Analyzing Factors Affect the Comprehensive Evaluation of Smartphones

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Abstract. With the continuous progress of modern technology and the more prevalent of smartphones, smartphones have become an indispensable part of people's lives. Nowadays, with a vast number of powerful and different-priced smartphones in the market, consumers always face many choices when purchasing. Through extensive document searching, key dimensions of factors of the evaluation process were identified by this study, including hardware specifications, system software, user experiences, pricing, and brand reputation. By using the descriptive statistics method, these factors are discussed in multiple dimensions, which analyzed the influence of hardware performance on user evaluation. The hardware and price of a phone have a vital impact on users' purchasing decisions. Brand building and word-of-mouth management are also crucial for phone manufacturers. Users tend to choose more cost-effective phones to get satisfactory performance and experience within a limited budget. According to the results of the analysis, mobile phone manufacturers need to consider many factors such as hardware performance, software ecology, brand awareness and price to fit user's needs. In addition, providing quality post-sales service and focusing on the balance between price and performance will help attract more consumers to choose its products. Understanding users' preferences of different factors for smartphones has important guiding meaning for manufacturers' marketing strategies and product planning.

Keywords: Smartphones, factors, evaluation, user preferences.

1. Introduction

Since 2010, mobile phones have improved in parts of memory capacity, storage space, screen resolution, and camera pixels, enabling them to better meet the functionality and performance of users' needs. However, the speed of mobile phone upgrades seems slowed down in recent years. Because lack of innovation, the smartphone industry leads a crazy rat race for mobile phone hardware between major manufacturers, but it still cannot save the decline of the mobile phone industry [1].

A multitude of factors will lead to impacts on customers' purchases, thus studying these factors can undoubtedly provide manufacturers with better design ideas and sales methods. Among them, the price of a smartphone is one of the pivotal factors for buyers to consider when deciding whether to buy a mobile phone. Higher-priced phones often have advanced hardware and better performance. Nevertheless, price is not the only factor that affects mobile phone ratings [2]. The subjective evaluation of brand fans will affect the grade sometimes [3]. The intensity of product promotion will also affect the mobile phone evaluation [4]. Even Jamalova reports that different regions have different acceptance levels for different brands of mobile phones [5]. Therefore, studying the relationship between mobile phone price and sales volume is a sophisticated task, which requires comprehensive consideration of multiple factors.

Especially now, which contains developed networks, online comments have become more and more common, and all aspects of smartphones will affect customers' comments on products. In an environment with inequivalent information, the number of evolutions provides information about the selection of the product of other users for consumers, allowing them to infer the intrinsic information of the product. When online reviews contain function descriptions of products, consumers' imagination and impression of product features will be more specific, enhancing consumers' sense of

experience and satisfaction with the product. It affects the purchase intention of potential customers [6]. So, online reviews would greatly affect the likelihood of customers buying. Furthermore, reviews are closely connected to the performance and price of the actual goods that buyers will buy. As a result, understanding the relationship between the hardware, price and the final grade of the phone is significant for both manufacturers and consumers.

There are multiple ways to analyze the comment. Wang and Liu designed a text analysis system to determine consumer's comments about the product and automatic quantification. And refined the classification of consumer reviews based on the Gopinath research. According to the measure of consumer satisfaction, they divided the product attributes from the consumers' comments into six categories [7]. Liu, et al used Latent Dirichlet Allocation (LDA) to extract the qualifying feature. Meanwhile, transfer each online comment to a structured vector. Then, based on the online comments qualify feature, apply Long Short Term Memory (LSTM) Internet to predict customer ratings. Finally, use the Gaussian Mixture Model (GMM) model to test whether these Carnot category variables will have a positive, negative, or indifferent impact on the sales ranking of the product [8].

Zheng Ya Wei be aimed at the 2016s iPhone which in the Chinese mainland area have a serious decline in sales volume, and suggest some ideas and method that focus on this phenomenon, The author used the Strengths weaknesses opportunity Threats (SWOT) analytic technique from management, also the least squares regression and the principal component regression method which from statistic, in the end, analyzed the positive and negative factors of the sales [9]. Jia Ran Ran and Han Xu introduced how to use the multivariate linear regression method to analyze influence factors of food output, and gave some advice on the result [10]. linear regression method is useful for solving influence factor problems. So, this article uses a new method to avoid repetition and decided to use multivariate linear regression to do data analysis.

