Preliminary study on innovative design of bamboo furniture based on users’ big data

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Abstract. Leverage Python software combined with contrastive analysis, structural analysis and trend analysis to analyze the current bamboo furniture market. Make use of Baidu Index to analyze the future development trend of bamboo furniture and user portrait. The research showcases that the simple modern style, pastoral style and European style furniture have made up a huge part of the market on the bamboo furniture market at present, and the bamboo furniture structure in the market mostly adopts weave structure and scaffold structure. From regional analysis’ perspective, the bamboo furniture developed more advanced in southeast coast and furniture industry spreads around Guangdong to its surrounding areas in cluster effect. The evaluation of bamboo furniture users shows that users pay more attention to the height, size, comfort and folding adjustment of bamboo furniture, whilst paying less attention to its design, which also reflected that bamboo chair is relatively lack of design. Through the analysis of the future development trend of bamboo furniture by Baidu Index, the conclusion is drawn that bamboo furniture can expand consumer groups by improving the design, such as, the exploration of intelligent development. In summary, based on the data analysis of the current situation and development trend of bamboo furniture market, this paper puts forward the innovative design of bamboo furniture to improve the competitiveness of bamboo furniture market, and promote the development of bamboo furniture Industry.

1. Introduction
In the context of global warming and wood shortage, bamboo furniture - as a new ecological low-carbon industry by replacing wood with bamboo- has attracted public attention [1]. But bamboo furniture only accounts for a small part of the furniture market. There are two main reasons: Firstly, as bamboo is easy to crack, it is difficult to carry out mechanical processing. Secondly, the masters of the traditional handicrafts are lack of innovative design, which makes it difficult to adapt to modern market.

Python is a cross-platform computer programming language, which can collect and organize network big data. In recent years, with the rise of artificial intelligence and data mining, python is becoming increasingly popular in China and widely used in data mining and analysis, for example: Huiling Wang, Ruimei Wang and others used Python to sort out and analyze the network recruitment data to further assist job seekers' career planning [2-3]. Ming Luo, Hanhan Wang and others had analyzed the data of Weibo comments to demonstrate the high efficiency and effectiveness of public opinion [4], Jieru Hou and Jixu Lu to analyze Tmall commodity data in order to provide reference for
mass shopping [5]. As a result, this paper adopts Python software combined with Baidu index to analysis the data of bamboo furniture market. The current bamboo furniture market and development trend can be displayed intuitively and clearly in the form of chart.

At present, big data is more and more widely used in furniture market, and the value to furniture enterprises is becoming more and more significant. Using big data to assist bamboo furniture innovation design and grasp the market data advantage becomes the important trend of bamboo furniture industry competition [6], big data is both an opportunity and a challenge for the traditional bamboo furniture industry. Big data is both an opportunity and a challenge for the traditional bamboo furniture industry. In this paper, the application of big data in bamboo furniture design serves as a preliminary theoretical basis for the application of big data technology in bamboo furniture industry.

2. Materials and methods

2.1. Research data

The data in this paper mainly comes from Baidu index and web page data crawled by Python web spider.

Baidu index is based on the behavior of Internet users data analysis. Further, it is to record Baidu netize’s behavior. In this paper, the author needs to use the data-mining of furniture, bamboo furniture, intelligent furniture, folding furniture, custom furniture, combination furniture as keywords and search keyword analysis the Baidu index to record the overall daily average for 2012-2020 year and user portrait data.

Setting up the environment of Python, searching "bamboo furniture" keyword. Programming code automatically crawling dynamic shopping web page data. Programming code automatically crawl dynamic shopping web page data, such as commodity title, area, price, sales, evaluation and other information. Through the data cleaning to output documents, the specific work flow is shown in figure 1 as below:

![Figure 1. Python basic work flow.](image)
2.2. Research methods
Python software was born in the 1990s founded by Guido van Rossum, which was widely used in the processing of system management tasks and Web programming. The usage rates of Python has increased linearly since 2004. In 2011, it was named the language of the year by the TIOBE programming languages rankings because it is simple and extensible. It is increasingly used in scientific data computing research. Based on the Python data mining and analysis function, this paper analyzes the bamboo furniture market.

