Extracting Knowledge for the Success Factors of Digital Games from the Customer Review of E-Commerce

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Abstract

The digital games have become one of the most popular activities across different age and gender. While the digital games introduced over 40 years ago, very little is known what the factors that lead a game being successful in the market area. In this regard, this study presents a novel method and practical implementation for extracting knowledge of the factors that lead a digital game being successful in the market area. The knowledge obtained from this study could be used as a recommendation for game companies and game designers in their marketing strategy. Firstly, this study develops a method for discovering the factors that lead a game being successful from a customer review of e-commerce. Secondly, based on analyzing the findings, this study presents the knowledge as a recommendation for the marketing strategy of a game product. The customer review of e-commerce is used as a data source for analyzing in the experimental study. Finally, the results of this study revealed that the proposed method could obtain a knowledge recommendation.

Keyword*: Extracting knowledge, the success factors, the digital game, customer review, e-commerce*

Abstrak

Permainan digital telah menjadi salah satu kegiatan paling populer pada user berbagai usia. Meskipun game digital telah diperkenalkan lebih dari 40 tahun yang lalu, tetapi masih sangat sedikit yang diketahui faktor-faktor apa saja yang menyebabkan sebuah game menjadi sukses di pasaran. Dalam hal ini, penelitian ini menyajikan metode baru dan implementasi praktis untuk menggali pengetahuan tentang faktor-faktor yang membuat game digital sukses di pasaran. Pengetahuan yang diperoleh dari penelitian ini dapat digunakan sebagai rekomendasi bagi perusahaan game dan desainer game dalam strategi pemasaran mereka. Pertama, penelitian ini mengembangkan metode untuk menemukan faktor-faktor yang menyebabkan sebuah game sukses dari review pelanggan e-commerce. Kedua, berdasarkan analisis temuan, penelitian ini menyajikan pengetahuan sebagai rekomendasi strategi pemasaran produk game. Hasil review user terhadap e-commerce digunakan sebagai sumber data untuk dianalisis dalam studi eksperimental. Akhirnya, hasil penelitian ini mengungkapkan bahwa metode yang diusulkan dapat memperoleh rekomendasi pengetahuan.

Kata kunci: Menggali pengetahuan, faktor keberhasilan, permainan digital, ulasan pelanggan, e-commerce

1. Introduction

Nowadays, in the market area, many games have obtained popularity and successfully attracted the broad range of customers. However, there is a limited knowledge regarding the factors that lead a game being successful. Currently, several researchers have started to investigate the factors that lead a game being successful through user experience (UX) [1], [2], game design [3] and marketing areas [4]. Nevertheless, understanding the factors, that lead a game being successful, are still challenging. Many researchers have stated, the factors that lead a game being successful, are still not clear [1]–[5]. This problem has argued underlying in the complexity the factors that associated with the digital games [5]. Therefore, there is essential to obtain more understanding of the factors that lead a game being successful.

The objectives of this study are presented. Firstly, this study presents a novel method to discover the factors that lead a game being successful and do not significantly lead a game being successful. Secondly, based on analyzing the findings, this study presents knowledge as a recommendation for improving the marketing strategy.

For the simplicity, this paper has chosen to investigate the factors that lead a game being successful through marketing area. The factors are the attributes or variables that attached to the specifics game product on e-commerce website. This study has chosen seven attributes such as rating of the game, date of published, the price, the genre of game, publisher of the game, total review, negative and positive customer sentiment.

The proposed method is divided into three levels. Firstly, collecting dataset, the web scraping method is performed to collect the customer review information from (amazon.com). Secondly, preprocessing data is performed. Based on the collecting dataset, the sentiment analysis method is performed to complete dataset. Thirdly, the building and execution model, the machine learning algorithm is performed to predict the factors that lead a game being successful and do not significantly lead a game being successful. Finally, the knowledge recommendation is presented.

The structure of this study is organized as follows. This section presents an outline and the objective of this study. Section 2 explains the related studies. Section 3 introduces proposed model. Section 4 describes the experimental study. Section 5 presents the results and knowledge recommendations. Section 6 presents discussion. Finally, section 7 explains conclusions and future works.

2. Background

In this section, the review of related works is presented. First, this paper presents the advantages of this study and the related works. Secondly, this paper presents several works that support the idea of this paper.

