



Sentiment Analysis- A tool for Data Mining in Big Data Analytics

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Abstract: With the current business environment and rapid changes in technology, the amount of data produced is increasing as each day passes. This huge collection of data is what can make or break such institutions, so it is vital for such a sector to efficiently utilize the data generated. Effective tools and analyses are required to make sure that this data is comprehended and organized in such a manner that it can be used for the tasks at hand. The challenge faced here is knowing how to extract and use the data to the benefit of the business world. The objective of understanding the underlying emotion displayed in each opinion that is voiced out is a huge exercise. Through this paper an attempt has been made to understand how the gap between consumers and providers can be bridged by analyzing secondary data through Sentiment Analysis tool. This research proposes a framework CSA (Continuous Sentiment Analysis) to repeatedly analyze the sentiments from customers highlighting the purpose of one such attempt to capture the tone of the message. This method of "Sentiment Analysis"- a fairly new field uses Natural Language Processing (NLP) in order to give meaning to the abundant data available at hand.

Index Terms: Business Analysis, CSA, Data Analysis, Data Mining, Sentiment Analysis, NLP.

I. INTRODUCTION

Sentiments are feelings, emotions, opinions, likes and dislikes whereas sentiment analysis is the key to understanding verbal and written communication that represents several mixed opinions about varied topics. Sentiment Analysis can be interpreted as the task of detecting the perspective of various authors on particular datasets [10]. It raises the question of importance of opinions shared by those who actually use the product or service offered. It is imperative for those who are looking for opinions or social media acceptance. Sentiment analysis frameworks are being connected in pretty much every business and social space since judgements are fundamental to every human pursuit and are key influencers of our practices. Our convictions and view of the real world, and the decisions we make, are to a great extent molded on how others see and assess the world [11]. The phrase text mining has generally been related with business applications, data examination is currently giving noteworthy bits of knowledge to numerous portions of the business, government, service agencies and even political exercises [16]. Rising complains regarding customer care in banking institutions go unheard and the gap between the management and the end users goes on increasing. Sentiment analysis can be the solution that gets the two parties back on

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track. To further understand the functioning and utility of Sentiment analysis, we conducted a secondary research in order to know how financial institutions can use it to their benefit. The tool used for the above mentioned research is called Itecheck. All the reviews have been lifted directly from Zomato: an application that collects reviews on various restaurants. Section I is the introduction itself, Section II is a discussion on natural language processing, Section III is the evolution of sentiment analysis covering the product, production, selling and marketing, Section IV is the background study on the topic, Section V discusses the applications of sentiment analysis, Section VI is the procedure and workflow followed in sentiment analysis, Section VII is the methodology followed in the study and Section VIII is the proposed framework for continuous sentiment analysis followed by conclusion and future works.

II. NATURAL LANGUAGE PROCESSING

Sentiment Analysis attempts to classify the opinions and statements as positive, negative or neutral [9]. Also known as opinion mining, it understands human behavior and categorizes the opinions expressed. It uses Natural Language Processing (NLP) to classify and interpret data available online. It uses a combination of data mining and NLP to explore, extract and purify the abundant data found on the World Wide Web so as to suit the purpose at hand [8]. NLP utilizes computational methods to grasp, perceive and create human vernacular content. NLP was one of the primary eminent achievements of the utilization [23]. Portrayal of words has an impact on the NLP framework, words are portrayed as organized files in a vocabulary but this technique often fails to hold the relation between these phrases [24].

III. EVOLUTION OF SENTIMENT ANALYSIS

As the environment developed, with it grew the need to understand the stakeholders of the financial sector, to capture the true "Human Sentiment" was the aim, but how to achieve it was the question left hanging. Various manual feedback tools were put to use but they proved to be distant from the true emotion displayed. There was always something missing, which left a dent in management-consumer relationships.

Earlier marketing theories have believed in two types of strategies, "The Push" strategy that highlights pushing the produce/service towards the customers by means of extensive and aggressive marketing and promotion, in contrast to, "The Pull" strategy that signifies the importance of attracting the customer

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towards what is being provided [19]. In today's dynamic business scenario, it becomes imperative for banks to utilize the pull strategy considering the number of substitutes available out there and for this purpose it is vital for them to know the true need of their customers. These days the form of communication between the consumers and the management has evolved completely, since there is no actual physical contact between the two parties, the only way for the management to know the true perception of the customers is through feedback. The feedback collected can either be favorable or unfavorable but the way these sentiments or emotions are structured leaves the reader wondering whether or not these opinions are positive.

This gap has caused a downturn in understanding the customer and hence the need for customer relationship management arises, in order to build better human-human relationships and establish the true meaning of what is being said. With that being said, the need for a tool that specializes in such an understanding is felt.

