Social Media Data Analytics to Improve the Customer Services – The Case of Fast – Food Companies

Rose S, Sreejith R, Senthil S

Abstract The proposed paper exhibits a study that uses Twitter to identify and assess client perception in the fast food industry. The intention behind the research is to measure the customer discernment about the product and the services by observing and inspecting the public twitter comments, to disclose the insights on whether the customers are satisfied or not satisfied with the brand and to predict the business growth and do further improvements accordingly.The methodology in the paper incorporates the text-based analysis using Support Vector Machine (SVM), which is a classifier that helps to classify the negative and positive words. In this approach, 10,000 public tweets about the customer services of three fast-food organizations were extracted. The text-based analysis (also known as word-based analysis) was conducted using R-programming by calculating the NPS value, highlighting the most negative and positive words.From the study, the negative and positive words in the Twitter comments for McDonald's, Pizza Hut and Burger King were extracted showing the customer perception towards these three companies. Along with this, the NPS score for each of the company was also found out.The Paper shows how text mining of tweets can be utilized in market research to help in revealing the customer perception of any product or service offered by McDonald's, Pizza Hut and Burger King.

Index Terms: Fast-food Company, NPS (Net Promoter Score), Customer Perception, Twitter Data, Text-Mining.

I. INTRODUCTION

In this new era, Quick Service Restaurants (QSR) also known as the fast-food industry, offers luring food to customers. McDonald's, Burger King, KFC (Kentucky Fried Chicken) was acknowledged between 1940 -1950 and had an impact in society due to these changes. The year 1960 was observed to be a period of development in drive-in restaurants and fast food groups such as Subway and Wendy's [8]. Marketing managers and researchers depend on the client experience which is an efficient method to measure their views which is done via calculating NPS. Most companies use methods like conducting surveys for the feedback of customers to know the psyches of the customers. But often they don't exhibit the actual reviews of the people especially for the QSR industries [2]. Companies may ask customers to rate their product as in apps, websites, and also ask to press on the emoji (emoji showing whether the service is good, very good, not good etc.) near the billing counter in many supermarkets (More, Supermart etc.) for collecting their feedbacks. Using text-based mining, NPS score was figured out in the proposed paper from Twitter to gauge the client experience as a whole. This helps the marketers and business person to take the decision accordingly to an extent. Why to an extent? Twitter Sentiment analysis using NLP (Natural Language Processing) helps the marketers to take a fast and correct decision than the word-based approach using R. Twitter Sentiment analysis holds natural language processing and word-based analysis to discover and extract the subjective content placed on the customer reviews from the social media. NLP is basically a program to describe human language which is a part of artificial intelligence.

First, data (tweets) were extracted from Twitter via API using the keyword ('@') and then tweets are preprocessed (clean).
After this, the negative and positive tweets were separated with the help of SVM classifier and the positive and negative polarity were highlighted. And then the sentiment values were calculated in which the expressed emotions (temper, hope, distaste, unease, delight, negative, positive, sadness, surprise, trust) of customers are been plotted of each brand of QSR. With the help of Scoring Algorithm, the histogram was plotted and then the NPS rate for each brand was calculated which is a relevant part of the paper, that helps to measure the client perception towards each brand. This finally gives the overall perception of customers towards each brand.

II. LITERATURE REVIEW

In literature, different frameworks suggested for the social media analysis problems and concerns associated with the fast food industry are analyzed to get a gist of how the problem can be solved. Table1 draws a brief idea of the related work. *Yisak Jang* proposed a paper [8] where the author examines whether the perceived value affects the consumers buying behavior. The paper basically discusses about the QSR where they want to maximize the customers' perceived value. The author collected the samples from both the online and offline. Performed MANOVA test, Regression analysis to know the perceived value of each brand. *Akshit, Nagesh, Nishikant,* recommended the paper [2] that deals with the Twitter data for the identification of the logistics network issues in the food industries.