A. The factors that lead a game being successful

Enhancing understanding, what factors lead a game being successful, are necessary because it can offer many benefits. Understanding the factors that lead a game being successful gives knowledge on how to improve the quality of the game product, enhancing customer satisfaction, and maintaining the relationship with the customers, and it can give knowledge about marketing strategy for the game product [4], [6].

The work that highly related to this study by [4]. The authors have investigated the factors that influence the success of e-commerce. The authors investigated several factors such as customer satisfaction, customer awareness, and inside and outside organization costs, organizational and technological infrastructures. However, this paper investigated the success factors of e-commerce and is not investigated the particular success product. In [7], the authors investigated how textual information of e-commerce website affects their market success. The goal of this study is to predict the success of e-commerce companies. However, this study is not investigated in the particular product. In [8], the authors investigated the essential factors for guest houses in China based on customers opinions. The authors investigated several essential factors such as an atmosphere of the guest house, facilities, services, cleanliness, location, and the cost. In [9], the authors explored the success factors of mobile marketing. This paper investigated the success factors of marketing communication. Specifically, this study investigates the successful marketing communication using short message services (SMS) advertising. Mostly, the previous studies are not investigated the factors/attribute that attached to the specific's product. Therefore, the previous works show that the area of digital games have not yet explored, specifically, the study of the factors that lead a game product being successful.

B. Online Customer Review

In this section, the advantages of online customer review as a source of information is stated. The customer review presents a credible source of information that can reflect the factors that lead a game being successful. Several advantages of using customer reviews have explained.

Many studies stated that customer review could be used as an indicator of success product [10]. Some studies also stated that customer review reflects customer opinion toward the

product (positive or negative), so it can reflect the knowledge about the product [8], [11]. Moreover, the customer review can reflect the acceptance of a product among customers heterogeneity [10]. Customer review can show opinion, evaluation, and quality of the product [12]–[14]. Therefore, in this study, customer reviews have chosen because it can provide credible information that reaches far beyond the global community [15]. As free volunteer, customers provide a natural source of information [10]. Thus, the online customer review is highly considered to use for this study.

Finally, the previous works have supported the idea and the goal of this paper. For this reason, this paper proposes the online customer review as a source of information for discovering the factors that lead a game being successful. In conclusion, this paper presents contributions, as follows:

- This study proposes a novel method and practical context which investigates the factors that lead a game being successful that previous studies have not yet explored.
- This study presents knowledge as a recommendation that can be used for the marketing strategy of game product.

3. Proposed Model

This section explains the proposed model for extracting knowledge from the customer review of e-commerce. The proposed model is divided into three steps: (1) collecting dataset, (2) preprocessing data, (3) building and execution model.

In the first level, customer review information is collected from e-commerce website. The customer review information is collected by web scraping method. Web scraping is a method which collects information from web pages [16]. This method extracts the customer review information for several games and stores into CSV format (see Table I and Table II).

In the second level, after collecting data in CSV format, the processing data is performed. The sentiment analysis is used. Sentiment analysis is a method for extracting user opinions from the text [14]. This method analyzes customer opinion toward the specific game product (whether positive or negative). The result of sentiment analysis is used to complete the final dataset (Table IV). Table IV gets input data from Table II and sentiment analysis (Table III). Therefore, finally the final dataset has ten variables including the game name, the rating of the game, date of published, the price of the game, genre game, publishers' game, total review, positive sentiment, negative sentiment and outcome (Table IV).

The final level is building and execution model. The machine learning algorithm is analyzed the customer dataset (Table IV) to predict which factors that lead a game being successful. Finally, based on the analyzing of findings, the knowledge recommendation is presented. Fig.1 presents an architecture of the proposed model which contains (1) collecting dataset, (2) preprocessing data, (3) building and execution model.
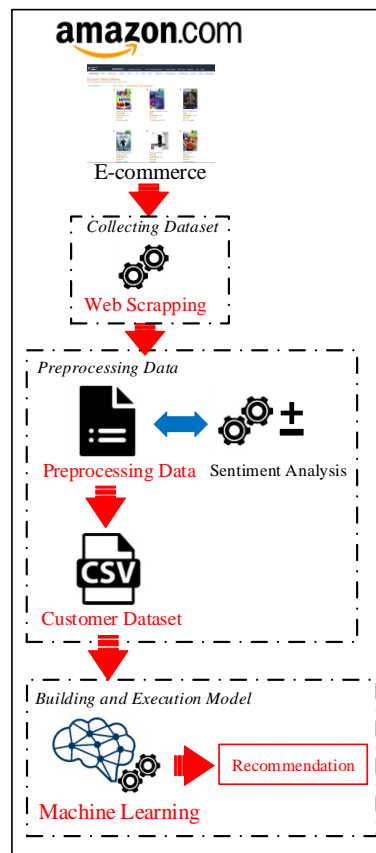
Figure 1. Proposed Model

