Research on the Evaluation of Provincial Public Libraries in China: A Case Study of Dianping.com Data (Postprint)

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Abstract

[目的/意义]To investigate the current status of public evaluation of provincial public libraries in China, compare the developmental differences among 39 provincial public libraries across 31 provinces in 7 regions (East China, Central China, South China, North China, Northwest China, Southwest China, and Northeast China), and provide recommendations for the future development direction of public libraries.[方法/过程]Objective evaluation data of public libraries were obtained from the "Overview of Basic Data on the Development of Public Libraries in China", "China Library Yearbook 2016", and the website of the National Bureau of Statistics of the People's Republic of China, and several dimensions for data acquisition were determined. Python web scraping technology was applied to obtain assigned ratings and user reviews of provincial public libraries in China on Dianping. Frequency analysis, skewness analysis, correlation analysis, and sentiment analysis methods were employed to analyze the relationships among various elements of public library evaluation in China from the readers' perspective, and constructive recommendations were proposed.[结果/结论]Through data analysis, the following research conclusions were drawn: 1) Balancing disparities, involving both regional differences and differences in evaluation content; 2) Enhancing attractiveness to users, especially in remote areas; 3) Monitoring user sentiment orientation, focusing on hotspot keywords of reader interest, while also mitigating the impact of negative sentiment.

Full Text

Preamble

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Abstract

[**Purpose/Significance**] This study investigates the current status of public evaluations of provincial public libraries in China, comparing construction differences across 39 provincial public libraries in 31 provinces across seven regions (East China, Central China, South China, North China, Northwest China, Southwest China, and Northeast China) to provide recommendations for future library development. [**Method/Process**] Objective evaluation data of public libraries were obtained from the *Basic Data Overview of Chinese Public Library Development*, *Chinese Library Yearbook 2016*, and the National Bureau of Statistics website to determine data acquisition dimensions. Python web crawler technology was applied to collect assigned ratings and user comments on provincial public libraries from Dianping.com. Frequency analysis, skewness analysis, correlation analysis, and sentiment analysis methods were employed to analyze the relationships between various elements of public library evaluation in China from a reader's perspective, offering constructive suggestions. [**Result/Conclusion**] Data analysis yielded the following conclusions: (1) Balance differences, involving both regional disparities and evaluation content variations; (2) Enhance user appeal, particularly in remote areas; (3) Pay attention to user sentiment tendencies, focusing on hot keywords of reader concern while addressing negative emotional impacts.

Keywords: library evaluation; Python; evaluation analysis; big data

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With the continuous development of China's public library sector and the ongoing improvement of service standards, library services are gradually entering a stage of scientific and standardized management. To enhance the comprehensive service capacity of public libraries, research on library evaluation has become a focal concern.

Research on public library evaluation in China originated in the 1980s. Early studies were conducted through reference and comparison, with scholars such as Song Yunjiao [1] and Shi Shiyu [2] attempting to draw guidance from foreign public library evaluation methods for China's burgeoning library sector. In 1986, following the Ministry of Culture's directives on public library evaluation work, research began with county-level public library assessments [3], using overall evaluation requirements as the primary construction basis [4]. This sparked vigorous research discussions on evaluation across public libraries at all levels and regions nationwide [5-6]. Deepening theoretical research facilitated refined exploration, and by the 1990s, discussions on overall evaluation theory shifted to multi-angle research paradigms including library evaluation indicator systems [7-

9], staff performance evaluation [10], collection evaluation [11-13], service work evaluation [14-15], and service effect evaluation [16-17].

The early 21st century witnessed a wave of library quantification, electronicization, and intellectualization, and public library evaluation research was swept into this technological tide [18-21], achieving integration of theory and technology. Over the past decade, benefiting from the emphasis on public library services in the 12th and 13th Five-Year Plans [22] and the smooth implementation of public library evaluation work [23-25], theoretical research on public library service evaluation [26-27], performance assessment [28-29], and evaluation methodologies [30] has regained mainstream prominence.

From a practical perspective, China's public library evaluation work has undergone six sessions spanning 23 years, combining expert evaluation from both quantitative and qualitative perspectives. Key indicators include building area, collection size, funding, technical equipment, reader satisfaction, major cultural projects, modern technological conditions, digital resource services, and regional service system planning and resource sharing [31]. This evaluation is based on an expert perspective, with reader evaluation examined only through reader satisfaction surveys. Therefore, this study adopts a reader's perspective, using actual user experience evaluation information from Dianping.com to explore reader-based public library evaluation.