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The authors used the approach of text mining to get the positive and negative sentiment of the tweets using SVM. The results help to inform supply chain decision makers about the customer feedback and issues in quality. *Ankit, Nabizath Saleena,* the paper [6] focuses on identifying the most suitable classifiers – Naïve Bayes, Random Forest Classifier, Support Vector Machine, and Logical Regression. And the authors put forward an approach that aims to improve the performance and accuracy of sentiment classification technique. The steps included like data pre-processing, extracting out features, and then sentiment classification. SVM it's a nonlinear mapping to find a large margin between the classes. Also, finds a decision boundary which maximizes the separation gap between the classes.

Jianqiang and Xiaolin and Zhang, the paper [4] used an approach for the word sentiment polarity score. The author used AFINN lexicon and extended the senti - word net, to obtain the tweet sentiment polarity score.

Shercahan, Pervin, Butler, Lai, Ghahremanlou, Han, the paper [14] the author uses an Australian Crisis Tracker (ACT), an apparatus intended to encourage the comprehension of basic data accessible in online networking channels for individuals also, offices reacting to catastrophic events. ACT saddles the Twitter spilling application program interface by handling each tweet through a pipeline of logical segments, including filtering, metadata parsing, picture extraction, and bunching of significant tweets into occasions. Every one of these occasions is then geocoded, arranged, and expanded with pictures from Instagram. The pipeline of this investigation is coupled to a web– UI that permits partners to all the more likely access data amid catastrophic events.

Jianqian, Xiaolin, [3] Twitter Sentiment Analysis helps any organization ability or track the open inclination towards the products and events related in real time. The paper basically discusses the pre-processing which is the foremost step after extracting the data from any social media. There are methods to clean the tweets were many researchers ignore the cleaning process. The process includes cleaning of URL, numbers, stop words, white spaces etc.

Kristensen, K., & Esklidsen, J., The paper [21] points Consumer adherence and customer unwavering-ness have turned out to be vital ideas in the current administration and quality models. Reichheld shared a bit of content in HBR, in which he asserted that the NPS, is the primary number one have to develop, and the main number one has to oversee client reliability.

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Table I: Studies based on Social media analysis in the literature.

Area	Method	References
Sentiment Analysis	SVM, Hierarchical clustering, Multi-Scale Bootstrapping, Ensemble Classifier.	Akshit, Nagesh, Nishikant - 2018, Ankit, Nabizath Saleena – 2018, Jian qiang and Xiaolin, and Zhang -2018
Data Collection	Extracting the data from the microblogs Twitter and Instagram	Shercahan, Pervi, Butler, Lai, Ghahremanlou, Han -2017
Text Pre-processing	Six pre-processing methods using two-feature models and four classifiers on 5 twitter datasets.	Jianqiang, Xiaolin -2017
NPS	Consumer loyalty and client unwaveringness	Kristensen, K., & Esklidsen, J. 2011

III. SEMTIMENT ANALYSIS

Sentiment analysis a process to determine the perceptive tone of the words, which helps to know the attitudes, opinions, and feelings asserted by the customers online. *Figure I* show various expression and measuring the emotions from positive to negative.

Figure I: Different Expressions

Sentiment Analysis is nothing but the judgment of the feeling behind a bit of writing. For example: *"I love pizza"* which is a positive comment. *"Burger is disgusting"* obviously this is a negative comment.

A. Text Mining

Casual discussion through any microblog like Facebook, Twitter [13] will have a great experience in the new education system– conclusions, sentiment, and worries about the learning course.

Information from such a situation gives profitable advice to illuminate properly. Text partition is the procedure to scrutinize and analyze a large data of unstructured text which can identify the concepts, topics, patterns and other components in the data. Mining and inspecting the text benefits the organizations to get business insights from the various sources of content based data. To comprehend the current case of art and future trends about the utilization of web-based life in co-creation of customers, [12] the author conducted studies to analyze the posts on microblogs. The result benefitted the managers to take part in co-creation exercises with clients.