4. Experimental Study

This section explains the experimental study. In this study, the full body game gesture (Kinect Xbox 360 games) has chosen as a case study because this game has obtained the popularity among global community [17]. The full body game gesture is a PC game that uses gesture control [18]. The customer review of Amazon.com was used since Amazon is the top 100 successful e-commerce companies [19]. Therefore, it potentially reflects the success of a product within across customers heterogeneity. This section is structured as follows. Section A presents the method. Section B presents the process of collecting dataset. Section C explains the preprocessing data. Section D presents the results of prediction from execution model.

A. Method

Firstly, the customer review of Kinect Xbox 360 games was collected, with total 40 games (20 favorite games and 20 less favorite games) (accessed on 29/04/2018). Secondly, preprocessing data was performed to obtain the customer dataset. Thirdly, building and execution model was used in classification algorithms of machine learning. The classification algorithms, such as Random Tree, Random Forest, Naïve Bayes, J48, and SMO, were performed using 10-folds cross-validation. The algorithms were evaluated by relative error, precision and recall [20]. The process of collecting dataset was performed by Parsehub [21]. The sentiment analysis was performed by RapidMiner Studio and third-party software (Aylien). [22], [23]. Finally, Weka software performed the prediction [24].

B. Collecting Dataset

This section explains process for collecting customer dataset. In the Amazon website, there was best sellers or success games among customers, and also there were fewer favorite games with less purchased. The favorite and fewer favorite games were considered as the

reflection of success and unsuccess a game product. In this study, 40 full-body game gestures were randomly selected, with a total of 20 favorite games and 20 less favorite games (see Appendix A). To collect the customer data, first, the web scraping method was performed to collect data from customer review of each Xbox 360 games. Parsehub was extracted customer review information and stored the data into CSV format.

Finally, there were two results of the scraping method, (1) customer review data and (2) the game data. The customer review data included information such as customer name and customer review, with total 40 CSV files for each game product (Table I). The game data included information such as game name, a rating of the game, date of the published game, price, genres of game, publishers of the game, and a total number of customer review (Table II).

TABLE I. CUSTOMER REVIEW DATA

Name of Game	Customer Name	Customer Review
Kinect Sport	Name 1	I just got finished playing …
	Name 2	We lost our first copy of…
	Name 3	This is one of the best…
	.	.
	Name n	.

TABLE II. GAME DATA

Name	Rating	Date	Price	Genres	Publishers	Total Review
Kinect Sport	Very good	2010	16.49	Sports game	Microsoft	730
Wipeout 2	Very good	2010	8.33	Dance game	Microsoft	268
Star Wars	Good	2012	39.36	Action game	Lucas Arts	411
.	.	.	.	.	.	.
Name 40	.	.	.	.	.	.

C. Preprocessing Data

This section presents the process to obtain the final dataset in Table IV. Firstly, the customer review data in Table III was used for sentiment analysis. In this case, Table I column customer review was used. The comment of each customer was analyzed to obtain the customer sentiment toward a specific game (positive or negative). RapidMiner and Aylien software were used. Table V presents example result of sentiment analysis which included customer name, date of review, customer review, and the customer sentiment.

TABLE III. CUSTOMER REVIEW PREPROCESSING

Name of Game	Customer Name	Customer Review	Sentiment
Kinect Sport	Name 1	I just got finished playing …	Positive
	Name 2	We lost our first copy of…	Negative
	Name 3	This is one of the best…	Positive
	.	.	.
	Name n	.	.

The sentiment was counted according to positive and negative sentiment in Table III. Table IV gets input data from Table II and the count of sentiment (Table III). Finally, the variable outcome was added to this final dataset and was filled according to success or unsuccess of a game on the Amazon website (in this case based on their rating). The customer dataset was included ten variables including the game name, the rating of the game, date of published, the price of the game, genre game, publishers' game, total review, positive sentiment, negative sentiment and outcome as a special label for classification algorithms.