2.2.1. Python environment
from selenium import webdriver
import time
import requests
import pandas as pd
from retrying import retry

2.2.2. Access to web pages
def getHTMLText(url):
    try:
        r = requests.get(url, timeout=30)
        r.raise_for_status()
        r.encoding = r.apparent_encoding
        return r.text
    except:
        print('')

2.2.3. Data acquisition
price = []
name = []
address = []
count = []
title = []
id_ = []
detail_url = []
for item in cont['mods']['itemlist']['data']['auctions']:
    name.append(item['nick'])
    price.append(item['view_price'])
    address.append(item['item_loc'])
    count.append(item['view_sales'].replace(' receipt ,'))
    title.append(item['raw_title'])
    id_.append(item['nid'])
    detail_url.append(item['detail_url'])
result = {'Shop Name': name, 'Commodity Title': title, 'Price': price, 'Store Address': address, 'Sales Volume': count, 'Commodity Number': id_, 'Details Page'
results = pd.DataFrame(result)

3. Results and discussion
3.1. Baidu index analysis
3.1.1. Analysis on development trend of bamboo furniture. The development types of furniture market were investigated and analyzed. After collecting the relevant information, the following four types of popular market developments are listed in Table 1.

Table 1. Analysis of bamboo furniture development direction.

| Category       | Causes                                                                 |
|----------------|------------------------------------------------------------------------|
| Smart furniture| The acceleration of social rhythm makes modern people pursue convenient, fast and efficient way of life. |
| Folding furniture| With the acceleration of urbanization and the increase of urban population agglomeration, people's demand for housing has become to improve the utilization rate of space. |
| Customized furniture| As the change of times, consumers has tending to be younger, the furniture requires more personalized design. |
| Composite furniture| Considering the use of small house space, furniture design tends to be multifunctional. |

Figure 2 shows the annual trend analysis of four types of development. It can be seen from the diagram that the trend of custom furniture and folding furniture is mainly divided into two stages. Custom furniture search volume showed an upward trend after 2016. Custom furniture and folding furniture search volume showed a downward trend. The difference is that the trend of custom furniture is steeper, while the trend of folding furniture is more stable. Intelligent furniture showed a slow upward trend in 2012-2016, and the trend of rapid to slow decline in 2016-2018, and the trend of warming up in 2018. The combined furniture showed a slow upward trend before 2017, but a slow downward trend after 2017. Conclusion: bamboo furniture design should develop towards the intelligent direction to be more competitive. Given the 2020 data is as of November plus the big environment influence, it only serves as the reference.

Figure 2. Analysis of bamboo furniture development trend.
3.1.2. Bamboo furniture user portrait analysis. Through the data collection, analysis of user portraits, the TGI index is introduced into the survey of users' interest. TGI index refers to the strong or weak index of the target group in the specific research scope (this article refers to Baidu users). The larger the index, the higher the degree of population coincidence [7].

Figure 3 is a comparative analysis of the population divided into men and women: blue for male and yellow for female. It can be seen from the outer ring of the pie chart that 58.82% of the keywords searched for bamboo furniture were from male and 41.18% were from female. Men are more interested in the bamboo furniture than women. From the inner ring of the pie chart, it can be seen that the TGI index of male is 115.38, and that of female is 84.01. The proportion of men was also far greater than that of women, indicating that men prefer bamboo furniture than women. It is concluded that most of the consumers of bamboo furniture were male from Baidu user data analysis.

![Figure 3. Population analysis chart of preference degree.](image)

According to the analysis of different age groups, as shown in figure 4, from the gray bar chart can be concluded that the search for bamboo furniture keywords users were mainly in the 20-29 age group, under 19 years old and 30-39 years old age group search index were higher. The blue histogram represents the distribution index of the whole network. It can be seen that 20-29 and 30-39 age groups are more distributed in the whole network, but less in the age group under 19 age group. Over 50 years old, the overall data is low. According to the yellow line, the highest TGI index is in the under19 age group, it shows that the preference for bamboo furniture is high. In conclusion, the main consumer groups of bamboo furniture should be between 20-39 years old, and other age groups are relatively small.

![Figure 4. Interest analysis chart of different age groups.](image)
Through the analysis of user portraits, we can draw a more scientific conclusion: the main consumer groups of bamboo furniture are men aged 20-39.

