

The Insights of the Popular Game Apps from the Reviews Analytic

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Abstract. Mobile devices have not only become popular in recent years, but also have taken our society by storm; in turn, the number of application developers and publishers has grown rapidly. This research aims to investigate the review analytics of Android games listed on Google Play using a proposed text analysis approach to extract all user reviews from game apps in Chinese. This research proposed a heuristic n-phrase rule technique to extract user reviews that were analyzed according to various characteristics such as reviewer's gender, games categories, star ratings, game attributes, and high sentiment games. The synthesis of content analysis in sentiment and topic categorization along with correspondence analysis (CA) contributes to summarize, visualize, and provide many insights into users' concern as well as best practices for developers. Furthermore, apps developers would gain direct feedbacks regarding how to improve their products or services in more detailed aspects.

Keywords: Review Analytics, Game Apps, Correspondence Analysis.

1 Introduction

The smartphone application (app) market has become one of the most important consumer electronic resources. This market emerged rapidly and is highly competitive, due to the lower costs associated with developing apps as compared to developing traditional software. Google Play provides different types of information including the app descriptions, screenshots, user reviews, and star ratings information to help users select apps. Prior researches about user-generated contents (UGC) in the web have shown that they are useful as a marketing tool and effective in increasing competitive advantage. To understand users' app preferences, many platforms such as Google Play provide different mechanism that users can use to review downloaded apps. The most commonly mechanism is a ranking scale from 1 to 5. However, more detailed insights on user's feelings, experiences, critiques, suggestions, or preferences are missing due to a lack of additional written comments.

According to the report from app store analytics firm Distimo, "the uptake in the types of quick downloads are most common with games, which are the most downloaded and revenue generating types of apps" [1]. Game reviews, especially those written by fans and nonprofessionals, are a relevant source of information that can help us understand how players describe games, gameplay, and so on [2]. It undoubtedly can influence potential users' decision to purchase or download the game.

This research investigates Chinese app review analytics associated with Android smartphone games listed on Google Play using an opinion mining approach. Google Play provides different types of information including app descriptions, screenshots, user reviews, and star ratings to help users select apps. Opinion mining helps to identify the subjectivity, sentiment, appraisal or feeling of user expressed comments in unstructured texts on specific topics, or the overall context of a review, using certain analytic approaches [3]. In this paper, a heuristic n-phrase rule technique is proposed to automatically extract all user reviews crawled from game apps in Google Play. These texts are analyzed according to various metrics including game types and game attributes.

2 The Background

2.1 App Reviews

User reviews usually add value by providing feedback to both the developer and the user community. App user reviews are important because they communicate information that may influence product-purchasing decisions via polarized sentiment and user expressed opinion. User reviews can warn people about undesirable or privacy-invasive apps [4]. For developers, reviews represent user generated and crowd-sourced content regarding user preferences and app quality; they also facilitate developers in terms of design priorities and marketing strategies. UGC offers the opportunity to learn from successful apps that are similar to the one being designed and developed [8].

Typically, app users provide a numerical rating (often as stars) and a brief text comment. Hu et al. [6] demonstrated that product reviews have a J-shaped distribution with mostly 5-star ratings, some 1-star rating, and hardly any ratings in between. People tend to write reviews only when they are either extremely satisfied or dissatisfied.

Prior researchers have attempted to apply data mining techniques to deal with context dependent opinion words from app reviews. Ha & Wranger [5] examined a majority of reviews focused on the quality of apps available through Google Play and found that people often described an app using an adjective, wrote about its features/functionality, and clarified whether the app worked or not. The star ratings were generally positive and had a J-curve distribution. Huang & Ting [7] suggested that recipients' ability to search for information, the relationship between the message receiver and communicator, and opinion leader's viewpoints are the most important factors influencing the word-of-mouth marketing strategies for apps. Raison et al. [9] extracted user opinions posted at Gamespot by applying co-clustering to an adjective-context co-occurrence matrix. From the derived co-clusters, they discovered that game users tend to care about the overall look and feel of the game more than the concrete elements used in the game. In the current paper, we employ a sentiment analysis approach to extract users' sentiments associated with polarized ratings of game apps on Google Play.