TABLE IV. CUSTOMER DATASET

Game name	Rating	Date	Price	Genres	Developer	Total Review	Positive	Negative	Outcome
Kinect Sport	Very good	2010	16.49	Sports game	Microsoft	730	559	82	success
Wipeout 2	Very good	2010	8.33	Dance game	Microsoft	268	185	45	success
Star Wars	Good	2012	39.36	Action game	Lucas Arts	411	268	93	unsuccess
.	.	.	.	.	.	.	.	.	.
Name 40	.	.	.	.	.	.	.	.	.

D. Building and Execution Model

The goal of this model is to discover the factors that lead a game being successful and do not significantly lead a game being successful. The classification algorithm of machine learning was proposed to analyze the final dataset in Table VI. The classification method is a data mining technique which uses a set of training data and testing data to build a model and produce the prediction [20]. The researchers have proposed several classification algorithms. Therefore, several algorithms were compared to get the best prediction.

3. Results

This section presents results of classification algorithms. Several algorithms were performed, including Random Tree, Random Forest, Naïve Bayes, J48, and SMO. Section A presents prediction of the factors that lead a game being successful. Section B presents the knowledge recommendation.

3.1. The results of prediction

Random Tree algorithm performed best with an accuracy of 92.50% and error 7.50% (Table V). Thus, the Random Tree algorithm was used for discovering the factors that lead a game being successful. Table VI presents the result of prediction with Random Tree. The F-Score is the evaluation of classification algorithm ability to correctly recognize between data relevant and data irrelevant to a class variable [25]. The F-score of 1.0 means that a particular factor consistently predicts the success of a game. None of the factors obtained the F-score of 1.0. The prediction showed the factors that lead a game being successful such as positive sentiment, with confidence score of 0.900, followed by total review with 0.857 and rating with 0.810. On the other hand, the prediction showed that genres (0.438) and price (0.333) were not significantly influence the success of the game.

TABLE V. ALGORITHMS PREDICTION

No	Algorithm	Accuracy	Error
1	Random Tree	92.50%	7.50%
2	Random Forest	90.00%	10%
3	Naïve Bayes	87.50%	12.5%
4	J48	85.00%	15%
5	SMO	85.00%	15%

TABLE VI. THE RANKING FACTORS

Ranking	Important Factors for Success	F-Score	Recall	Precision
1	Positive Sentiment	0.900	0.900	0.900
2	Total review	0.857	0.900	0.818
3	Rating	0.810	0.850	0.773
4	Publisher	0.750	0.900	0.643
5	Negative Sentiment	0.732	0.750	0.714
6	Published Year	0.611	0.550	0.688
7	Genres	0.438	0.350	0.583
8	Price	0.333	0.300	0.375

3.2. The knowledge recommendation

This section presents the knowledge recommendation (Table VII). The recommendation was extracted based on the results of prediction. The recommendation can help game companies and game designers for their marketing strategy.

TABLE VII. THE KNOWLEDGE RECOMMENDATION

Ranking	Recommendation

1	The positive sentiment is the most significant factor that influences a game being successful. Considering that customer could get a positive experience toward the product of the game.
2	The total review is also a significant factor that leads a game being successful. The result of prediction showed that almost the success game has a lot of the total number of customer review. Therefore, it is better to consider the way on how to attract the customer to review the game product.
3	The result of prediction showed all the success game have a good rating on the Amazon website. The prediction showed very good, good and acceptable rating (5, 4 and 3 stars in Amazon website) that lead a game being successful. Therefore, the game product or marketing strategy should ensure how the game product obtains the good rating.
4	The prediction showed that publisher also affects a game being successful. From the prediction, the publishers, such as Microsoft, Ubi Soft, Ignition Entertainment Ltd, Lucas Arts, THQ, Sega and 2K, were successful among customers and publishers, such as Activision Inc, Majesco Sales Inc, Warner Bross, Konami, D3 Publishers, and SVG Distribution, were not successful among customers.
5	The game companies should consider negative sentiment of customers. Ensuring that customer could get a positive experience toward the game product.
6	The finding showed that the published year leads the game being successful. However, this study noted that the limitation of the study is time-based which the customer review information reflects the knowledge at the time. Therefore, in other cases, the published year may affect or may not affect a game being successful.
7	The result of prediction showed the genres of game, such as sports game, music video game, digital pet game, and the fighting game has higher chance to lead the game being successful. Therefore, it may be advantageous to develop these types of game genres.
8	The result showed that the price of a game was not significantly lead a game being successful. However, as mentioned above, this study has a limitation which the customer review information reflects the knowledge at the time this study conducted. Therefore, in other cases, the price may affect or may not affect a game being successful. Thus, this study suggests several works that investigated how price influence a game being successful in [26]–[28]

4. Discussion

This work presented a novel method to discover the factors that lead a game being successful and do not significantly lead a game being successful. This study has presented the knowledge as a recommendation for marketing strategy of game product.