B. Support Vector Machine

SVM is a linear arrangement or regression algorithm. The method is used to discover the hyperplane among labels or classes of data to get a perfect outcome. SVM a selective classifier defined as a dividing or a disjoint hyperplane.
In laymen terms, suppose the graph in *Figure 2:(a)* with two labels able to decide a separating line between the two labels?
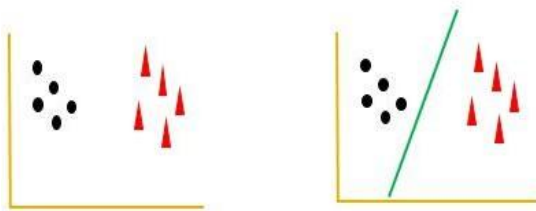

Figure II: (a)   **Figure II: (b)**

The graph in *Figure II :(b)* similar to that of the above one, which separated the two classes by a line. Any point that is left of the line falls into circle class and another side of the line belongs to triangle class, separation of classes. This is what SVM does. The proposed paper SVM plays a sizable part in allocating the negative and positive sentiments from the data. [17] SVM is basically used to perform the training data and classification. And the impact was that the methods used were effective and efficient. SVM is classifier meant to classify the participants to participate in a controversy with the help of the method called disputant relation based method to extract the feature who are participating in controversies. [20]

IV. PROCESS DESIGN

Figure: III (a) explains the process design. The steps in process design include invoking all the necessary libraries and connect the system to Twitter API, extracting the tweets from the twitter and cleaning the data for further processing.
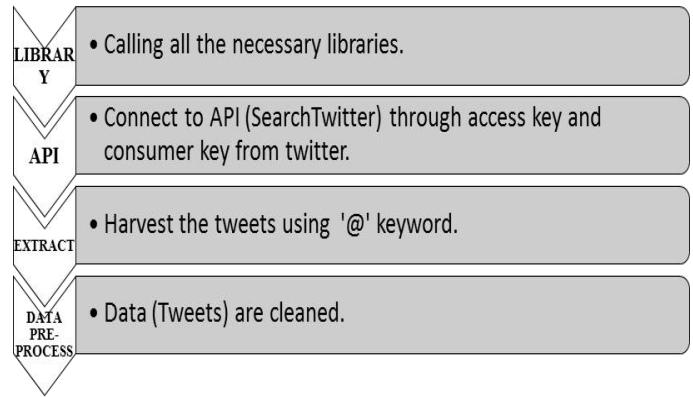
Figure III (a): An Overall Approach
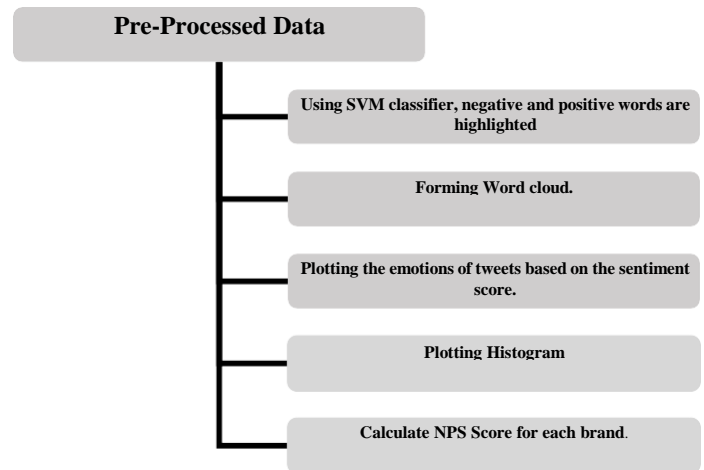
Figure III (b): After Pre-Processing data

Figure III (b) is the continuation of *Figure III (a)*. After the data is cleaned the figure shows four analyses to be done.

V. DATA COLLECTION

A. API

Application Programming Interface acts as a software mediator that let on two end-user programs to communicate with each other.

Figure IV: API Example

Imagine sitting in a table in a restaurant with a menu of decisions to arrange from. The kitchen or the chef who is a part of a framework which is responsible to prepare.