3 The Proposed Method

Users commonly seek quality information from online user reviews prior to downloading or purchasing an app, while many developers use online user reviews as an important resource for product development and marketing management. As illustrated in Figure 1, an opinion mining method is proposed to extract attribute-opinion pairs that reveal insights associated with user reviews for free downloadable Android games from Google Play. Content analysis accompanied by correspondence analysis (CA) is also utilized to summarize and visualize users' reviews according to various metrics including game type and game attributes.

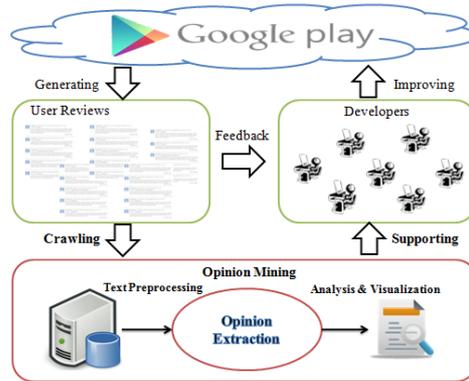


Figure 1. App Review Analysis Architecture

Heuristic N-Phrase Rule

A heuristic n -phrase rule is proposed to identify the opinion polarity of an attribute in review sentences. An n -phrase is a contiguous slice of n words or phrases of a longer sentence. An n -phrase of size 2 is referred to as a bi-phrase; size 3 is a tri-phrase; size 4 is a four-phrase, and so on. The steps are as follows:

- Step 1: Identify the attribute in a processed sentence—that is, whether it is on the predefined game attribute word list.
- Step 2: Check the first phrase after the attribute to see whether it is in the opinion lexicon. If so, these two words “attribute” + “opinion polarity” are put together as an attribute-opinion pair. If the first phrase after the attribute is not in the opinion lexicon, check the first phrase prior to the attribute. If this matches, these two words are put together as an attribute-opinion pair.
- Step 3: If the first phrase prior to the attribute is not in the opinion lexicon, check the second phrase after the attribute. If no, check the second phrase prior to the attribute. Continue this procedure until a qualified attribute-opinion pair is located, or until none can be found.
- Step 4: If a negation operator precedes the opinion word by one or two words, the opinion polarity is reversed.
- Step 5: If a degree word precedes the opinion word by one or two words, the strength sentiment of the phrase is computed based on the predefined level of strength of the degree word.

4 The Findings and Discussions

Data Description

This study mined and analyzed 207,048 reviews of 4,268 game apps from 2,181 developer free games across the six game types (arcade & action, casual, brain & puzzle, cards & casino, sports, and racing) listed on Google Play.

Table 1 shows the descriptive statistics of the data, which includes the numbers of reviews made by men (59.5%), women (32.3%), and those with no specified gender (8.2%). In addition, more than 75% of the reviews focused on either arcade & action or casual games. More specifically, males reviewed more arcade & action, sports, and racing games, while women reviewed more brain & puzzle and casual games, suggesting significantly different game type preferences between genders.

Table 1. Descriptive Statistics of the Data

Game Type	No. of Apps	No. of Developers	No. of Reviews	Gender				Opinion		
				Men	Women	Unknown	M/W	Positive	Negative	P/N
Arcade & Action	1,159	519	78,501	55,616	16,853	6,032	3.3	62,486	16,015	3.9
Casual	1,235	557	77,578	37,986	32,444	7,148	1.2	55,984	21,594	2.6
Brain & Puzzle	852	472	28,432	13,472	12,715	2,245	1.1	18,024	10,408	1.7
Cards & Casino	428	224	9,891	5,979	3,339	573	1.8	7,229	2,662	2.7
Sports	268	177	8,190	6,711	938	541	7.2	6,554	1,636	4.0
Racing	326	232	4,456	3,472	610	374	5.7	2,261	2,195	1.0
Total	4,268	2,181	207,048	123,236	66,899	16,913	1.8	152,538	54,510	2.8

* M/W: men/women ratio; P/N: positive/negative ratio.

