

Success Measures Evaluation for Mobile Commerce Using Text Mining based on Customer Tweets

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The customer acceptance of mobile commerce application systems is one of the driving factors of a successful mobile commerce implementation. However, there is an increasing number of companies that fail to implement. This shows the need to measure the success in implementing mobile commerce. One of the approach to determine success measures of mobile commerce can use customer perspective through user feedback regarding the application performance. The development of technology allows customers to share their feedback about mobile commerce services through online media without the limitation of time and place, for example using Twitter. Any tweets that contain comments or questions about a service is called a customer tweet. Customer tweets, processed using text mining, facilitate the company to get information about the success measures of a particular service based on customer point of view. Based on previous literature study, research on success measures of mobile commerce from the customer perspective is still in the early stages. Therefore, there are several reasons why this research is important. First, every mobile service has different characteristics, especially in the measurement of success. This shows that many explorations can be done regarding the success measures of mobile commerce. Second, the availability of customer tweets that contain comments about mobile commerce has allowed the data to be collected and processed into information to analyse the success measures of mobile commerce systems. Third, there is very little or no studies that use text mining method to model the success measures for mobile commerce based on customer tweets. Thus, the study reported in this paper aims at developing the success measures for mobile commerce based on customer tweets using text mining approach. The results from data processing indicate that some constructs that represent the success measures for mobile commerce include System Quality, Information Quality, Process Quality, Service Quality, Use, User Satisfaction, Individual Benefit and IT Infrastructure.

1. Introduction

The globalization era has forced enterprises to face complex competition and rapid changes in order to improve productivity effectively and efficiently. The improvement of efficiency and effectiveness in a company can be achieved by adopting the role of Information Systems (IS) and Information Technology (IT) appropriately and optimally [1]. It will encourage companies to increase their investment in Information Technology (IT), especially the ones using mobile phone technology in helping them to face business competition. Currently, mobile phone is used for various actions that support business activities such as text messaging, taking pictures, web surfing, downloading ring-tones, playing games and payment transactions [2]. The transaction processes, ownership transfer process as well as the right to use goods and services, which are initiated and completed using mobile access to computer networks with the help of electronic devices, are called mobile commerce [3]. Based on a research conducted by Lila Rajabilon in 2015, the number of mobile commerce transactions in the world increase year to year from 498 billion in 2006 to 4.8 billion in 2010 with average transaction increase of \$ 7 in 2006 to \$ 13 in 2010 [4].



Some companies use mobile commerce as one of media to communicate with customer, such as Uber, Grab, Lyft, etc. Although the number of companies that are using mobile commerce technology is increasing, but there are still many companies that fail in implementing mobile commerce[5]. Many mobile commerce applications failed to get user acceptance from the customer perspective.

The success measures of mobile commerce implementation from customer perspective can be determined using various methods. One of which is based on the final evaluation feedback provided by users about the information systems performance [5]. The development of technology makes it easier for companies to get feedback about certain services, including reviews and online product reviews [6]. The development of technology allows customers to be able to provide online product reviews with no boundary of time and place, one of which is through social media, for instance, Twitter. Twitter is a website service of microblog, a type of blog that limits the size of each post. Twitter facilitates users to write a text for a maximum 140 characters. Twitter is one of the most easy-to-use social networks, because it only takes a short time to spread information instantly and widely.

Customer tweets on Twitter can be processed using text mining method. The method can be used to perform the process of classification, clustering, information extraction and information retrieval [7]. Text mining is a mining implemented by a computer to get novel insights as well as to discover implicit information from different text data sources [6]. In this context, text mining can facilitate companies in getting information about the success measures of particular services based on the customer's point of view. In the prior research, customer evaluation was conducted by implementing questionnaire survey in order to obtain a product review. This method requires a lot of time and cost. Moreover, the quality of data depends on the willingness of the respondents to participate and their ability to understand the questions as well as the length and complexity of survey questions given [8].

The research conducted by Chevalir & Mayzlin in 2006 stated that 24% of internet users that previously gave product reviews offline were starting to provide their product reviews online [9]. Through online review, customers are able to share their reviews more freely and voluntary. It makes customers have the highest authority [6] to decide the content of review that they want to share.