The above studies provide a lot of the relevant factors affecting the comprehensive evaluation of mobile phones. Therefore, this paper refers to the relevant market research reports and academic research results, to further deepen the understanding and understanding of this field. The purpose of this paper is to make a comprehensive analysis of the relationship between the hardware, price, and scoring of mobile phones, to provide useful insights and decision bases for market participants and consumers while revealing the potential patterns and rules among them.

2. Method

2.1. Data Source and Description

When collecting mobile phone sales data, to ensure reliability and accuracy, it would be best to recommend reliable Industry research institution data, so the article combined data from authoritative reports and Mechanical Turk. That dataset contains the most popular mobile phones from the U.S. in 2022. Each phone’s data has significant functions such as performance (AnTuTu Performance scoring software), RAM, camera resolution, battery size, screen size, release date, etc. Each mobile phone’s price is collected from Amazonas and Best Buy (22/8/2022). In conclusion, the dataset has 34 mobile phones, contains 13 functions, and 991 data.

In addition, to get ratings, Mechanical Turk conducted another survey of users. Each participant randomly received 10 mobile phones and was asked to indicate how likely it was to buy each mobile phone at a given price, ranging from 1 (highly unlikely) to 10 (highly likely). The data also includes personal information about each participant, such as age, gender, and occupation.

2.2. Variable Selection and Description

In this paper, by reviewing the relevant literature of domestic and foreign scholars, the influencing factors selected by scholars in establishing the model, and the collected data, to select and determine the indicators. Since this study took the evaluation as the final result, the score of the mobile phone was set as the dependent variable, and the variables involved were divided into two categories. And subdivided into 10 subcategories.

As shown in Table 1, the following numerical variables include price (USD), RAM (GB), storage (GB), performance, front camera pixel (mp), rear camera pixel (mp), screen size (inch), weight (g), and battery capacity (mAh). categorical variables include operating system, brand, and gender.

Table 1. Influence factor

System	operating system *
Camera	front camera pixel、rear camera pixel
Screen	screen size
Appearance	weight
Battery	battery capacity
RAM	RAM
Storage	Storage
Performance	Performance
Consumer	gender* age
Market	brand* price

*Represents categorical feature

2.3. Method Introduction

Before conducting the descriptive statistics analysis, the collected data underwent a series of preprocessing steps to ensure its quality and suitability for analysis. Descriptive statistics provide a comprehensive overview of the dataset, allowing us to understand the central tendencies, dispersions, and distributions of the variables. This analysis aids in identifying patterns, trends, and potential outliers in the data.

3. Results and discussion

In the graph shown in Fig. 1, the popularity of iOS is slightly higher than that of Android, which is a significant advantage of Apple smartphones.

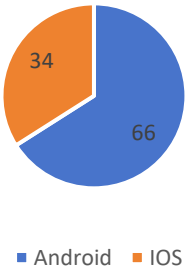


Fig. 1 The average distribution of operating systems (two major systems) (Photo credit: Original)

As can be seen from Fig. 2. the preference diagram of the system, the IOS system is more favored by female consumers.



Fig. 2 System Preferences Graph (Photo credit: Original)

From Fig. 3, it can be observed that most users prefer smartphones with smaller storage space, as the number of people choosing larger storage space decreases.

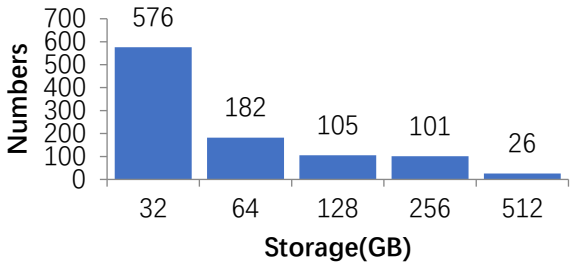


Fig. 3 Storage space histogram (Photo credit: Original)

Fig. 4 displays an area chart of preferred brands, showcasing the top five brands favored by users: Samsung, Apple, Xiaomi, Motoria, and Oneplus.

