apriori algorithm, FP growth algorithm). Finally, calculate the confidence level of the rules between commonly used furniture products and evaluation indexes in senior living places, and analyze the purchase decision of elderly users' preferred furniture products.

II. The Construction of Furniture Ease of Use Evaluation System

II. A.Ease of use of furniture products in the interior design of retirement buildings

Furniture products in the interior of senior living buildings mainly refer to the products in the family residential space to meet the functional needs of people's daily life, mainly including door products, sanitary ware products, electrical products, lighting products, furnishing and decorative products, furniture and hardware. With the continuous improvement of living standards, furniture products in function, shape, color and other aspects of continuous improvement, on the other hand, furniture product design is also considering a deeper level of content, that is, the ease of use of furniture products design and humanized design, therefore, the study of ease of use and the application of furniture product design is becoming more and more extensive.

In today's increasingly developed science and technology, ergonomics still occupies a pivotal position in the elderly furniture. In recent years, with the continuous development of the furniture industry, the formation of a new trend in the development of elderly furniture, one is due to the quality of people in the continuous improvement, the concept of life is changing, people are more and more concerned about the concept of healthy life, so as to form a kind of healthy and sustainable development ideas. On the other hand, with the updating of technology and materials, coupled with the continuous improvement of the production process, the concept of intelligent furniture gradually appeared. Such as the current bathroom products in the intelligent toilet, in addition to automatic lifting function, there are intelligent cleaning function, therefore, the future development of the elderly furniture will gradually realize the intelligent, but intelligent at the same time, the elderly furniture products, ease of use of the study is also gradually being paid attention to, from the visibility of the product, easy to operate, easy to remember, and so on, pay more attention to humanistic care for the elderly will be more and more popular products. Products that emphasize more on humanistic care for the elderly will be more and more welcomed by the elderly, and the application of the principle of ease of use in the design of elderly furniture will be more and more extensive.

In addition, the application of the principle of ease of use in electrical appliances and other products has also been emphasized. For the elderly, a good product, whether in product design or product functional design, should be in line with the behavioral habits and psychological needs of the elderly, from the perspective of the most acceptable and easy to operate the elderly, so as to make it a simple and easy to use products.

Furniture products on the market at present, the speed of updating, the appearance of the product modeling is also more and more diversified, the function is also increasing, but the practicality and ease of use of the product is often ignored, in the market competition is becoming increasingly fierce today, the product designers are beginning to realize the importance of humanization of the product, pay attention to the principle of ease of use of the furniture product design, so that the user really experience their care for human nature.

II. B.System of evaluation indicators

In this paper, the formation of the evaluation index system of furniture for elderly buildings with practicality, economy, aesthetics and sociality as the guideline layer is shown in Table 1.

Table 1: Evaluation index system for furniture in elderly care buildings

Primary index	Secondary index	Three-level index
(A) Practicability	(A1) Safety	(A11) The harmful substances in the furniture are below the limit
		(A12) The dimensions of the furniture are ergonomic
		(A13) Safety guardrails are set on the outside of the bed
	(A2) Function	(A21) Rich storage space and storage forms
		(A22) The furniture makes little noise when in use
		(A23) Provide privacy space
		(A24) Create a quiet space
	(A3) Material	(A31) Material durability
		(A32) The supply of raw materials is sufficient
		(A33) The material has mature processing techniques
	(A4) Structural process	(A41) It lands smoothly and the structural components are firmly connected

		(A42) It has a reasonable structure and is convenient for installation and disassembly
		(A43) There are no sharp structures such as sharp edges or corners
		(A44) The process structure meets the principles of standardization and generalization
		(A45) The surface treatment and wood veneer are smooth
(B) Economy	(B1) Price	(B11) Product purchase price
		(B12) Product maintenance price
	(B2) Innovation	(B21) The design is creative
		(B22) The application of new materials, new processes and new technologies
(C) Beauty	(C1) Styling	(C11) Simple form
		(C12) The proportion is harmonious, and the volume and space are appropriate
		(C13) The design conforms to the usage habits of the elderly
	(C2) Color	(C21) The colors are soft and not overly stimulating
		(C22) The color is in harmony with the environment of the elderly care buildings
		(C23) The colors are suitable for age characteristics
	(C3) Decoration	(C31) The decoration is in harmony with the function
		(C32) Decoration is artistic
	(C4) Style	(C41) The style caters to the age group of the elderly
		(C42) The style is in line with the manufacturing feasibility of the production enterprise
(D) Sociality	(D1) Environmental protection	(D11) The materials can be recycled and reused
		(D12) The furniture has no pungent smell
		(D13) Rational use of hardware ensures no noise pollution
	(D2) After-sales service	(D21) The packaging is suitable for flat transportation
		(D22) The structure is easy to inspect and maintain
		(D23) The accessories are universal and easy to replace
		(D24) Restore practicality and aesthetics after repair