What is missing is the basic connection to convey your request to the kitchen and convey your nourishment back to your table. That is the place the server or API comes in. *Figure IV* clearly explains the process that happens between the end – user and application program. In short, API acts as a m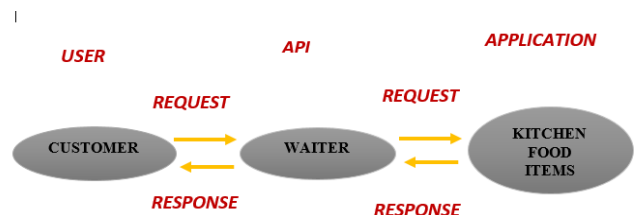essenger that takes the request from the end user and tells the system 'what to do' and then the system gets back with the response (in this case it is food.)

But Why API?

To join certain applications with social microblogs like Google or LinkedIn account, the Facebook or Google account details are asked for the signing in, where the Facebook or Google API are called and gathers the data like name, place, date of birth etc. *Figure V* demonstrates the working of an API. These particulars are fed into the goal account and the required account is thus created. It saves the customers from the inconvenience of filling the forms and feeding the data or the information again and again. The process behind is to get the information from another established resource.
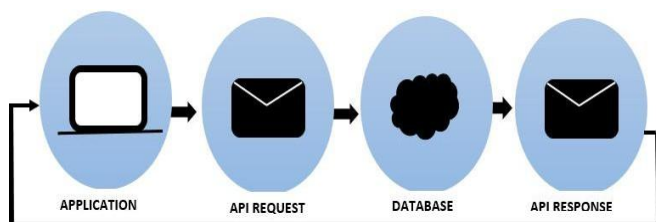
Working of an API

Figure V: Showing the working of API

The information (tweets) are collected from Twitter through R-programming using the Standard Search API. Before extracting the tweets, the major step is to fabricate a twitter application which requires a twitter account. Steps to construct a twitter application are stated below:

Connect to API

1. Go to Twitter Developer site.
2. Click on "Create a new application".
3. Fill the details required to create the app.
4. The application is made with the unique consumer id and tokens.

Install the necessary libraries in R. Also, ROAuth which maintains an interface to OAuth1.0. OAuth (Open Standard for Access delegation) which is an internet protocol enables an end client's data to be utilized by outsider services, such as Facebook, without uncovering the client's secret word.

Creating and storing Authenticated Twitters credential object.

This can be done by downloading the "cacert.pem" and store in the working directory. Then create an object were the consumer key and consumer secret key is saved. After

executing the program in R, a 6-digit pin is available, copy it to the R-console.

B. Extract the tweets

Now the application is built and is connected with Standard Search API of twitter and Using searchTwitter() to harvest the tweets from the Twitter, with the help of keywords starting with '@'.

VI. DATA PRE-PROCESSING

Data cleaning is the first step after gathering the data where most of the researchers ignore it. *Figure VI* shows the steps that performed in cleaning the tweets in R. The extracted data is cleaned line by line removing the retweet symbol (RT), the HTML links, punctuation marks, the whitespace, number, stop words and converting the whole text to lower cases.
Most existing researchers about Twitter opinion investigation are centered on the extraction of new opinion highlights. In any case, to choose the pre-preparing technique is disregarded.
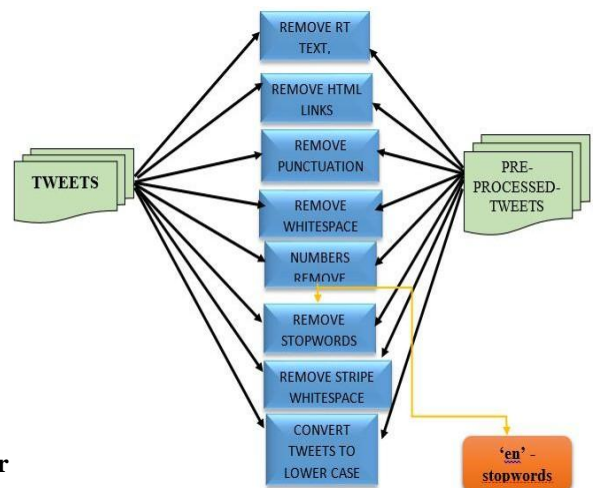
Figure VI:

Steps in cleaning the data (tweets).