J-Shaped Distribution of Users' Reviews

As shown in Figure 2, the distribution of users' reviews exhibited a J-shaped distribution with mostly 5-star ratings across all samples, followed by 1-star ratings. 80.0%, 81.7%, 81.5%, 83.7%, and 77.6% of the ratings, developers, reviews, reviews from male, and reviews from female are greater or equal to four stars that confirming review ratings of free Android game apps are overwhelmingly positive. However, the J-shaped distribution for female reviews was flatter than that for males. This suggests that males tend to write reviews when they are either extremely satisfied or extremely unsatisfied accompanied with the extremely star rating. In contrast, females are more prudent in terms of star ratings than are males. In addition, the polarized developer ratings (77.0% 5-star; 14.1% 1-star) demonstrate that users tended to express their sentiments using extreme ratings.

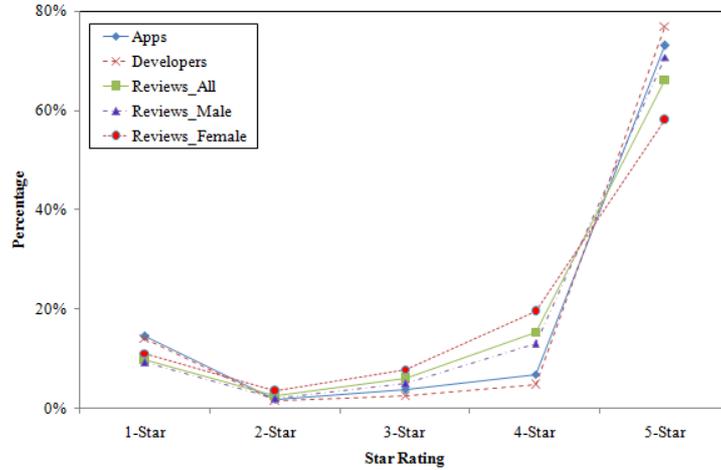


Figure 2. Distribution of Star Rating Reviews by Game, Developer, and Gender

Figure 3 presents the distribution of sentiments calculated using the opinion scoring technique across the ratings. A strong correlation of star ratings with positive reviews can be observed. Based on the distribution of sentiment polarity, 91.3% of the 5-star rating reviews had positive polarity, while 85.6% of the 1-star rating reviews exhibited negative polarity.

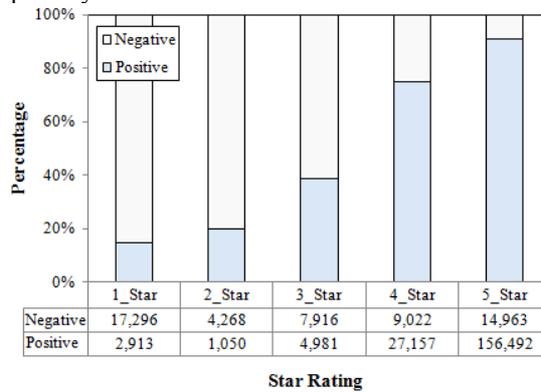


Figure 3. Distribution of Sentiments among the Ratings

Sentiment Mining for Game Attributes

Figure 4 shows the distribution of reviews among the game attributes based on gender and opinion polarity. Most reviews (67.5%) focus on gameplay discussion, while 17.6% is about stability and 0.4% about musicality. Male positive reviews for game attributes nearly double those from females; however, male negative reviews exceed female negative reviews by 50%. Figure 5 presents the distribution of sentiments among the game attributes. Based on the distribution of sentiment polarity, most of the reviews associated with gameplay, aesthetics and musicality have positive polarity