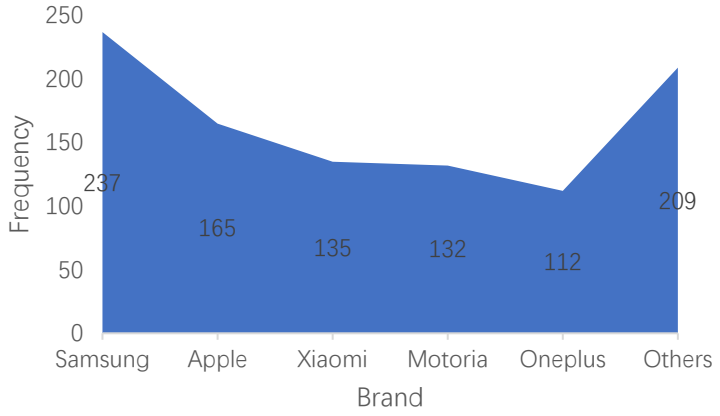


Fig. 4 Brand selection area map (Photo credit: Original)

As shown in Fig. 5, the price histogram reveals that users tend to prefer smartphones priced at $1000 or below, with $500 being somewhat more popular.

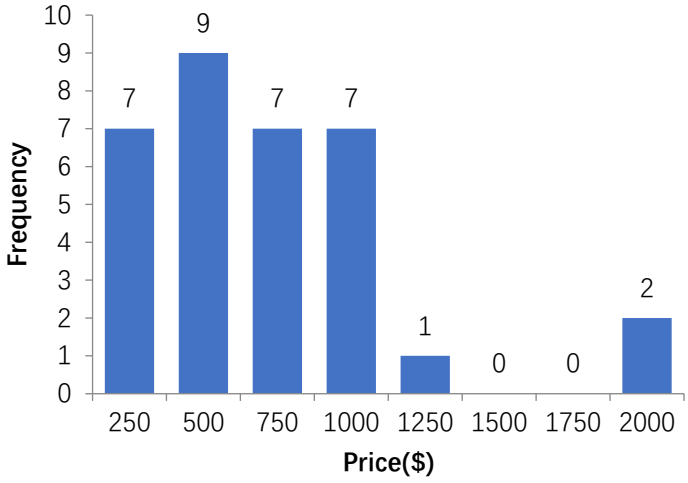


Fig. 5 Price histogram (Photo credit: Original)

Fig. 6 displays a histogram of performance ratings, illustrating users' preferences for mobile phone performance. Among them, phones with a performance score of 8 are the most popular.

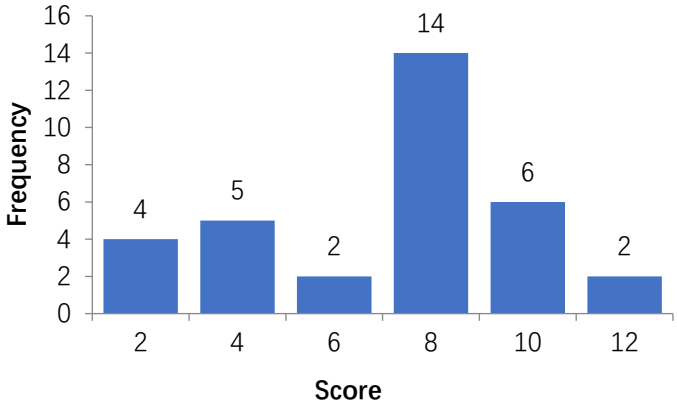


Fig. 6 Performance score histogram (Photo credit: Original)

From the histogram in Fig. 7 about RAM, we can see that the most popular size of RAM is 8GB, which is much more favored compared to other RAM sizes. Additionally, it gradually decreases as it moves towards both ends.