The proposed paper expresses the effect of data pre-handling technique on the opinion classification by executing in two sorts of classification assignments and summed up the classification exhibitions of six pre-handling strategies utilizing the two component models and four classifiers on Five Twitter datasets. The tests demonstrate that the exactness and F1-proportion of Twitter opinion classification classifier are improved when utilizing the pre-preparing techniques for growing abbreviations and supplanting nullification, yet scarcely changes while evacuating URLs, expelling numbers or stop words. [3] Stop words are nothing but the collection of words or terms in any language not only English. Stop words are necessary for the cleaning process as we can extract the targeted words.

VII. ANALYSIS

After data collection, tweets are cleaned for further analysis. To calculate the sentiment score for the collected tweets using the sentiment function in R.

The formula used [4] is:
I. SENSCORE (W) = PMI (W, POS) – PMI (W, NEG) WHERE W = WORD IN THE LEXICON.
II. IPMI = POINT –WIDE MUTUAL INFORMATION
III. SENSCORE = INFORMS THAT THERE IS A PRESENCE OF STRONGER RELATION CONNECTION AMONG W AND POSITIVE SENTIMENT OR THE CONCLUSION AND THE OTHER WAY AROUND.

Now, the tweets are separated into two text files with positive polarity and negative polarity. The comparison word cloud is highlighted, the negative tweets with green and positive tweets with red colour in *Figure VII, Figure VIII, Figure IX*.

Figure VII: Most Negative and Positive words – Burger King

Here, from *Figure VII* customers of Burger King are happy with the 'food' they provide and the service is also 'fast'. But the customers are also 'sad' and feel 'bad' about the product or the service.

Figure VIII: Most Negative and Positive words – McDonald's

From *Figure VIII*, the clients of McD talk positively about the products like 'breakfast', 'mac', 'chicken' many more things can be assumed from the word cloud.
But From the word cloud, it could be seen that customers are not happy with the 'shake' they provide and also the audience is comparing with 'burger king' and have used atrocious words to explicit their emotions like 'fuck', 'shit'.

Figure IX: Most Negative and Positive words – Pizza Hut

The Pizza hut customers are happy with the product, the positive terms 'good', 'thank', 'love'. The assumption is that the customers are happy with the 'delivery' service and much more can be visualized from the plot.
Customers are 'disappointed' with the 'order' which means poor service.
'PETA' – PEOPLE FOR ETHICAL TREATMENT OF ANIMALS. The Pizza hut introduced a new concept for the vegan people by serving the veg-pizzas. But once accidentally the organization served meat to one of the vegan clients, that shows the word 'orders' in negative- which is a proof to the situation.

Word Cloud
Word clouds, also called text clouds, are those words appears more in any source of data, greater and bolder it shows up in the word cloud. So, after the execution, there are frequent and relevant terms being used in the data that we have extracted.

Figure X: Word cloud

The creator utilized the word cloud technique as it is a basic and visual suit of perception strategy for text. In the paper, the creator built a word cloud subsequent to the cleaning process and that causes the expert to investigate profound experiences from the visual intrigue [22]. *Figure X* shows the word cloud of three different companies under the QSR industry and the words are shown in the word cloud according to the frequency of occurrence.

Sentiment Analysis

Sentiment analysis identifies the attitudes, opinion, feeling, and emotions. Sentiment analysis specifies the type of applying Natural Language Processing and content mining techniques to identify and remove the abstract data from a bit of text. An individual's emotions are generally abstract, they are not facts which intends to examine the person's attitude from a bit of text that can be incredibly troublesome.