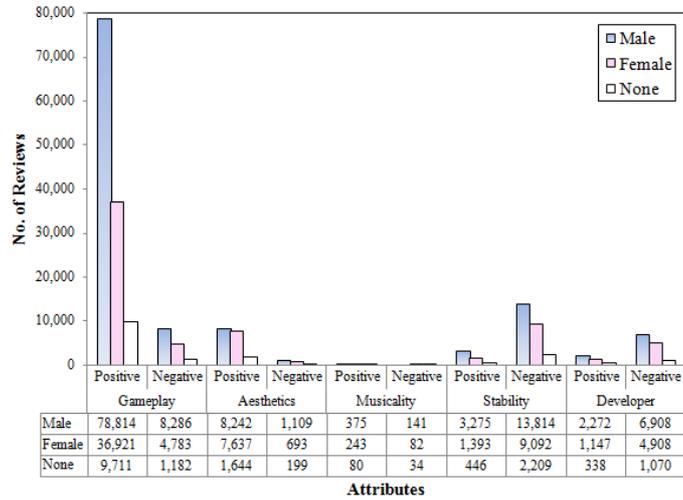


Figure 4. Distribution of Reviews among the Game Attributes

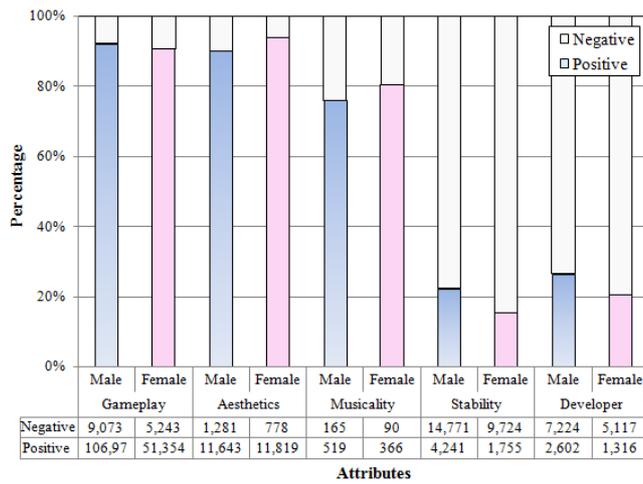


Figure 5. Distribution of Sentiments among the Game Attributes

Figure 6 shows the perceptual map for the six game types on the relative proximities of the five attributes with sentiment polarities (P: positive, N: negative) in corresponding space. Figure 7 depicts the perceptual map for the star ratings and game attributes. The first two principal components collectively explain 99.85% of the variance, with 98.80% accounted for by the first dimension and 1.05% accounted for by the second dimension. Figures 8-10 show the perceptual maps for the top five popular games among all respondents, men, and women, respectively, in terms of the relative proximities of the five attributes with sentiment polarities in the correspondence space.

Discussion

Game apps are facing intense competition due to a fast growing, emerging market, and developers need to be cognizant of how users perceive their products. The inter-

personal influence arising from opinion exchange is an important factor influencing users' selection decisions. Users seek quality information from online user reviews prior to purchasing a product. Developers need to put more focus on user perceptions of their games, including what their users want and expect from an app. It is essential that developers constantly monitor and assess online user reviews to identify how users rate the various game attributes.