III. Determination of weights of evaluation indicators

III. A. Entropy weight-TOPSIS method

The specific steps of entropy weight-TOPSIS method are as follows:

(1) Construct evaluation matrix

Assuming that there are a evaluation objects $(a1, a2, a3, \cdots, a_m)$, and b evaluation indicators $(b1, b2, b3, \cdots, b_n)$, define X_{ij} as the data corresponding to the j evaluation indicator under the i evaluation object as in equation (1):

$$(i = 1, 2, 3, \cdots, m; j = 1, 2, 3, \cdots, n) \tag{1}$$

to build the evaluation matrix as in equation (2):

$$\{X_{ij}\}_{m \times n} (i = 1, 2, 3, \cdots, m; j = 1, 2, 3, \cdots, n) \tag{2}$$

The original matrix is equation (3):

$$X_{ij} = \begin{bmatrix} X_{11} & \cdots & X_{1n} \\ \vdots & X_{ij} & \vdots \\ X_{m1} & \cdots & X_{mn} \end{bmatrix} \tag{3}$$

(2) Normalization of the original matrix

Positive indicators: processed according to equation (4):

$$b_{ij} = \frac{x_{ij} - \min(X_{1j}, \cdots, X_{mj})}{\max(X_{1j}, \cdots, X_{mj}) - \min(X_{1j}, \cdots, X_{mj})} \tag{4}$$

Negative indicators: treated as in equation (5):

$$b_{ij}=\frac{\max\left(X_{1j},\cdots,X_{mj}\right)-x_{ij}}{\max\left(X_{1j},\cdots,X_{mj}\right)-\min\left(X_{1j},\cdots,X_{mj}\right)} \tag{5}$$

Adequacy indicators: processed according to equation (6):

$$b_{ij}=1-\frac{\left|x_{ij}-d_{best}\right|}{\max\left|x_{ij}-d_{best}\right|}\left(d_{best}\text{ is the determined standard value}\right) \tag{6}$$

In order to ensure the validity of the values, each value after the dimensionlessness of each value plus 0.0001 of the effective value.

(3) Define the standardized value

Calculate the weight of the j th evaluation index under the i th evaluation object, as in equation (7):

$$P_{ij}=\frac{b_{ij}}{\sum_{j=1}^{m}y_{ij}} \tag{7}$$

(4) Calculate the entropy value, coefficient of variation and weight of indicators

First, the entropy value of the i th evaluation indicator is calculated as equation (8):

$$e_i=-\frac{1}{\ln n}\sum_{j=1}^{n}P_{ij}\ln P_{ij} \tag{8}$$

Next, the coefficient of differentiation for the i th evaluation indicator is calculated as in equation (9):

$$g_i=1-e_i \tag{9}$$

Finally, the weight of the i th indicator is calculated based on the differentiation coefficient as in equation (10):

$$w_i=\frac{g_i}{\sum_{i=1}^{m}g_i} \tag{10}$$

(5) Construct weighted normalization matrix

Multiply each vector in the normalization decision matrix with the indicator weight corresponding to that vector to get the weighted normalization matrix as equation (11).

$$z_{ij}=y_{ij}\times w_{ij} \tag{11}$$

(6) Determine positive and negative ideal solutions

Under the weighted normative matrix, the positive and negative ideal solutions are determined based on the optimum values of the indicators for different attributes.

The positive ideal solution is shown in equation (12):

$$z^{+}=\max(z_{1j},\cdots,z_{nj}) \tag{12}$$

The negative ideal solution is shown in equation (13):

$$z^{-}=\min(z_{1j},\cdots,z_{nj}) \tag{13}$$

The Euclidean distance to the positive ideal solution is Eq. (14):

$$d_j^{+}=\sqrt{\sum_{i=1}^{n}\left(c_{ij}-c_j^{+}\right)^2} \tag{14}$$

The Euclidean distance to the negative ideal solution is Eq. (15):

$$d_j^{-}=\sqrt{\sum_{i=1}^{n}\left(c_{ij}-c_j^{-}\right)^2} \tag{15}$$

The relative closeness of each evaluation object is calculated based on the Euclidean distance of the positive and negative ideal solutions as in equation (16):

$$C_j = \frac{z_j^-}{z_j^+ + z_j^-} \tag{16}$$

(7) Ranking of evaluation objects

The ranking is based on the size of the relative closeness C_j. The larger the value of C_j, the further the evaluation object is from the negative ideal solution, and the closer it is to the positive ideal solution, the better the evaluation object is.