With sentiment analysis from content mining, the author centres to comprehend the frame of mind and its extremity. The author extracted the Tweets from online networking and they utilized a philosophy based process to retrieve and analyze the client's tweets. And the outcomes were utilized to take the remedial measure to keep the issues for what's to come.[23]

The proposed paper uses the inbuilt sentiment analyzer having NRC sentiment dictionary in R to assess the presence of 8 different emotions and the scores correspondingly present in the text.
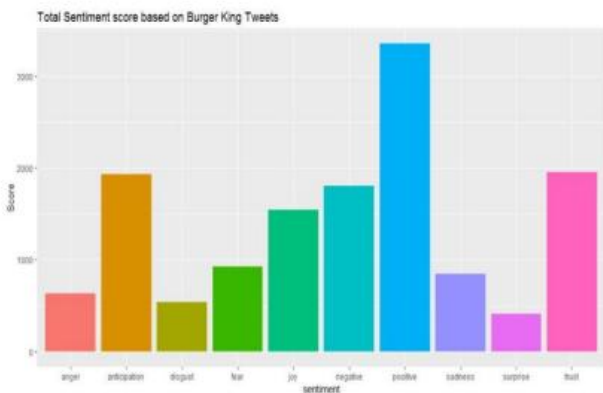
Figure XI: Emotion Sentiment Score –Burger King

From *Figure XI* the sentiment analysis on the tweets of '@BurgerKing', it's noted that burger king has a positive impact on the customers and is severely trusted by the customers. There has been really a good number of anticipation may be on their products or other possibilities.

From *Figure XII* the sentiment analysis on the tweets of '@McDonlads', it is observed that customers are anticipated with the products along with which the number of negative sentiment associated with tweets on McDonald's is also quite more. Among the other emotions, trust and joy were the company is maintained.
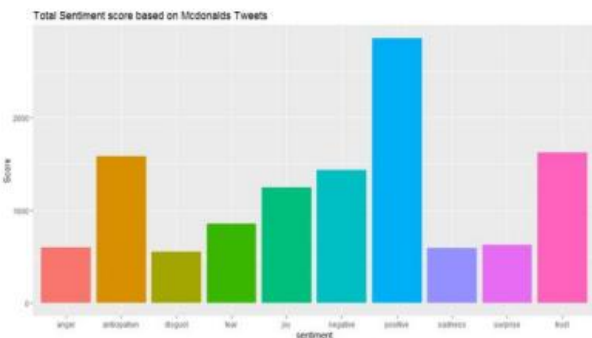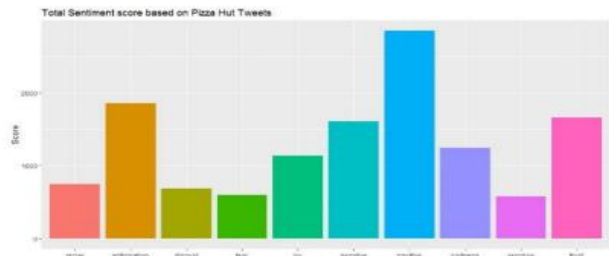

Figure XII: Emotion Sentiment Score - McD

Figure XIII: Emotion Sentiment Score –Pizza Hut

From *Figure XIII* Pizza Hut is anticipated and trusted by their audience. But the number of sadness sentiment connected with the tweets on Pizza Hut is more. Along with that joy is also maintained.

Histogram

The histogram depicts the sentiment or the emotion score of Twitter using the scoring algorithm in R. The negative sign from the *Figures XIV, Figure XV, and Figure XVI* shows the unhappiness of the audience whereas the positive symbol shows that customers are happy with the brand. And zero represent that the Twitter users are neutral.

SCORING ALGORITHM

Algorithm: In the scoring algorithm, horizontal and vertical iteration is done on each tweet.

STEP 1: START
STEP 2: Initialize final score = 0.
STEP 3: Using a loop, from 1 to length of tweet text.
STEP 4: Split each word in the text and
        compare it, with the positive terms in
        the dictionary.
STEP 5: Sum up the Positive words found.
STEP 6: Repeat STEP 4 and STEP 5, to get
        negative Words and sum up the
        Negative Words.
STEP 7: final score = sum of positive words –the sum
        of Negative words.