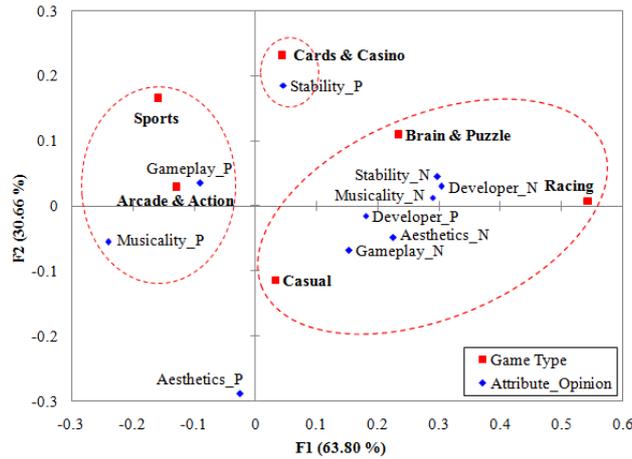


Figure 6. Perceptual Map for Game Type and Attribute

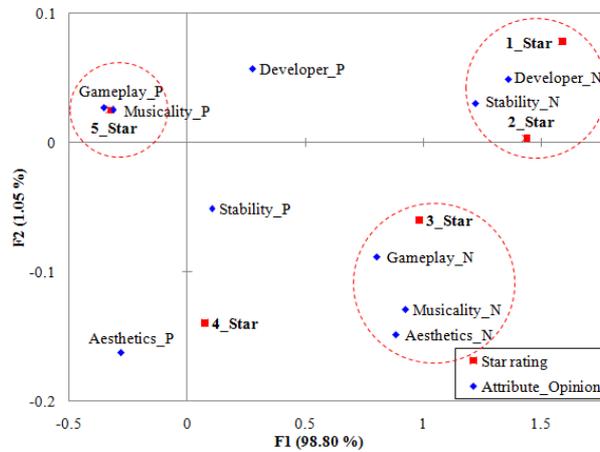


Figure 7. Perceptual Map for Star Rating and Attribute

UGC in Google Play contains substantive information about apps. In this study, the content of users' reviews of free downloadable Android game apps is analyzed. Overall, most reviews focus on arcade & action and casual games game types, as well as two attributes: gameplay and stability. Males' reviews outnumber those by females, particularly for arcade & action, sports, and racing games; the opposite is true for brain & puzzle and casual games. This shows that there are significantly different preferences in terms of game type across genders. Further, the reviews are overwhelmingly positive, particularly for arcade & action and sports games. Our results

suggest a J-shaped distribution with mostly 5-star ratings for a series of data sets including games, developers, and reviews by males, females, and all respondents.

Table. 2 Top 5 Games among All Respondents, Males, and Females

Ranking		1	2	3	4	5
All	Name	9 Innings: 2013 Pro Baseball	Chick Kitchen	Cat War2	Undead Slayer	Mandora
	Game Type	Sports	Casual	Arcade & Action	Arcade & Action	Arcade & Action
	Developer	Com2uS	iDT Digital	WestRiver	NHN	Rayark
	Opinion Score	5,566	5,263	4,983	4,737	4,390
Males	Name	9 Innings: 2013 Pro Baseball	Undead Slayer	Cat War2	Little Commander - WWII	Battle Cats
	Game Type	Sports	Arcade & Action	Arcade & Action	Casual	Casual
	Developer	Com2uS	NHN	WestRiver	Cat Studio HK	PONOS
	Opinion Score	4,628	4,150	3,748	3,337	2,369
Females	Name	Chick Kitchen	Mandora	LINE Play	Hotel Story	Ovenbreak
	Game Type	Casual	Arcade & Action	Casual	Casual	Arcade & Action
	Developer	iDT Digital	Rayark	NAVER	Happy Labs	Com2uS
	Opinion Score	3,554	2,395	1,758	1,470	1,434