Based on several comparative literature studies, the current model to measure the success of mobile commerce using text mining method has not commonly been used. On the other hand, the importance of knowing the success measures of an information system, especially mobile commerce from the perspective of the customers, becomes a challenge in mobile commerce industry. Therefore, this study aims to explain the success measures of mobile commerce from the customers perspective based on customers tweets, using text mining method.

2. Implementation

This section is a preliminary study in order to identify indicator variables that best describe the success measures in mobile commerce. The identification process is performed using text mining technique, aspect extraction and apriori algorithm, with the help of Java, Python and RapidMiner. The steps are presented in Figure 1.

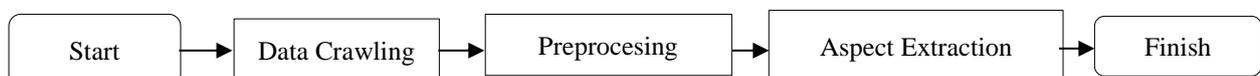


Figure 1. Aspect Identification Process

2.1. Data Crawling

Crawling is a process or automated script with a certain method of scanning or "crawl-ing" numerous pages in the internet to create index of the searched data. In this research, the data crawling is done by using RapidMiner software that connected to Twitter API. Using this software, all tweets that contain keywords such as "Uber", "Grab" and "Lyft" are collected as the dataset.

2.2. Data Preprocessing

Before performing the aspect extraction process, the product review dataset must go through preprocessing stage. The steps of data preprocessing are performed as follows:

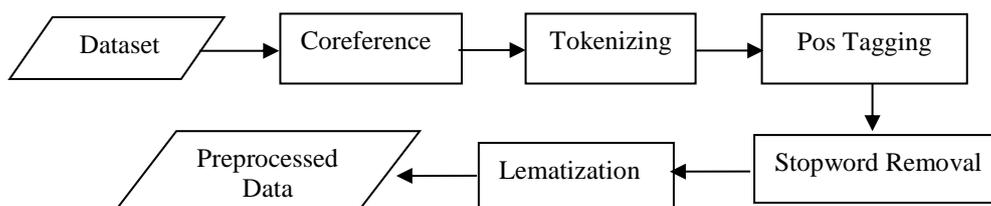


Figure 2. Preprocessing Process

Based on the Figure 2, data preprocessing consists of 5 stages namely coreference, tokenization, PoS tagging, stopwording and lemmatizing. The explanations are as follows:

2.2.1 Coreference Resolution

Coreference Resolution is the process of changing pronouns in English into the real subject. In this process the system will use the type of coreference resolution in the form of anaphora, cataphora, and co-referring noun phrase. An example of conference resolution is presented in Figure 3.

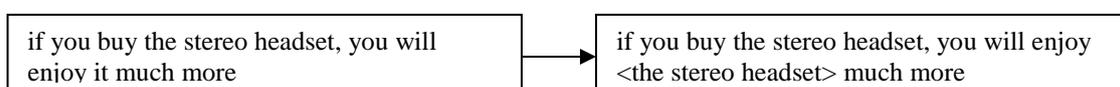


Figure 3. The Example of coreference resolution

2.2.2 Tokenizing

This process is performed by cutting the string based on each words. The result of this process is the snippet of words. An example of tokenizing is presented in Figure 4.

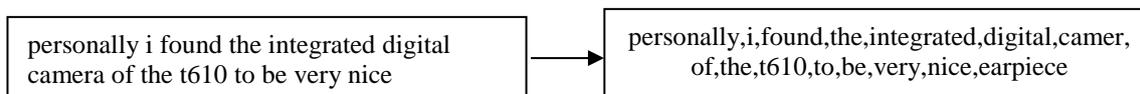


Figure 4. The example of tokenizing

2.2.3 Pos Tagging

PoS Tagging is process which select nouns that are found in the sentence. An example of tagging is presented in Figure 5.

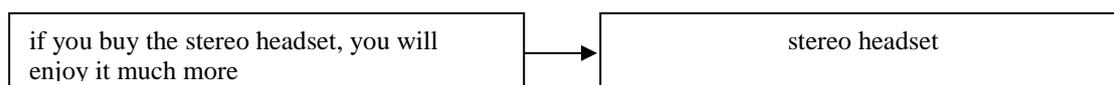


Figure 5. The example of pos tagging

2.2.4 Stopword Removal

The result of the pos tagging process then carried out to the process of removal of words that are unimportant and have no meaning. This filtering process is called stopword. An example of stopword removal is presented in Figure 6.