Over the years, marketing concepts have evolved over the idea of getting as close as possible to what the customer actually demands for. It is not an easy task to match the perception of the buyers to that of the sellers, it requires thorough understanding of the market at hand and healthy utilization of feedback. The target market ie- segments that represent greatest opportunities [20]; has to be understood deeply. For one to use feedback effectively they should understand the underlying meaning of what is being put forth. Overcoming this gap has changed the model of management through improvising communication as it were as according to Philip Kotler, companies should not only enquire about how to reach the consumers but should also build a path through which their consumers can reach them [1,2]. **A. Production:**

The earlier days of industrial revolution reflected a rise in the need for industrial goods, but the producers were a handful. This meant that these limited producers had a sort of monopoly over the market, what they produced was what was offered and consumed, no questions asked. The issue with this model was that the real need of the consumers was not being fulfilled, leaving the consumer unsatisfied. It was believed that the profits could be doubled by simply producing higher quantities. Availability and affordability were the only factors that were paid attention to. There was no channel of communication for the producer to know what the consumers needed and for the consumers to convey what they required.

The supply grew so much that now, there was need to understand and eliminate those who did not offer more. This led to the formation of the next concept [3]. **B. Product:**

With the availability of multiple substitutes consumers started getting aware of the quality that was being offered along with the superiority of the product that they were purchasing. Now, availability and affordability meant little. The companies that were too slow to understand this trend died out, the lack of proper communication channels led to huge losses. The focus of the business environment shifted towards providing better quality and features in order to stand out. They felt the need to understand their consumers so as to provide them with what they wanted. Slowly, the communication gap was being highlighted. Companies felt the need to differentiate themselves from their competitors and started realizing the importance of aggressive marketing, this is where the next concept developed itself [3]. **C. Selling:**

Companies by this time started realizing that there was an abundance of good quality products being served in the market and now there was a need to push the products towards the consumers. They started believing in the idea of aggressive selling, importance was given to persuading the buyer. Firms felt that the consumers would not buy enough till forced into doing so and hence this strategy was adopted. The focus shifted to ensuring that the consumers were buying enough through utilization of personal selling, advertisements etc whereas the wants and needs of the consumers were left out again. It was as if the users of the product had no say in what quantity or what type of goods they wanted to purchase [3].

D. Marketing:

The entire concept of marketing relies on ensuring that the end users of the goods are satisfied and this can only be achieved through thorough examination of the market in question and understanding what is asked of the producers. The communication gap at this point was understood, as all the decisions made in a company are made from the viewpoint of a consumer. The main objective of companies is to maximize profits and that is only possible when the needs of the present and prospective buyers are met with effectively [3].

Throughout the evolution we see that the importance of sentiment analysis is not highlighted even though the need is felt greatly, it is only now that the firms realize that throughout this evolution it was communication that was needed, and not just random feedback, companies required heavy inspection of the work in terms of consumer perception.

The

same applied to the current financial institutions scenario reveals that the gap was never filled. Through the various feedback platforms available today the financial sector has the chance to understand the true needs of the market they serve. Sentiment analysis is the type of effective tool which can be used to fill the gap between what the management perceives and what the consumers really ask for.

Various social media platforms today, carry the power to build and destroy brands that have till date known nothing but success.

Through the use of sentiment analysis banks are now able to capture the faults that have gone overlooked over these years.

Depending on the data presented and the reason for evaluating it, sentiment analysis classifies it into 2 categories; one being the binary version that highlights positive and negative aspects of the opinion, the other being the in depth evaluation that highlights more than just the positive/negative aspect, such an analysis can reveal the mood, communication style, emotion etc [4]. The greater part of sentiment analysis tools focuses more on the “English” dialect but of late an expanding number of works are focusing on the multiple language issue [17, 18].

IV. BACKGROUND STUDY

As such there are many models of Sentiment Analysis that can be adopted on various platforms. Broadly, there are two main classification methods, namely: Lexical based and Machine learning. Many software engineering practices can be used to examine and analyze the machine learning techniques in sentiment analysis. At the same time, it is important to have the right method of programming practice while developing a sustainable software [22] Machine learning techniques typically depend on regulated characterization approaches, where the emotion is classified under two heads. (i.e., positive or negative). This methodology requires labelled information to prepare the classifiers [13]. There are 3 basic algorithms followed by the machine learning method: Naive Bayes classification, maximum entropy classification, and support vector machines [14]. In contrast to this, we have the lexical-based techniques that utilizes a predefined rundown of words, where each word is related with an explicit emotion. The lexical techniques fluctuate as per the data set for which they were made [13]. It also involves understanding the connection between the sentiment expressed and the document in question by calculating the semantics of the words in the data set [15].

V. APPLICATIONS OF SENTIMENT ANALYSIS

The use of Sentiment analysis has outgrown the boundaries of the financial world as such. It is being used in various fields from Economics, Stock trade to Psychology. The scope of Sentiment analysis is no longer limited to understanding the preferences of a consumer, it is used in various arenas to understand Human emotions better.