1. Data Sources and Research Tools

1.1 Data Sources

Founded in 2003, Dianping.com is China's leading online platform integrating local lifestyle and transaction information, and the world's earliest independent third-party consumer review website. It provides users with merchant information, consumer reviews, and discount offers. Its pioneering third-party review model has become a new internet hotspot, allowing users to freely publish comments and personal experiences about businesses, with nearly all review information originating from and serving the public [32].

This study's data originates from Dianping.com, collecting information on 39 provincial public libraries across seven regions (East China, Central China, South China, North China, Northwest China, Southwest China, and Northeast China) covering 31 provinces (excluding Hong Kong, Macau, and Taiwan). The Qinghai Provincial Library was not included on Dianping.com, while provinces/municipalities including Tianjin, Guangdong, Guangxi, Fujian, Shanghai, Hunan, Henan, and Chongqing each contain multiple provincial public libraries. Data collection concluded on March 12, 2018.

Libraries were searched on Dianping.com using names from *Chinese Library Yearbook 2016*, identifying 39 provincial public libraries (including branch libraries) with ratings and reviews, as shown in Table 1 . Their corresponding URLs on Dianping.com were saved in JSON (JavaScript Object Notation) for-

mat. JSON is a lightweight data exchange format based on JavaScript (Standard ECMA-262 3rd Edition - December 1999) that is easy for humans to read and write and for machines to parse and generate [33].

1.2 Research Tools

This study utilized multiple Python libraries for data analysis and mining, including Pandas, Zipfile, Numpy, and Matplotlib. Given the large dataset for provincial public libraries and the need for compressed data upload, the Zipfile library was introduced for data decompression. Pandas incorporates numerous libraries and standard data models, providing efficient tools for operating large datasets and numerous functions for quick and convenient data processing. The Numpy library offers many advanced numerical programming tools, such as matrix data types, vector processing, and sophisticated computational libraries for rigorous numerical processing. Matplotlib is a Python 2D plotting library that can generate various charts such as histograms, bar charts, and scatter plots with just a few lines of code, making data results more intuitively displayed. By introducing these data analysis libraries, this study conducted rating comparisons, descriptive analysis, and correlation analysis on the collected data to identify deficiencies and propose response strategies.

2. Data Analysis

This study applied web crawler technology to collect all review information from Dianping.com, including provincial public library names, star ratings, book ratings, environment ratings, service ratings, review content, review content quantity distribution (including positive, neutral, and negative reviews, as well as reviews with images), and average price per person, as shown in Table 2 . Partial library evaluation information is presented in Table 3 .

Subsequently, data items (numerical and textual data) were examined. Due to network issues during data collection, missing data occurred—for instance, the average price field normally contained 39 entries but had 3 missing values, which were filled using the `fillna()` function. To further grasp the overall data distribution, `dataframe.describe()` was applied to examine the specific distribution of numerical data. The "review content quantity distribution" was split into separate columns for positive, negative, and neutral review counts to facilitate observation and analysis, as shown in Table 4 .

To further explore relationships and patterns in the collected data, this study applied frequency analysis, skewness analysis, correlation analysis, and sentiment tendency analysis: (1) Frequency analysis: counting the number of individuals in each group when total data is grouped by certain criteria; (2) Skewness analysis: describing the symmetry of sample data distribution, typically ranging between (-3, 3) to measure distribution shape [34]. A skewness coefficient closer to 0 indicates more symmetric data, while values farther from 0 indicate greater asymmetry. Positive values indicate right-side dispersion, while negative values

indicate left-side dispersion; (3) Correlation analysis: analyzing two or more correlated variables to measure their degree of correlation; (4) Sentiment analysis: identifying viewpoints from user review text, analyzing emotional tendencies, and extracting relevant opinion elements.

2.1 Frequency Analysis

According to this study's statistics, the 39 provincial public libraries on Dianping.com primarily display six star ratings: 10 five-star merchants, 7 quasi-five-star merchants, 9 four-star merchants, 12 quasi-four-star merchants, 1 three-star merchant, and 0 two-star merchants, as detailed in Table 5 .