STEP 8: Plot the histogram of the final score.
        The data is collected from major three fast-food
        companies from Burger King, Pizza Hut and
        McDonalds. And the respective plots are shown
        below:

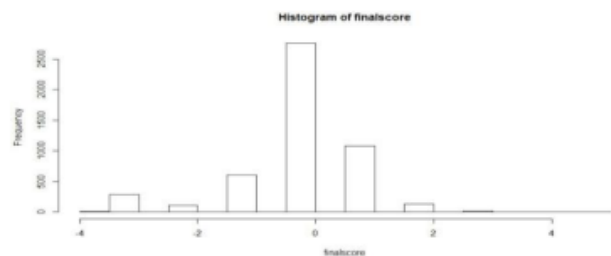*Burger King*: From *Figure XIV* the presence of the maximum number of neutral tweets and with 1000+ positive tweets.

Figure XIV: Histogram – Burger King

Pizza Hut: From *Figure XV* graph of Pizza Hut depicts 500+ negative scores and 1000+ tweets with positive scores.
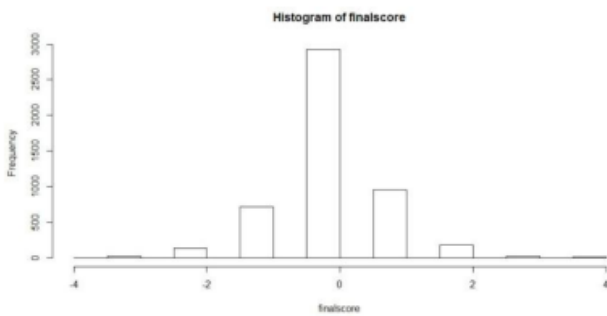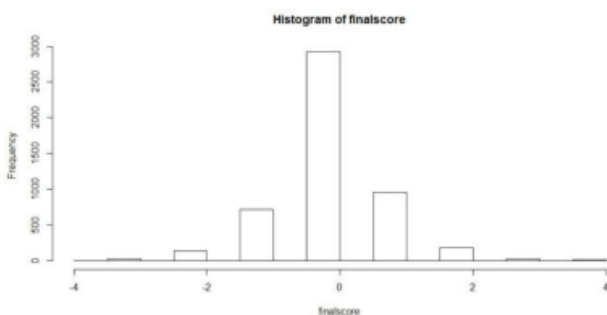

Figure XV: Histogram – Pizza Hut

Figure XVI: Histogram - McD

McDonald's: From *Figure XVI* the graph of McD shows with more neutral tweets and 500+ tweets with both positive and negative polarity.

Net Promoter Score (NPS)

Client loyalty and unwavering-ness have ended up being indispensable thoughts in the current administration and quality models. Reichheld circulated an article in HBR, in which the author asserts that the Net Promoter Score (presented independently from anyone else), is the primary number that has to be developed, and the principal number have to oversee the client reliability [21]

In marketing NPS, the client experience is measured and predicts growth. The measure moulded the business world which provides the crux of measurement for the customer experience management. *Figure XVII* depicts the standard NPS Score were: 0 -6 are Not at all likely, 7 – 8 are Neutral, and 9 – 10 are extremely likely.

Figure XVII: NPS

IV. NPS = % PROMOTERS - % DETRACTORS

Table 2: NPS Score - BRANDS

COMPANY	%PROMOTER	%DETRACTOR	NPS
McD	0.22	0.13	8.2
Pizza Hut	0.23	0.17	6.23
Burger King	0.24	0.19	4.83

From *Table 2* Customers of McDonald's and Pizza Hut are passives. The customers are satisfied but indifferent customers who all are accessible to competitive offerings.

Customers of Burger King Are not happy and their can damage the brand name and can block the growth through negative word-of-mouth. From the table, the comparison can be done McD > Pizza Hut > Burger King.

VIII. CONCLUSION

Text processing and sentiment analysis arrive at a challenging field with difficulties as they involve NLP. It has different sorts of applications that benefit from the results such as news articles, blogs, book. Fetching relevant insights from views expressed on Fast Food Companies especially from social media is the crux for many companies, whether the text could be in the form of product feedback or investors' opinions.

From the above study, we derive that McDonald's performance is better than Burger King and, Pizza Hut is average among the minds of customers but Burger King is not in the good list of customers, hence to be improved. The study can be further improved in terms of tweeting date and based on demographics which can be retrieved from the twitter profiles.

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