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Sentiment Analysis of Mobile Product Reviews

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Abstract: ***Reviews about products have started playing an important role in finding opinions about products that are available in the market [1]. Those reviews spread like rumours and help in decision making for the consumers to purchase the product or not and as well to the manufacturers to get feedback about their products. The reviews help in better selection of products for the customer and hence help them in selecting the best and the appropriate phone for their use. Several researches have been conducted on this problem using various techniques and have produced results of varied kinds. Many different kinds of approaches have been used to conduct the study of this problem and have shown the various desired results about a particular smartphone product. Some researches show comparative studies about various methodologies used for solving the problem while some make a combination of various approaches into one solution. All of these have been successful in their own ways and have helped the user in determining the best product according to their requirements. The growing number of opinions about a particular product make it ambiguous for a customer to take a decision of whether to buy that product or not [1].The problem customers face while picking a mobile phone is that there is no mechanism which gives detailed reviews about a product. Taking the previous works into account we have tried to enhance the research about this topic by adding some contribution in our own way and helping the community. We make an effort here to build a system that efficiently tries to predict the sentiments regarding a mobile product based on the reviews that people have given to that product on a particular platform.***

I. INTRODUCTION

Reviews provided by users prove to be vital for customers interested in buying a particular product. Reviews provided by customers already using a particular product come with a much broader sense of classification in terms of functionality and user experience. One more advantage that comes along with the product reviews is that it helps the product manufacturers to analyze response their product is getting in the market [2]. Its not possible for any user to read every review and make a decision [3]. The solution we figured out for this problem is to make a summary of all the reviews and produce a comparative analysis of all the reviews.This will not only help the customers get a comparative study about the mobile products features but also, they will also get to know about the user experience and the pros and cons of the product they are looking to buy.

The way in which this is achieved is that first the reviews from multiple e-commerce platforms are been extracted and then the information is cleaned [4]. The cleaned data is then passed through a test where they are classified based on various categories like positive or negative, hit or flop etc. and depending on the classification the conclusion is derived whether the product is a success or a failure [4]. This can be done individually for every review or together for all the reviews as one. The emphasis is to capture different aspects of a mobile product in order to make a broader analysis of the product.

Sentiment analysis can be termed as the application of text analysis,natural language processing, biometrics and compu- tational linguistics to comprehensively associate, draw, quan- tify, and examine affective states and instinctive information [5].Sentiment analysis is widely recognized to voice of the customer medium such as reviews and survey reactions, online and social network media, and healthcontrol materials for applications that range from customer service to marketing to clinical medicine [5]. The three main categories to into which sentiment analysis can be classified is: viz. statistical methods, knowledge-based techniques and hybrid approaches[6]. Senti- ment Analysis is circumstantial extraction of text which pin- points and pulls out instinctive information in origin material, and helping a business to perceive the social sentiment of their product,brand or service while tracking online conversations [7].

It is also the most general text classification tool that examines an incoming message and tells about the positiv- ity,negativity or neutrality of the underlying sentimentl. It helps in social network media exploration and allows us to gain an outline of the wider public belief of certain topics. Sentiment analysis on large collections of data set including web pages, internet discussion groups, online news, online reviews, social media and web blogs is automatically possible due to huge availability of free or paid open source sentiment analysis tools that deploy machine learning, statistics and nat- ural language processing techniques. [8]. The most extensively used approach to achieve this is to distinguish the data with two subsets of data one of which contains positive words and the other most of the negative words.

Text summarization refers to the expertise of condensing extensive chunks of scripts. The objective is to develop a rational and

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eloquent cursory having only the unique points outlined in the document [9].The principle objective of sum- marization is to find a fragement of information which exposes the information of the entire set. Such approaches are widely used in industry nowadays. Document summarization tries to create a descriptive prospectus or extract of the entire document, by finding the most crucial sentences, while in image summarization the system finds the most descriptive and exceptioinal images [10]. With the growing spectrum of data over the internet the need to develop algorithms that can summarize the data has been essential. These algorithms help in summarizing the data efficiently and deliver the ex- plicit message. There are two techniques for summarization 1. Extractive summarization where articles are summarized based on a subset of words by retaining the most important words and 2. Abstractive summarization which selects words based on semantic understanding [11]. The main idea of text summarization is to take out the valuable extract from the huge amount of textual data available. It is a method of simplifying the meaning of the whole paragraphs into one or two lines. This helps in better, faster and efficient understanding about the available information to the user. The user does not need to read the whole paragraphs instead they just need to go for the summarized content and they can make their conclusion.