3.2. Bamboo furniture market analysis based on Python technology -- Taking bamboo chair as an example

3.2.1. Style and structure analysis of bamboo chair. From the ring diagram in Figure 5 (a), it can be concluded that the main styles of commercial bamboo chairs are simple modern, pastoral and European style, accounting for 36.09%, 33.77% and 23.29%. The three main styles occupy more than 80% of the market. The style of classical and retro bamboo chair is less, and the style of Japanese bamboo chair is the least, accounting for 0.37% of the total. Classical, retro nostalgic bamboo chair style is less, Japanese style bamboo chair style is the least, only 0.37% of the total. Therefore, for the simple modern, European, pastoral style of bamboo chair, due to the variety, style innovation is more difficult. We can consider other innovative perspectives, such as emotional, intelligent and folding design.

It can be seen from the ring diagram in Fig. 5 (b) that the main structure of bamboo chair is woven structure. Through different weaving techniques and patterns, the bamboo chair is innovated, and the knitting is mostly used for the innovative design of chair back. Because of its bamboo characteristics, bamboo chair is mostly a support structure with good ventilation and dryness, a small part is frame structure, so the proportion of frame structure is only 9.86%. To sum up, bamboo chair structure in weaving structure research more, more difficult to innovative breakthrough, we can start from the bending of bamboo to study the innovative design of curved wood and irregular bamboo, which has a good market prospect.

To sum up, there is a certain deviation in the positioning of bamboo chair style in some markets, which reflects the weak position of bamboo furniture design. The market for bamboo chair style classification is not rigorous, easy to mislead consumers' cognition. We can strengthen positioning and innovative design in the style design of bamboo chair, and broaden the practical scope and environmental scope of bamboo chair.

3.2.2. Analysis on the regional distribution of bamboo chairs. Regional analysis is mainly carried out in two directions: regional attention and regional sales volume. Regional attention using Baidu index analysis area keyword search volume, regional sales are mainly collected through Python web crawler technology to collect bamboo chair sales data of shopping web pages for statistical analysis.
As can be seen from Figure 6, the attention paid to bamboo chairs in China is almost all over the country. The main search areas are in the southeast coastal areas and Sichuan Province, and the other areas are less than 20 times, it shows that the attention of netizen to bamboo chair has strong regional characteristics.

As can be seen from figure 7, the main sales areas of bamboo chairs in China were also concentrated in the southeast coastal areas. As can be seen from figure 7, the main sales areas of bamboo chairs in China are also concentrated in the southeast coastal areas. The sales volume of bamboo chairs in Hebei Province, Sichuan Province, Guangdong Province, Hunan Province and Zhejiang Province has reached more than 300 pieces.

It can be concluded that the areas with more developed bamboo chair development and major audience are from southeast coastal and Sichuan area, whilst other regions have smaller markets and greater development potential.

![Figure 6. Search quantity area map.](image1.png)  
![Figure 7. Product quantity area map.](image2.png)

In summary, the development of bamboo furniture in southeast coastal areas is better, especially in Guangdong. The bamboo furniture industry radiates around Guangdong to the surrounding areas, forming a cluster effect.

3.2.3. Evaluation analysis on the use of bamboo chair. We collect the user's evaluation, and make a radar chart through classification analysis and statistics, as shown in Figure 8. From the figure, we can see the properties of bamboo chairs that users care about. Users have more comments on the height, folding and comfort of bamboo chair, which are 674, 673 and 520 frequency respectively, it shows that bamboo chair is better in height, folding and comfort. The lowest evaluation frequency is 144 times, which indicates that bamboo chair is lack of design and impresses people.

![Figure 8. Radar map for bamboo chair evaluation.](image3.png)
4. Conclusions and recommendations

4.1. Conclusion
Through the analysis of the market and development trend of bamboo furniture, the following conclusions are drawn: from the perspective of the development trend, the design of bamboo furniture will develop to an intelligent direction; the main audience area is southeast coast and Sichuan area, the main consumers’ group is 20-39 years old male; the main style of bamboo furniture market is simple modern, European, pastoral style, the main structure type is woven structure; the users’ attention mainly focuses on the attribute, height scale, folding adjustable and comfort of bamboo furniture.

4.2. Recommendation
1) In the future, big data will apply to intelligent furniture with the development of intelligent city. The increasing public demand for bamboo furniture will inevitably promote the rapid development of intelligent design industry. Through the intelligent management and control, it will provide consumers with a suitable living environment and a more comfortable, green, environmental protection with efficient furniture experience.
2) The design of bamboo furniture should broaden the types of style, structure and interest groups, on the basis of the development of the original regional market, further extending new development areas.
3) Pay attention to the users’ feedback information to better improve bamboo furniture products.
4) We can understand the market with real data to cater to the market and promote the development of bamboo furniture industry.

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