Figure 6. The example of stopword removal

2.2.5 Lemmatization

In this process, each words of the result of stopword removal will be changed into its basic form. An example of lemmatization is presented in Figure 7.



Figure 7. The example of lemmatization

2.3. Aspect Extraction

After data preprocessing, the next step is the identification of “*aspects*”. In this context, “*aspects*” refer to the important words that are identified as indicators for construct of mobile commerce success measures. Nouns or noun phrases that are often mentioned by costumers in product reviews become candidates of potential aspects. Extraction of these aspects can be done using apriori algorithm to find frequent *itemsets* representing the aspects of product. The steps are presented in Figure 8.

Apriori algorithm produces a set of words that often appear alone or simultaneously in a sentence, regardless of the proximity of the words. So it is possible to produce a combination of some words that have no meaning. Elimination of aspects can be performed by calculating the distance between the two words that appear, if the distance is too far and it passes certain threshold then the aspect will be eliminated.

The threshold in this algorithm is called the pure support. Pure support is the number of sentence that only contains aspect which is not a superset of other aspects. If the pure support is less than the minimum pure support and the identified aspect is the subset of the other aspect phrases, then the aspect is eliminated. The apriori process that use Stanford University library package is implemented by choosing all types of nouns, including singular or mass noun, noun plural, proper noun, proper singular, proper plural. Then the coding process is performed based on each words in the dataset. Each words is coded which then will be used as input data for apriori library. The library then displays the output of each result of apriori processing.

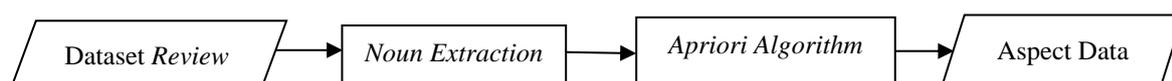


Figure 8. Aspect extraction with Apriori

Here is the example of extraction process performed by the system. Assumed, there is a dataset as with minimum support of 2 as shown in Table 1:

Table 1. The example of Apriori process

Sentence	List of Sentence
Sentence 1	The Application is amazing, the quality is very wonderful, I like the function too
Sentence 2	Zoom very clear, the quality more than everything, it has good feature
Sentence 3	This Application is bad, I don't like the zoom and the quality, its feature is not good
Sentence 4	Wow I interest with the zoom and feature
Sentence 5	This Application is fantastic. It has good quality and I like the features

From the existing data, it will generate all types of nouns from the PoS tagging process and will continue to the process of numbering each noun data generated. The example is listed in Table 2.

Table 2. The numbering process on Apriori Algorithm

Sentence	List Of Noun	Numbering Apriori
Sentence 1	Application, Quality, Function	1 3 4
Sentence 2	Zoom, Quality, Feature	2 3 5
Sentence 3	Application, Zoom, Quality, Feature	1 2 3 5
Sentence 4	Zoom, Feature	2 5
Sentence 5	Application, Quality, Feature	1 3 5

Then each word is calculated to count the its occurrence as shown in Table 3. *Itemset* {4} does not meet the minimum support of 2 so it will be eliminated and not be processed (Table 4).

Table 3. One itemset frequent

Itemset	Support
{1}	3
{2}	3
{3}	4
{4}	1
{5}	4

Table 4. The data result after selection with Minsup 2 and one itemset

Itemset	Support
{1}	3
{2}	3
{3}	4
{5}	4

The second *itemset* generation process will then be carried out with the combination of 2 aspects that is performed by Brute Force method, as follows (Table 5 and Table 6):

Table 5. Two itemset Frequent

Itemset	Support
{1,2}	1
{1,3}	3
{1,5}	2
{2,3}	2
{2,5}	3
{3,5}	3

Table 6. The data result with minsup 2 and two itemset

Itemset	Support
{1,3}	3
{1,5}	2
{2,3}	2
{2,5}	3
{3,5}	3

Table 7. The result of Apriori 3 Itemset

Itemset	Whether or Not
{1,2,3}	No
{1,2},{1,3},{1,5},{2,3}	
{1,2,5}{1,2},{1,5},{2,5}	No
{1,3,5} {1,3},{1,5},{3,5}	Yes
{2,3,5}: {2,3},{2,5},{3,5}	Yes