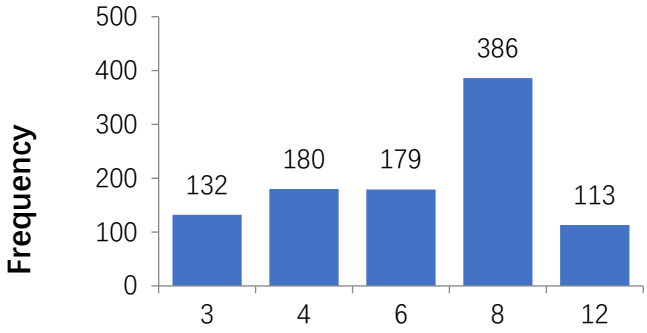


Fig. 7 RAM histogram (Photo credit: Original)

According to Fig. 8, the histogram of battery capacity reveals that larger battery capacities are more favored by users.

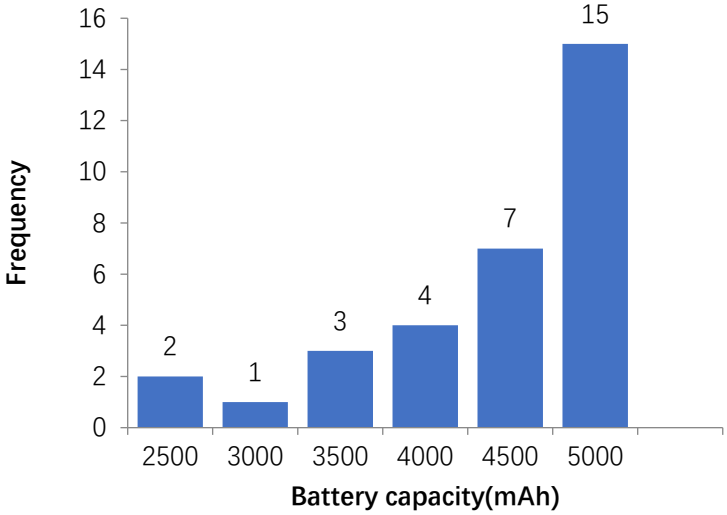


Fig. 8 Battery capacity histogram (Photo credit: Original)

By analyzing the histogram of screen sizes in Fig. 9, it can be observed that users tend to prefer smartphones with screen sizes of 6.5 and 7 inches.

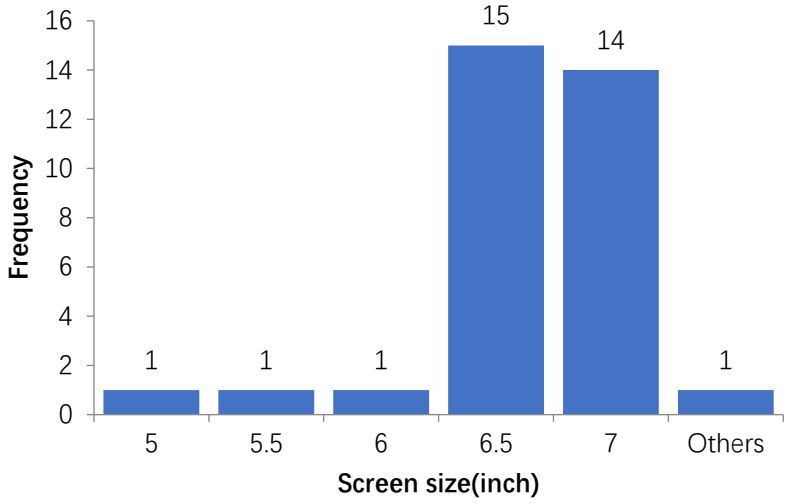


Fig. 9 Screen size histogram (Photo credit: Original)

Fig. 10 displays the camera histogram, which reveals that users prefer phones with a composite camera score of 12 and 50 (a weighted score considering both front and rear camera pixel count and the number of rear cameras). This is closely related to users' photography habits. It's also evident that mobile manufacturers have a penchant for producing phones with a composite camera score of 12, accounting for nearly 40% of the total.