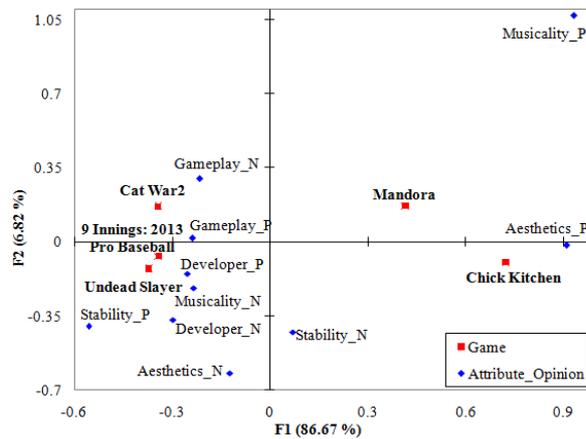


Figure 8. Perceptual Map for Top 5 Games among All Respondents

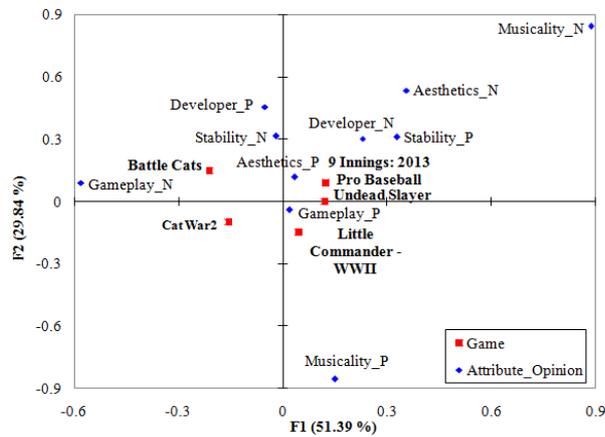


Figure 9. Perceptual Map for Top 5 Games among Males

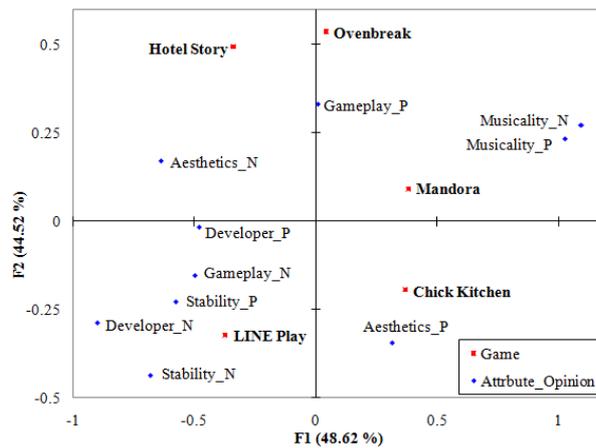


Figure 10. Perceptual Map for Top 5 Games among Females

With the aid of CA, we can learn more about the relationship between game types and user sentiments regarding particular game attributes, as well as the relationship between star ratings and user sentiments regarding game attributes. Arcade & action and sports games are mostly rated positively in terms of gameplay and musicality, while cards & casino games are rated positively in terms of stability. However, brain & puzzle, casual and racing games are mostly rated negatively in terms of gameplay, aesthetics, musicality, and stability. Further, 5-star ratings are most often given for gameplay and musicality, while 1- and 2-star ratings are most often given for stability and the developer. These findings suggest that the gameplay and musicality of game apps are generally recognized as positive by users; however, they are less likely to tolerate game instability. Finally, the top 5 popular games for males, females and all respondents are closely associated with users' sentiments regarding game attributes. Our research findings offer critical information associated with users' true experience, which can help developers provide immediate, complete, and accurate improvements to existing products and future designs.

5 The Conclusion

This study develops an opinion mining approach related to feature-level sentiment classification that extracts online user reviews for free downloadable Android games listed on Google Play. A heuristic n-phrase rule is proposed to extract the attribute-opinion pairs to elicit user opinions about game apps. The synthesis of content analysis and CA helps to summarize and visualize users' reviews according to different metrics including star ratings, game types (arcade & action, casual, brain & puzzle, cards & casino, sports, racing), and game attributes (gameplay, aesthetics, musicality, stability, developer). This study provides some insights on users' published reviews, as well as greater clarity on what app attributes and opinions are important to users.

Furthermore, developers should consider how best to exploit social recommendations and tactical sales promotions. They can encourage positive word-of-mouth from existing users as part of their marketing strategy, or provide more information-rich reviews to assist potential users. Developers should also continually track users' opinions to stay cognizant of their weak attributes. Future researchers may investigate paid game apps as well as the diversified information sources about them, including game discussion forums. The attribute-opinion pair extraction technique can be improved by including more detailed information on attributes connected to game reviews.

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