II. RELATED WORK

Association rule mining [fast algorithm for mining associ- ation rule (R Agarwal, R Srikant)] is used to extract the most frequent features when working with sentence-based analysis [12].

Kushal and Durga [Kushal Durga paper] in their research work they are extracting online reviews for a product period- ically and identifies the feature of a product from customer's opinion [4].

[Mining and Summarisation of customer review (Minquing Hu and Bing liu)] Here the authors proposed a system for summarization of customers review based on feature and opinion mining approach. This was a three-step process (i) mining the features of product from comments. (ii) identifying the opinion sentences and classifying the opinion sentences that whether it is positive or negative and in third step they simply (iii)summarize the solution [13].

May Thanda Theint Aung, Aye Aye Kyaw in their paper, Sentiment Analysis of Smartphone Product Reviews proposed two approaches for sentiment analysis in their paper, (i). machine learning approach where they have first pre-processed the data and then used naive based classifier to distinguish the data into positive and negative; and (ii). Dictionary based approach where they have used techniques such as Lemma- tization, POS-tagging and negation detection to complete the research [14].

Devendra Kamalapurkar, Ninad Bagwe , R. Harikrishnan , Salil Shahane, Manisha Gahirwal proposed a system which first uses a web crawler called Beautiful Soap to get infor- mation about mobile phones and then they have implemented Recursive Neural Tensor Network (RNTN) which derives the parts of speech from each word and based on the average of these ratings the results are determined in their paper, Phone Recommender: Sentiment Analysis of Phone Reviews [15].

Xing Fang and Justin Zhan in their paper Sentiment analysis using product review data proposed a three step solution for product reviews which includes: (i). An algorithm for negation phase detection, (ii). A mathematical approach for sentiment score computation and (iii). A feature vector gener- ation method that calculates polarity of sentiments [16].

Reshan Ahmed Rabbi, Md. Walid Amin Khan, Md. Shaown, Md. Shajidul Alam proposed a model where they calculated polarity of each attribute of product and then the average of the attribute of the product is calculated to get the ratings of the product in their work Product Rating Generation Based on Public Opinion Using Sentiment Analysis. They have not used the twitter search API/0Auth due its limitation of less data [17].

Mochamad Wahyudi, Dinar Ajeng Kristiyanti proposed a method where they use a feature selection method viz. Particle swarm Optimization to increase the accuracy of Support Vector Machine in their paper Sentiment Analysis of Smartphone product reviews using support vector machine algorithm based particle swarm optimization [18].

Aashutosh Bhatt, Ankit Patel, Harsh Chheda, Kiran Gawande have tried to find ratings for feature reviews and not service and product review and hence avoiding the computa- tional task for the both. They have achieved there by objective by the following techniques viz. Data Scrapping, Data Clean- ing and processing, and finally summarization is performed on the data in their work Amazon Review Classification and Sentiment Analysis [19]. Jun Feng, Cheng Gong, Xiaodong Li and Raymond Y.

K. Lau proposed a solution where they have constructed an probationary structure using which they weigh up the suggested domain-specific lexicon with two favoured universal lexicons and with state-of-the-art machine-learning and deep- learning approaches that don't make use of a lexicon in their work Automatic Approach of Sentiment Lexicon Generation for Mobile Shopping Reviews [20].

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III. PROPOSED METHOD

A. *Motivation*

Considering the drawbacks of the previous systems that were inefficient in providing the appropriate reviews of a mobile products we in our attempt are trying to make a system that tries to compare the varied data based on parameters specified and then make a conclusive evidence based on the classification of the data. The weightage is given more on trying to get the sentiments rather than just the specifications and the technicalities. Sometimes people express their feelings in more general context rather than going into the practical nature of the product. Taking into consideration this fact, we have tried to use the sentiment analysis approach. The most important strategy that we have applied is to focus on the most meaningful words from the sentences and deriving the emotions of those sentences. This way we are trying to reach more closer towards the sentiments of the user and in that process trying to achieve better and accurate results. Taking the assistance of the functionalities of natural language processing we are trying to achieve significant output for our methodology. Also an attempt is made to derive the best possible output by testing as many possibilities of the problem statement.