The study found that star ratings are largely determined by readers' book ratings, service ratings, and environment ratings for each library. Therefore, numerical analysis of these three factors was conducted to describe the approximate range of rating values for these 39 libraries, as shown in Figure 1 [Figure 1: see original paper] (the horizontal axis represents the numerical range of the three rating factors, while the vertical axis represents the frequency of each rating value).

As shown in Figure 1, the distribution ranges of the three rating types are relatively broad, but the frequency distribution of each value group differs. For instance, the most frequent value intervals for both book ratings and environment ratings fall within (9.0, 9.5), while the mode interval for service ratings is (7.0, 7.5), reflecting that provincial libraries are relatively highly recognized by readers for their collections and reading environment, but still have deficiencies in service aspects requiring improvement.

2.2 Skewness Analysis of Evaluation Factors

Building on frequency analysis, this study further conducted skewness analysis (see Figure 2 [Figure 2: see original paper]) to examine data distribution characteristics.

The skewness analysis reveals that the three rating types—book ratings, service ratings, and environment ratings—are relatively concentrated, with skewness values near 0 and no negative skew, indicating highly symmetrical datasets. This demonstrates that Dianping.com's classification of public libraries into these three dimensions for scoring is scientifically meaningful. The skewness of average price per person falls between (1, 2), within a reasonable range. The study found significant variation in skewness analysis of review counts across libraries, with an extreme value of 3,044 reviews for Shanghai Library, indicating substantial differences in review numbers among provincial libraries. Individual library review quantities are shown in Table 6 .

2.3 Correlation Analysis of Evaluation Factors

To determine correlations between various factors, this study used Python's `dataframe.corr()` function to calculate correlation values between factors (see Table 7), where larger values indicate stronger correlations.

Table 7 shows that the top three strongest correlations are: book ratings and environment ratings (0.98), neutral review count and negative review count (0.975), and service ratings and environment ratings (0.96). The weakest correlations are: average price and neutral review count (0.22), neutral review count and service ratings (0.22), and average price and negative review count (0.23).

For more intuitive visualization of relationships between factors, a heatmap was generated, where darker colors indicate stronger correlations. Figure 4 [Figure 4: see original paper] shows that book ratings, environment ratings, and service ratings are most closely interconnected. Average price shows low correlation with other factors, while positive, neutral, and negative review counts also demonstrate relatively strong intercorrelations. The analysis reveals that book ratings correlate most strongly with environment ratings (0.98), followed by service ratings (0.96). Environment ratings correlate most strongly with book ratings (0.98), followed by service ratings (0.96). Service ratings correlate most strongly with environment ratings (0.96), followed by book ratings (0.96). These three factors are thus closely correlated and represent important indicators for Dianping.com's evaluation of public libraries.

2.4 Sentiment Analysis of User Reviews

This study explores users' evaluations and emotional tendencies toward public libraries by analyzing user comments. High-frequency word statistics and text sentiment analysis were conducted on 10,072 user comments about provincial public libraries. Comments were segmented, with conjunctions and adverbs removed. WordCloud was applied to generate a word cloud diagram, as shown in Figure 5 [Figure 5: see original paper], visually displaying the frequency differences of various words and phrases.

Keywords were sorted by frequency, and the top 20 high-frequency keywords were extracted, as shown in Table 8 . These keywords reveal that user concerns primarily focus on "books," "environment," "borrowing," "learning," "atmosphere," "reading rooms," "service," "quiet," and "digitalization." Additionally, terms such as "collection," "staff," "reading," "location," "weekend," "ID card," "transportation," "checkout," and "return" also appear frequently.

This study employed the SnowNLP package for Chinese text sentiment analysis. SnowNLP's sentiment analysis value expresses "the probability that this sentence represents positive emotion," ranging from (0, 1), where values closer to 1 indicate more positive emotions. By examining sample comment data and their sentiment values (see Table 9), most user comments about public libraries on Dianping.com demonstrate positive attitudes. However, observation of lim-

ited data may lead to biased conclusions. To avoid this, the `mean()` function was applied to sentiment analysis results, yielding an average value of 0.793, exceeding 0.7 and indicating overall positive user evaluations. The median was then calculated as 0.9968, significantly higher than the mean and nearly approaching 1 (completely positive). This suggests that most evaluations express high satisfaction, with a small number of outliers significantly lowering the average. The majority of positive comments can inform future library development strengths, while the minority of outliers represent areas requiring improvement.