III. B. Calculation of evaluation indicator weights

III. B. 1) Data processing

According to the calculation process of the entropy weight-TOPSIS method mentioned above, the data performance of furniture products in 2023 of the selected 10 senior living places in Anhui Province is firstly sorted out and the standardization matrix is constructed. The data are standardized, and corresponding processing methods are adopted for indicators of different natures in order to eliminate the potential impact of differences in the nature of indicators on the evaluation results. Finally, due to the existence of 0 values in the data, non-negativization is carried out to avoid the situation of not being able to take logarithms. The 10 elderly places are numbered according to E1-E10, of which the results of standardized non-negative processing of indicators for E1-E5 places are shown in Table 2, and the results of standardized non-negative processing of indicators for E6-E10 places are shown in Table 3.

Table 2: Standardize and non-negatize the indicators(E1-E5)

Index	E1	E2	E3	E4	E5
(A11)	0.7831	0.5746	0.8668	0.2534	0.6559
(A12)	0.5824	0.2029	0.4025	0.7055	0.8009
(A13)	0.7106	0.1497	0.7735	0.1157	0.5092
(A21)	0.9298	0.7713	0.7643	0.8965	0.2513
(A22)	0.6032	0.7924	0.9433	0.5227	0.4718
(A23)	0.0248	0.5263	0.688	0.8029	0.9068
(A24)	0.5765	0.2243	0.7114	0.0875	0.3624
(A31)	0.1679	0.1292	0.0277	0.9373	0.8562
(A32)	0.2309	0.1018	0.446	0.9325	0.6128
(A33)	0.0933	0.7781	0.2257	0.4602	0.5313
(A41)	0.4209	0.0833	0.0986	0.205	0.2641
(A42)	0.8619	0.0504	0.8872	0.689	0.4191
(A43)	0.544	0.5903	0.1356	0.314	0.7375
(A44)	0.5965	0.574	0.7413	0.1048	0.5334
(A45)	0.1414	0.8052	0.3909	0.6807	0.4196
(B11)	0.0434	0.5807	0.0146	0.8908	0.4404
(B12)	0.6445	0.8283	0.6727	0.0824	0.2898
(B21)	0.7952	0.1908	0.6642	0.9437	0.836
(B22)	0.8582	0.7026	0.9363	0.2722	0.7114
(C11)	0.4739	0.1997	0.9263	0.7667	0.1016
(C12)	0.977	0.7888	0.7628	0.392	0.43
(C13)	0.8311	0.1506	0.6316	0.3712	0.1508
(C21)	0.6764	0.2555	0.0589	0.1444	0.0836
(C22)	0.8437	0.0305	0.0516	0.4357	0.3609
(C23)	0.5478	0.4144	0.1785	0.4709	0.4689
(C31)	0.1954	0.4206	0.5341	0.1081	0.0291
(C32)	0.12	0.1011	0.4202	0.7456	0.8471
(C41)	0.1298	0.067	0.8835	0.9901	0.3137
(C42)	0.618	0.0342	0.9594	0.7506	0.9898
(D11)	0.9245	0.4448	0.9286	0.4732	0.3377
(D12)	0.1098	0.9052	0.1317	0.9294	0.3089
(D13)	0.7136	0.2363	0.1605	0.2989	0.3246

(D21)	0.785	0.6901	0.5441	0.6604	0.9208
(D22)	0.674	0.8397	0.5058	0.4625	0.7855
(D23)	0.8796	0.3566	0.7862	0.8471	0.0744
(D24)	0.8963	0.065	0.0163	0.2958	0.3483

Table 3: Standardize and non-negatize the indicators(E6-E10)