Then it is proceed to the combination of 3 itemsets as shown on Table 7. If the itemset of combination of 3 meets the minimum support threshold, then it is considered as the result of apriori. Based on the above rule, only the itemset with the occurrences of {1,3,5} and {2, 3,5} become the final results of the apriori process. The final results refer to the word “Application”, “Zoom”, “Quality” and “Feature”.

3. Result

RapidMiner is used in this research to crawl customer tweets related to mobile commerce companies which are Uber, Grab and Lyft. From this crawling process, 7000 tweets related to Uber, 1500 related to Grab, 1200 related to Lyft are obtained. Using Apriori Method in factor extraction process, it is found that the best minimum support was 0.02 or the minimum occurrence frequency was at least 2% of the total terms. After the extraction of aspects for the model is obtained, then the clustering process is processed based on expert judgement. The results of the clustered aspects of success measures are shown in Table 8.

Based on Table 8, it was found that the success measures of mobile commerce based on customer tweets consist of several aspects, those are System Quality, Information Quality, Service Quality, Use, User satisfaction and Individual Benefit. This is in accordance with the measurement model of information systems produced by DeLone and McLean in 2003 [10]. In addition, the Proces Quality are also produced in accordance with recent research conducted by Legner et al. in 2016 [5], and IT Infrastructure Services conducted by Younis et al. in 2013 [11]. From Table 8, with the help of apriori algorithm, the more tweets are included in the processed, the more aspects appear. Tweets related to Uber produced 43 aspects, tweets related to Lyft produced 32 aspects, and tweets related to Grab produced only 26 aspects. The amount and quality of data affect the numbers of aspects extracted from the model and quality of data affect the result of the extraction aspect on the model of mobile commerce success measures.

Table 8. The result aspect based on Apriori Algorithm

Uber	Grab	Lyft
<p>System Quality: code promo, email, account, apps, password, email link, refund system, problem application, using credit card, error message, application quality.</p> <p>Information Quality: details information, contact, address information.</p> <p>Process quality: check order process, request time application, trip process.</p> <p>Service Quality: driver, promo, time access, car, credit for new users, application support, awareness, service center, time to reply, customer service, resolve the issue, respons application.</p> <p>Use: direct massage, feature, noted feature, payment.</p> <p>User Satisfaction: feeling happy, good experience.</p> <p>Individual Benefit: helpfull experience</p> <p>IT Infrastructure: phone number, connection, phone quality.</p>	<p>System Quality: app, application, code.</p> <p>Information Quality: news, details information</p> <p>Process quality: Join application</p> <p>Service Quality: time access, support center, driver, car, promo code, rides, offer, service center.</p> <p>Use: payment, feature,</p> <p>User Satisfaction: love, enjoy, good, nice.</p> <p>Individual Benefit: free apps.</p> <p>IT Infrastructure: phone, connection.</p>	<p>System Quality: code, enter apps, app quality.</p> <p>Information Quality: Credit, information guests, users.</p> <p>Process quality: join application, fastest apps.</p> <p>Service Quality: driver, ride, promo, coupon, taxi, ride, cab.</p> <p>Use: type feature, payment.</p> <p>User Satisfaction: Deal, feeling happy.</p> <p>Individual Benefit: Free, special offer, lyft discount.</p> <p>IT Infrastructure: download, internet, phone.</p>

4. Conclusion

This study found that text mining with Apriori Algorithm using review to mine the the customer tweets data together with the empirical testing with statistics on the results of the text mining method can be used to identify the success measure mobile commerce. Using this method it was found that with the best minimum support of 0.02, factors that measure the success of mobile commerce in the case of Uber, Grab and Lyft are System Quality, Information Quality, Process Quality, Service Quality, Use, User Satisfaction, Individual Benefit and IT Infrastructure. Based on the data processing results it was found that Service Quality has the highest frequency compared to the other measures.

5. References

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