B. *System Overview*

Figure 1 shows the summary of our Sentiment analysis for Mobile Product Reviews. The most Important component of our system is the sentiment analysis. Each review is first decomposed into corpus of words. The data is then cleaned and only words related to the product are been selected for further tests. For this we are using the natural language processing API provided by R Programming. It helps in cleaning and refurbishing the data and thus enables the derivation of better results. Finally, sentiment analysis is been performed on the data to get the best and the most appropriate results. One advantage of making the data granular is that each word is been tested for its origin and the makes the analysis more reliable.Sentiments are calculated in the final stage of the experiments to give the user the desired output.

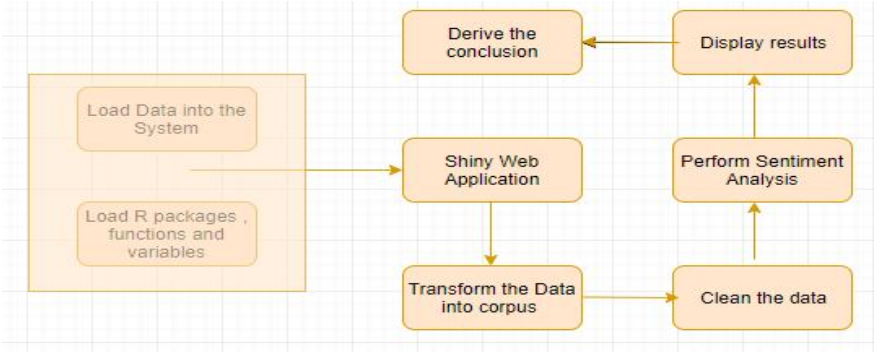


Fig. 1. System Overview for Sentiment Analysis

C. *Sentiment Analysis*

We are using R Language for our sentiment analysis. The reviews are converted into a corpus of data and vector list of all the reviews is created. Only words which prove meaningful for sentiment calculation are taken into consideration. The other word that commonly come into everyday use are discarded by a process while performing the Sentiment analysis.

reviews_clean < *tm_map*(*reviews_clean, removeWords, stopwords* (”*English*”) (1)

The data is then been loaded into a text-bag to store the important data for further usage. From this data we calculate the actual sentiments

reviews_textbag < *str_split*(*review_text, pattern* = ”*s* +”) (2)

IV.EXPERIMENT

A. *Experimental Data and Measure*

1) *Experimental data:* To perform the experiments, we are using a set of test data twitter for a particular mobile product. We have taken reviews given by 500 user reviews and used them as preliminary test data. The data is been loaded as a corpus of data into the system. The system then performs the analysis manually and gives the solutions of the sentiment analysis. A wordcloud of the test data is also been generated in order to summarize the most important words. It also helps in determining the most used words in the reviews.

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2) *Evaluation Criteria:* We are performing the test using the traditional method by calculating sentiments on each of the important words that form the base for the test. First the values in the text-bag are compared against two separate data sets of positive and negative words and count of that match is compared to get the score of the sentiments.

$match(reviews_textbag2, poswords)$ (3)

$match(reviews_textbag2, negwords)$ (4)

Based on the difference in count of this two the result is been calculated, whether the sentiments are positive or not

B. Experiment Results

The Experiments conducted on the test data gave positive sentiments towards the mobile product stating that the users of the mobile product i.e. OnePlus6T 4 were happy with the product. The results of the test were as follows:

$sum(!is.na(match(reviews_textbag2, poswords)))$

> 297 (5)

$sum(!is.na(match(reviews_textbag2, negwords)))$

> 97 (6)

The difference between the positive and negative sentiments were calculated as follows:

$a < -sum(!is.na(match(reviews_textbag2, poswords)))$

$-sum(!is.na(match(reviews_textbag2, negwords)))$

$> a = 200$ (7)

A wordcloud was also created to find the most words used in the review. Below is the wordcloud derived from the tests

The variation in the sentiments were calculated as follows:

$s <- get_nrc_sentiment(iconv(reviews_text, to =^{j} utf - 8^{j}))$ (8)

Above are the results of the test conducted for sentiment scores of each diffrent feelings

The results of the test showed that though some of the cus- tomers were not that satisfied with the product but maximum people gave good reviews for the product and that's why our test concluded that the product was hit based on the sentiments of the people.