Index	E6	E7	E8	E9	E10
(A11)	0.9228	0.0955	0.8054	0.594	0.7025
(A12)	0.8759	0.0436	0.5103	0.8837	0.3086
(A13)	0.6055	0.4894	0.7428	0.079	0.6923
(A21)	0.4999	0.2411	0.7973	0.7797	0.4239
(A22)	0.4778	0.7156	0.6336	0.3894	0.3849
(A23)	0.3922	0.91	0.9786	0.6872	0.015
(A24)	0.8632	0.7939	0.3951	0.5371	0.55
(A31)	0.706	0.1381	0.3932	0.5285	0.8048
(A32)	0.43	0.3593	0.6555	0.3003	0.0616
(A33)	0.1488	0.0422	0.6657	0.7335	0.6488
(A41)	0.1461	0.4082	0.5487	0.542	0.66
(A42)	0.3662	0.5274	0.1327	0.3621	0.8079
(A43)	0.4037	0.8254	0.3573	0.4842	0.5541
(A44)	0.3144	0.6037	0.261	0.4564	0.5353
(A45)	0.6124	0.1004	0.0852	0.3345	0.1302
(B11)	0.0805	0.4022	0.9155	0.5618	0.2751
(B12)	0.9257	0.3323	0.742	0.4532	0.059
(B21)	0.5401	0.0419	0.618	0.2571	0.8311
(B22)	8E-4	0.4795	0.3161	0.5986	0.5717
(C11)	0.7054	0.1427	0.6111	0.0462	0.6028
(C12)	0.1195	0.3798	0.3136	0.2874	0.2199
(C13)	0.4015	0.5683	0.1931	0.422	0.222
(C21)	0.1632	0.9662	0.3179	0.5477	0.5232
(C22)	0.204	0.826	0.1758	0.6359	0.221
(C23)	0.5201	0.2353	0.8205	0.8567	0.9564
(C31)	0.3132	0.3845	0.701	0.0707	0.2951
(C32)	0.517	0.6247	0.6355	0.4772	0.5393
(C41)	0.5404	0.9977	0.7819	0.0784	0.0221
(C42)	0.4559	0.1629	0.985	0.7333	0.4784
(D11)	0.1153	0.9429	0.8223	0.0362	0.3198
(D12)	0.5103	0.4886	0.64	0.8101	0.0226
(D13)	0.6949	0.9029	0.5932	0.5067	0.3018
(D21)	0.5533	0.1146	0.3438	0.8516	0.4817
(D22)	0.6243	0.949	0.3426	0.9188	0.2328
(D23)	0.3541	0.6092	0.6703	0.4405	0.6143
(D24)	0.8824	0.9334	0.5718	0.7795	0.7273

III. B. 2) Constructing the weighting matrix

Calculate the positive and negative ideal solutions According to the above results use Excel to further calculate the entropy weights and weights of each index. According to the constructed weighting matrix, the positive ideal solution and negative ideal solution of 10 senior living places are calculated, and the calculation results are shown in Table 4.

Table 4: Evaluate the entropy weight assignment results of each index

Index	Entropy weight	Weight	Positive ideal solution	Negative ideal solution
(A11)	0.854	0.02661	0.0502298648	0.00000502
(A12)	0.9587	0.02988	0.0448930951	0.00000449
(A13)	0.999	0.03113	0.0585328297	0.00000585
(A21)	0.9142	0.02849	0.0627679275	0.00000628
(A22)	0.8519	0.02655	0.0414913050	0.00000415
(A23)	0.8998	0.02804	0.0532407942	0.00000532
(A24)	0.9871	0.03076	0.0628842371	0.00000629
(A31)	0.8301	0.02587	0.0664605116	0.00000665
(A32)	0.8867	0.02763	0.0598142920	0.00000598
(A33)	0.9563	0.02981	0.0587564429	0.00000588
(A41)	0.9303	0.02899	0.0661236489	0.00000661
(A42)	0.811	0.02527	0.0404436746	0.00000404
(A43)	0.8646	0.02694	0.0418194090	0.00000418
(A44)	0.9994	0.03114	0.0447777922	0.00000448
(A45)	0.8502	0.02651	0.0534963576	0.00000535
(B11)	0.8424	0.02625	0.0412708257	0.00000413
(B12)	0.8595	0.02679	0.0627177261	0.00000627
(B21)	0.9166	0.02856	0.0629879068	0.00000630
(B22)	0.9491	0.02958	0.0601748897	0.00000602
(C11)	0.8713	0.02715	0.0448334676	0.00000448
(C12)	0.8805	0.02744	0.0624050832	0.00000624
(C13)	0.8059	0.02511	0.0613712524	0.00000614
(C21)	0.8038	0.02505	0.0529093886	0.00000529
(C22)	0.8446	0.02632	0.0438523018	0.00000439
(C23)	0.9772	0.03045	0.0605338308	0.00000605
(C31)	0.825	0.02571	0.0483919229	0.00000484
(C32)	0.8665	0.02701	0.0513405580	0.00000513
(C41)	0.8776	0.02735	0.0551529318	0.00000552
(C42)	0.8763	0.02731	0.0553542277	0.00000554
(D11)	0.8997	0.02804	0.0431521390	0.00000432
(D12)	0.9797	0.03053	0.0494854125	0.00000495
(D13)	0.9884	0.0308	0.0518371482	0.00000518
(D21)	0.8314	0.02591	0.0492846821	0.00000493
(D22)	0.8577	0.02673	0.0613884463	0.00000614
(D23)	0.8335	0.02597	0.0600930452	0.00000601
(D24)	0.9088	0.02832	0.0523169814	0.00000523