As the main contributions, this study introduces a practical way for discovering the factors that lead a game being successful from an online customer review of e-commerce and presents the knowledge recommendation.

Furthermore, the factors, such as positive sentiment, total review, and rating, should highly consider in the marketing strategy. Quite surprisingly, the price of game product was not significantly affected a game being successful. However, this study was limited by the specific population. Therefore, this may difficult to generalize the findings to the main population. This study suggests that the price may have to consider in the marketing strategy, as supported by [26]–[28].

As the limitation of the study, the results of this study were time-based and used 40 sample games. Therefore, the proposed recommendation should carefully consider for another game platforms.

5. Conclusion and Future Works

This work presented a novel method to explore knowledge about the factors that lead a game being successful and do not significantly lead a game being successful. This knowledge is highly recommended for the marketing strategy of game product. Thus, the future research should more explore in this direction of work.

As the future works, a similar study using different game platforms can be explored. Also, this may benefit that the further study uses large data source. Thus, further studies are needed to consider the recommendations and the limitations of this work. In conclusion, this work has opened a new insight and it hopes could be used in the future studies.

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Appendix A. List Games

Name of Game	Rating	Genres	Publishers
Kinect Sport	very good	sports game	Microsoft
Just Dance 3	very good	music video game	UBI Soft
Kinect Adventure	very good	adventure sports game	Microsoft
Your Shape Fitness Evolve 2012	very good	sports game	UBI Soft
Dance Central 2	very good	music video game	Microsoft
Kinect Rush a Disney Pixar Adventure	very good	action-adventure game	Microsoft
Kinectimals	very good	digital pet game	Microsoft
Kung Fu High Impact	very good	sports game	Ignition Entertainment Ltd
Kinect Star Wars	good	action game	Lucas Arts
Nike + Kinect Training	good	sports game	Microsoft
Dance Central	good	music video game	Microsoft
UFC Personal Trainer	good	sports game	THQ
Wipeout in the Zone	good	sports game	Activision Inc
Fighters Uncaged	good	fighting game	UBI Soft
Fantastic Pets	good	digital pet game	THQ
Zumba Fitness	acceptable	sports game	Majesco Sales Inc
Sonic Free Riders	acceptable	racing video game	Sega
Child of Eden	acceptable	music video game	UBI Soft
Gunstringer	acceptable	fighting game	Microsoft
Nickelodeon Dance	acceptable	music video game	2K
Game Party in Motion	acceptable	music video game	Warner Bros
Wipeout 2	acceptable	music video game	Activision Inc
Rabbids Alive & Kicking	acceptable	party game	UBI Soft
Motion Explosion	acceptable	party game	Majesco Sales Inc
Twister Mania	acceptable	music video game	Majesco Sales Inc
Nicktoons MLB	poor	sports game	2K
Deca Sports Freedom	poor	sports game	Konami
Kung Fu Panda 2 Kinect	poor	action-adventure game	Microsoft
Deepak Chopras Leela	poor	sports game	THQ
Motionsports Play for Real	poor	sports game	UBI Soft
Jillian Michaels Fitness Adventures	poor	sports game	Majesco Sales Inc
Victorious Time to Shine	poor	music video game	D3 Publisher
Brunswick Pro Bowling	very poor	sports game	SVG Distribution
Adrenalin Misfits	very poor	sports game	Konami
Self-Defense Training Camp	very poor	sports game	UBI Soft
Alvin and the Chipmunks Chipwrecked	very poor	music video game	Majesco Sales Inc
Big League Sports for Kinect	very poor	sports game	Activision Inc
Rapala for Kinect	very poor	sports game	Activision Inc
Michael Phelps Push the Limit	very poor	sports game	Microsoft
DanceMasters	very poor	music video game	Konami