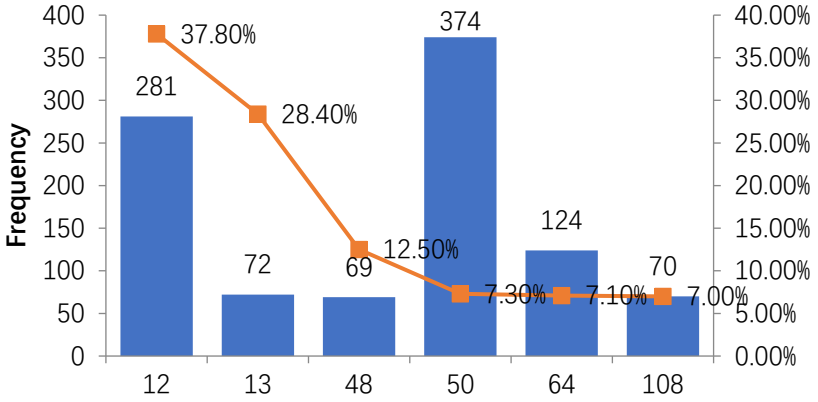


Fig. 10 Displays the camera histogram (Photo credit: Original)

Fig. 11. The Gender Distribution Chart of Respondents reveals that the gender distribution of the participants in this survey is quite balanced, which minimizes the potential influence of gender on the survey results.

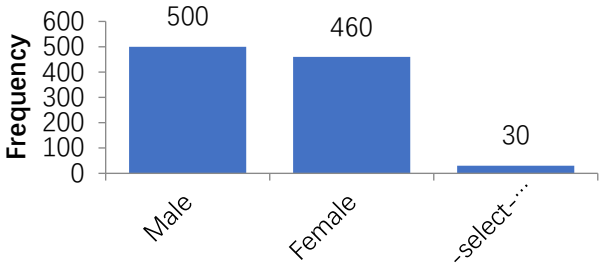


Fig. 11 The Gender Distribution Chart (Photo credit: Original)

4. Conclusion

Based on the analysis provided above, the following conclusions can be drawn:

1)Importance of Hardware Specifications: Hardware specifications are among the key factors in the comprehensive evaluation of mobile phones. From the analysis results, it is evident that high-performance processors, appropriate memory and storage capacities, and high-quality cameras have a positive impact on user satisfaction. This implies that users are more inclined to purchase smartphones that excel in hardware performance.

2)Influence of Software Ecosystem on User Experience: The analysis results indicate that the software ecosystem of a mobile phone significantly affects user experience and satisfaction. Users prefer phones with diverse application stores and timely and stable system updates. This underscores that apart from hardware performance, users also value the stability of the operating system, app compatibility, and system usability.

3)Impact of Brand Reputation and Word-of-mouth: The research findings demonstrate that brand reputation and word-of-mouth play a crucial role in users' purchasing decisions. Brands with high recognition and positive reputations find it easier to gain users' trust and selection. This suggests that brand management and reputation are highly important for mobile phone manufacturers.

4)Balancing Price and Value: The analysis shows that users typically consider the balance between price and performance when buying a mobile phone. Phones with high value for the price are more likely to be favored by users, as they desire the best performance and experience within their budget.

In light of the comprehensive analysis above, mobile manufacturers need to focus on optimizing product performance and the software ecosystem. Simultaneously, they should enhance brand establishment, maintain a positive reputation, provide quality after-sales service, strike a balance between price and value, and strive to design appealing aesthetics. These efforts will help attract more consumers to choose their mobile products. Understanding consumer preferences for different factors is of significant guidance for mobile manufacturers in formulating marketing strategies and product planning.

Moreover, this article still has certain limitations. The data collected for reviews might not encompass all current phone models and audience demographics, which limits the analysis to contemporary mainstream phone configurations. Factors influencing reviews were considered in a somewhat incomplete manner due to data constraints, focusing solely on textual analysis of reviews. Additionally, other analysis results were not highlighted, and further in-depth and diversified analyses are warranted in the future.

Authors Contribution

All the authors contributed equally, and their names were listed in alphabetical order.

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