III. B. 3) Ease of use ranking based on entropy weight-TOPSIS method

Calculate the Euclidean distance of the furniture of the 10 senior living places to the ideal solution on each metric, and then calculate the relative closeness of each evaluation metric to the positive and negative ideal solutions and determine the rankings are shown in Table 5.

Table 5: Euclidean distance and relative closeness degree

Number	h+	h-	f	Sort
E1	0.1285	0.2348	0.7179	1
E2	0.1435	0.2158	0.6589	2
E3	0.1518	0.2157	0.6423	3
E4	0.1566	0.2079	0.6208	4
E5	0.1577	0.2046	0.6132	5
E6	0.154	0.1962	0.6055	6
E7	0.1534	0.1933	0.6016	7

E8	0.1556	0.1946	0.5997	8
E9	0.1648	0.1972	0.5875	9
E10	0.1603	0.189	0.5806	10

The smaller the Euclidean distance of the object to be evaluated to the positive ideal solution, the higher the furniture product ease of use. Conversely, the smaller the Euclidean distance to the negative ideal solution, the lower the furniture product ease of use. Therefore, the relative closeness of the evaluation objects can be calculated and then ranked according to the magnitude of the furniture product ease of use. Specifically, the closer the evaluation scheme converges to the positive ideal solution, the larger the relative closeness is, and the higher the furniture product ease of use is. On the contrary, the closer the evaluation object is to the negative ideal solution, the smaller the relative closeness is, and the lower the ease of use of the furniture product is. When the relative proximity is close to 1, it means that the distance between each index of the sample furniture product and the optimal solution is closer, and the performance is better.

IV. Association Analysis of Furniture Ease of Use and Purchase Decisions

IV. A. Relevance analysis

Correlation analysis in data mining is mainly used to discover meaningful connections hidden in the data, for example, the connection between users and the goods they are likely to buy in the process of merchandising, as well as the connection between goods and commodities. The most widely recognized application of association analysis is the association between “beer” and “diapers”, i.e., through the analysis of user shopping data, it is found that users who buy beer usually also buy diapers, and the sales of both products are increased by placing beer and diapers together. The use of beer and diapers together will increase the sales of the two products.

The association rule can be described as the equation $X \rightarrow Y$, where X and Y are two datasets that do not intersect with each other, and the strength of the association relationship can be evaluated by two measures, namely: support and confidence, which are defined as in equations (17) and (18):

$$\sup port\left(X \rightarrow Y\right)=\frac{\sigma\left(X \cup Y\right)}{N} \tag{17}$$

$$confidence\left(X \rightarrow Y\right)=\frac{\sigma\left(X \cup Y\right)}{\sigma\left(X\right)} \tag{18}$$

where $\sigma(X)$ denotes the support count of the itemset X. The discovery of association rules is to find all the rules in a set of transactions that have support greater than a support threshold and confidence greater than a confidence threshold. A basic algorithm is to iteratively compute the confidence and support of all relations and then select the relation with greater confidence and support, however, this method is too time consuming and is generally not used for computation.

Apriori algorithm is a common association analysis algorithm, which is based on the pruning technique of support and utilizes the a priori principle to limit the exponential growth of the candidate set. The a priori principle is that if a dataset is frequent, then all of its child datasets must also be frequent.The Apriori algorithm utilizes the inverse negation of the a priori principle, i.e., if an itemset is not frequent, then its parent itemset is also not frequent.