Fig. 2. WordCloud for Sentiment Analysis

Table I Count Of Different Ssentiments

Anger	Anticipation	Disgust	Fear	Joy
20	29	8	17	25
Sadness	Surprise	Trust	Negative	Positive
30	13	35	34	71

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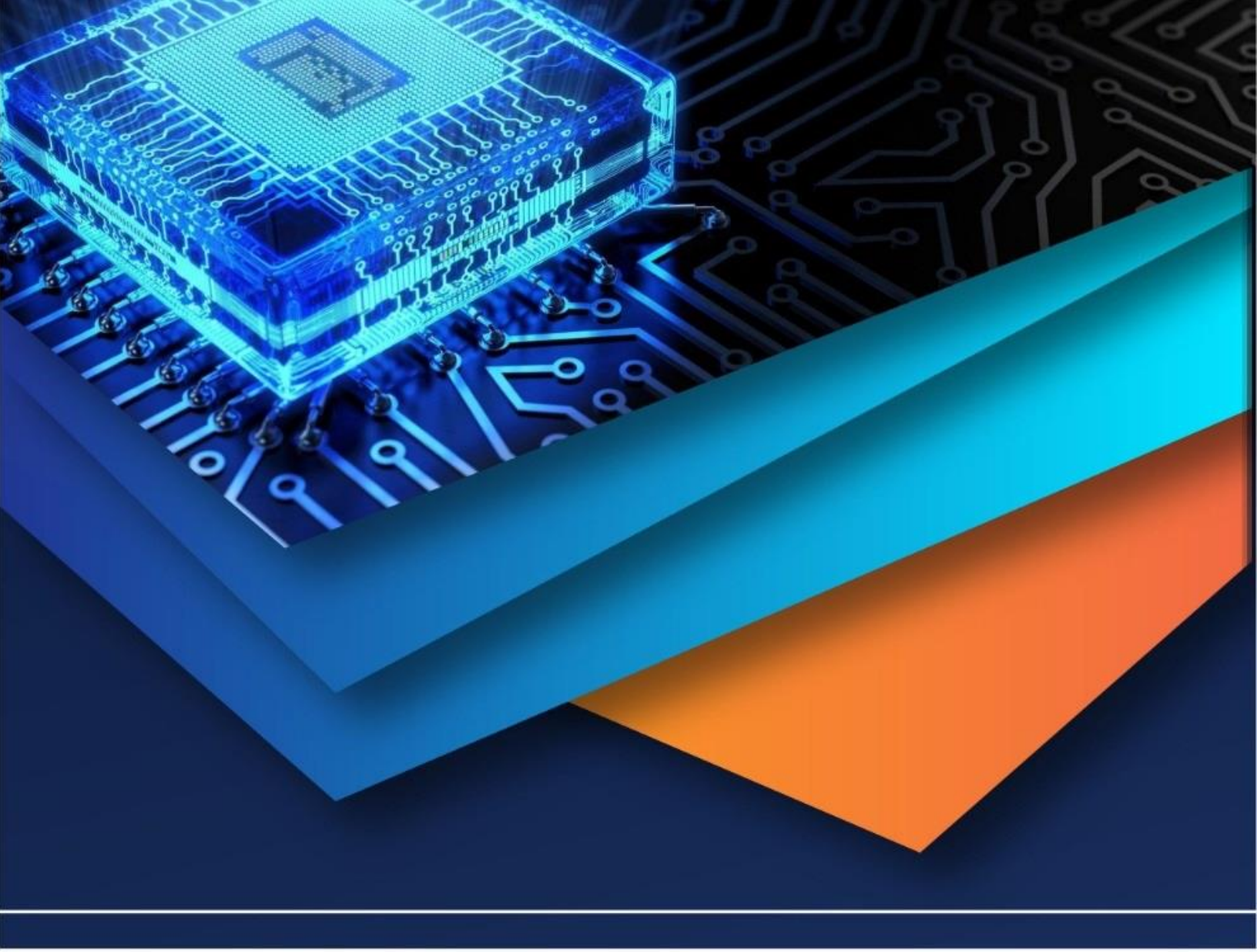
V. CONCLUSION

From the results conducted on the reviews for OnePlus6T, we came to the conclusion that customers were more than satisfied with the product. The sentiment scores were towards the positive side. We have tried to calculate the sentiments of the mobile products and successfully implemented the system. We are trying further to enhance the system for better results by trying to combine reviews from multiple platforms into one and then getting the more faultless results. One more improvement that we tend to make is that we try to calculate sentiments for each review individually which helps in more precise outcomes.

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