3. Research Results and Discussion

Overall, this study investigated public evaluations of 39 provincial public libraries across 31 provinces on Dianping.com through status surveys, frequency analysis, skewness analysis of influencing factors, correlation analysis of evaluation factors, and sentiment analysis, yielding the following findings:

3.1 Balancing Differences

Research data reveal differences in user evaluations across regions and content dimensions.

Balancing Regional Distribution Differences: Statistical distribution of provincial libraries by region based on frequency analysis star ratings shows that libraries in North China, East China, and Northeast China are more favored by Dianping.com users than other regions. Specifically, North and East China each have 4 libraries, Northeast China has 3, South and Southwest China each have 2, and Northwest and Central China each have 1, demonstrating regional disparities. Additionally, skewness analysis indicates significant regional variation in online review numbers across provincial libraries. The factor with the largest skewness value is reader review counts, with Beijing and Tianjin in North China showing high review volumes and Inner Mongolia having the fewest participants. Northwest China shows the highest review numbers in Shaanxi, while Gansu, Qinghai, and Xinjiang have fewer participants. East China shows outstanding review numbers in Zhejiang, Jiangsu, and Shanghai, with Anhui having the lowest. Northeast China shows relatively balanced distribution, led by Liaoning. Southwest China shows higher values in Sichuan and Chongqing, while South China shows the highest in Guangzhou. Central China shows Hubei with the highest numbers, followed by Hunan. Overall, regional imbalance reflects gaps in library visits, verified in skewness analysis. Therefore, to balance regional distribution differences, libraries should learn from each other's strengths, develop regional characteristic resources, and promote reader visits.

Balancing Evaluation Content Differences: The rating value distribution chart from frequency analysis (see Figure 3) shows that Dianping.com's rating indicators for provincial libraries primarily include books, environment, and service. Within high rating intervals, service rating frequencies are noticeably lower than the other two indicators, suggesting relative weakness in service aspects.

Simultaneously, service shows strong correlation with books and environment—improving library services further enhances user perception of collection quality and environment.

3.2 Enhancing User Appeal

Correlation analysis shows high overall correlation in user evaluation data, demonstrating good reliability. However, skewness analysis reveals large skewness differences in library review counts, indicating high dispersion in Dianping.com user reviews and limited comparability of evaluation results across some regions. This aligns with China's regional economic development and current status of provincial public libraries. Therefore, enhancing user appeal, especially in remote areas, is necessary. Correlation analysis suggests that improvements in collection resources and environment can promote user attraction. On one hand, increasing user visit rates attracts more readers to enjoy library services; on the other hand, increasing user participation by providing rewards to users who submit online evaluations encourages user engagement in library assessment.

3.3 Paying Attention to User Sentiment Tendencies

User sentiment serves as a pathway to understanding reader needs and expectations, helping to focus on reader interests and provide targeted services. High-frequency word and word cloud analysis reveal that beyond key concerns about resources (books, collections), services (borrowing, returning, checkout, reading), and environment, hidden needs and expectations such as quietness, digitalization, location, ID cards, and transportation should also be addressed. Focusing on key content helps libraries develop relevant services and activities purposefully.

Attention should also be paid to readers' emotional attachment. Sentiment value analysis reveals that evaluations of public libraries are positive overall, but a few outliers warrant significant attention. For example, among all collected comments, 26 directly mentioned staff service attitude, including 10 negative reviews, 8 positive reviews, and 8 neutral reviews. Negative reviews frequently mentioned terms such as "poor personal quality," "weak service ability," "turning a blind eye," and "unfamiliar with operations." Such feedback directly impacts user satisfaction. Therefore, negative emotional words help libraries grasp user 负面情绪 and respond promptly.

Limitations

This study has certain limitations. First, it is constrained by the structure of Dianping.com data, which can only explain book ratings, service ratings, environment ratings, average price, positive, neutral, and negative reviews, but cannot reveal more evaluation content. Second, the correlation results only show relationships, not causation, requiring further in-depth research. Third,

the sentiment analysis only assigns values to overall emotional evaluation without assigning values to specific emotional tendencies, which requires subsequent research.

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Author Contributions

Zhang Wenliang: Proposed research ideas, content, and framework; revised the paper.
Fu Xiaonan: Conducted literature review, data acquisition, and paper writing and revision.

Wang Yanfang: Conducted data acquisition, data analysis, and paper writing and revision.

Note: Figure translations are in progress. See original paper for figures.