The flow of Apriori algorithm is shown below:

(1) Traverse the data on one side and determine the support of each item.

(2) Using the discovered frequent k datasets, discover frequent $k+1$ datasets and delete datasets smaller than the minimum support.

(3) End when no new dataset is generated, otherwise return to (2).

The Apriori algorithm utilizes the a priori principle to solve the problem of the explosion of the number of itemsets, which significantly improves the performance of the algorithm. However, the algorithm needs to scan the dataset many times, generating a large amount of I/O time, and as the amount of data increases, the time consumption of the algorithm increases.

FP growth algorithm is also an association analysis algorithm, unlike Apriori algorithm, FP growth algorithm uses a completely different approach to discover frequent itemsets. The frequent itemsets are extracted directly from the FP tree by building the FP tree.

The construction process of FP tree is as follows:

(1) Traverse the dataset once to obtain the support count of each frequent item, and discard it if the support count is less than the threshold. After obtaining all the support counts sort them in descending order.

(2) Continue traversing the dataset and build a path from the root node based on the set of items that appear.
(3) While building the path, record the frequency of occurrence.
(4) Continue this process until all the itemsets are mapped to the tree.

FP growth tree is a bottom-up growth tree that employs a partitioning algorithm, and with each recursion, the FP tree is constructed by keeping up with the support counts of all nodes in the prefix path and by deleting the items whose support counts are less than a threshold.

IV. B. User Preferences Furniture Product Recommendations

Using the evaluation system designed above to evaluate the performance of the ease of use of furniture products in 10 aging places, based on the evaluation results, five commonly used aging-friendly furniture products were selected as experimental objects: (P1) nursing beds, (P2) bath chairs, (P3) wheelchairs, (P4) induction lamps, and (P5) anti-fall rails, and correlation analysis algorithms were used to calculate the confidence levels of the three-level indexes of the furniture ease-of-use evaluation system designed above. Rule confidence level. The confidence level of some rules obtained on the basis of the support degree of 0.001 is shown in Table 6, and since most of the confidence levels are above 0.035, the confidence value is set to 0.035.

Table 6: Partial rule confidence with support above 0.001

Product→Index	Confidence
P3→D22	0.9011
P2→B12	0.5833
P1→C21	0.7963
P3→A22	0.6286
P4→D21	0.2382
P5→A45	0.4481
P4→A24	0.372

Selected five furniture products rule confidence in 0.9000 and above the three indicators are shown in Table 7, indicator (A12) furniture scale ergonomics and indicator (B11) product purchase price are higher frequency. Among them, indicator (A12) furniture scale ergonomics with: (P1) nursing beds, (P2) bath chairs, (P3) wheelchairs three furniture products with high confidence. Indicator (B11) product purchase price and: (P1) nursing beds, (P3) wheelchairs, (P5) anti-fall rails three furniture products, showing the highest confidence level of 0.9739, indicating that in addition to the overall ease of use in large-scale elderly care-related furniture products, the user's purchasing decision is also closely related to the purchase price of the product.

Table 7: Indicators with a relatively high level of confidence in furniture product rules

Product	Index	Confidence
P1	A12	0.9626
	C13	0.9453
	B11	0.9152
P2	A12	0.9963
	A41	0.9931
	C13	0.9783
P3	A41	0.9811
	B11	0.9739
	A12	0.971
P4	C11	0.9732
	C21	0.967
	C41	0.9576
P5	A43	0.9972
	C31	0.9895
	B11	0.937

V. Conclusion

This paper takes furniture products of 10 senior living places in Anhui Province as research samples, and combines the performance of the ease of use of furniture products used in the indoor space layout design of senior living buildings to construct a set of senior living furniture ease-of-use evaluation index system with practicality, economy, aesthetics, and social dimensions as the first-level indicators. After determining the index weights using the entropy weight-TOPSIS method, the correlation analysis algorithm was used to calculate the confidence level of the rules of the five furniture products with higher ease of use and the third-level indexes. The two indicators of ergonomic furniture scale and product purchase price appear more frequently, and the rule confidence level of the indicator "product purchase price" and the furniture products is up to 0.9739, which indicates that in the purchasing behavior of elderly furniture products, the experience of the elderly users and the economy of the product price are important factors affecting the purchase decision of the users. It shows that in the purchase behavior of elderly furniture products, the experience of elderly users and the economy of product price are important factors affecting users' purchase decision.

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