A. Applications in Business:

The importance of a healthy relationship with the consumers is deemed to be important and the only way to achieve this is by reducing the disparity between what is asked and what is given. Businesses use Sentiment analysis tools for understanding the following:-

1. Popularity of a product:

Sentiment analysis is able to capture the various emotions displayed by the users of a product so for example a beverage company launches a new drink and wants to know its success rate, it will simply feed the data about the new drink found online on various social media platforms or official feedback sites into the tool. The tool carries the capacity of analyzing this chunk of data and organizes it into comprehensible and usable beneficial data. Through the tool’s analysis the firm can know whether or not the beverage produced is favored. The tool might highlight comparisons and even phrases used the most to define the product. Based on this data, the firm can either bring about changes or continue with the product as it is.

2. Popularity of a brand:

Companies can use sentiment analysis to judge the popularity of their brand with respect to the substitutes available in the market. A very good example of this is the study conducted by various analyzers on the use of Careem and Uber. The research conducted by Crimson Hexagon, a social media analytics company in 2017 revealed that Careem that was launched in the year 2012 in the middle east region has had an increase in feedback of 108% as compared to the US based Uber that was launched in the middle east in 2013 that has an increased feedback of 827% from 2014. This may look like the users are in favor of Uber as compared to Careem but with sentiment analysis in action we get a closer look that states that the positive feedback is 25% more than the negative whereas for Uber, it is only 4% more than the negative [5].

3. Reduce Service Gap:

The service industry can only face acceptance if what they deliver is what they promise and for this to be achieved they have to reduce the disparity between what is asked for by the consumers and what is given to them by the providers.

Sentiment analysis can be used to judge the consumer’s point of view. Through feedbacks given on the web, sentiment analysis can identify the emotions displayed along with the positivity or negativity reflected in the opinion, giving a chance to the companies to evolve. A good example of this is the research conducted in 2013 by Klout that highlights the fact that as compared to the production industry, the service industry faces more negative remarks and when broken down further, Airlines have the most negative feedbacks as compared to automobile industry. When the airline industry analysis is broken down further, it is seen that the consumers are extremely negative towards Spirit, Delta, and United, whereas they are pretty positive towards Air-Mauritius, Sun- Country and Thomas Cook. This information is essentially crucial for these companies to know where they can reduce the service gap [6].

B. Applications in Stock Market:

This is one sector that functions solely on prediction and it is vital for the investors to make sure they pay for the right shares. A huge amount of intuition and judgement calls are made in order to get financial gains. The simple business principle: Bigger Risk = Bigger Returns is what is followed in stock markets. There are a variety of factors that impact the price levels of stocks and hence it is very difficult for investors to find the right time for buying or selling these stocks. Sentiment analysis plays the role of understanding the moods and emotions displayed by the buyers through the opinions given on various social media sites or the web in general. It uses the

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sense points of the combined opinions and shows the positivity or negativity of the buyers so that the investors know when to sell.

There are two ways in which this system functions, one way is when the emotion is not taken into consideration but only the moving average is calculated in contrast to this we have the second method that takes the emotion and the moving average to ascertain the improvement in the stock market [7].

C. Applications in Review Analysis:

The most popular application of Sentiment analysis is examining reviews and opinions of people in order to generate an overall perspective about what consumers feel about a particular topic. Such an example could be movie reviews, Zomato feedbacks or even the reviews we give online on websites for any product purchased. An average of all the product reviews helps in generalizing the view point of the consumers. A very good example of this is the review put up for each seller's product on Souq. Figure: 1 is a collective review of a product sold by Maybelline New York [12], out of the total 281 reviews collected most of them have given 5 stars to the product.



Figure 1: Souq Rating for Maybelline

D. Applications in Mental Health Sector:

The medium to communicate or reach out to others in terms of "Feelings" or "Emotions" is social media. Today, maximum of the population uses these social media platforms to communicate whatsoever. Sentiment analysis tools can be used here to understand the true emotions of the ones who are communicating. Sometimes people find it easier to be completely honest while behind a screen and hence with the sentiment analyzer in place, psychologists and researchers can actually understand and help those in need.

VI. PROCEDURE

There are many different ways of attaining the required results through Sentiment analysis, one such method known is the General Workflow of Sentiment Analysis [13] being discussed here. Figure: 2 explains this process of General Workflow of Sentiment Analysis.

Step 1: It is important to identify the objective of conducting the analysis in the first place. The purpose could be different depending on the industry that is using the tool. If a bank wants to analyze the popularity of a service, then their objective would be to know whether or not the users enjoy their offering. Step 2: After the objective of the study is set, it is imperative to decide on the channel from which the data has to be lifted for the analysis. The information can be picked directly off the Web. After the required information is accumulated, it is

entered into the framework of sentiment analysis. The text should be freed of any undesired words or phrases. The text is made to be more precise and any emotions expressed through words are highlighted.

Step 3: The next step involves differentiating the words based on their polarity, which means the level of positivity or negativity expressed by a word. It involves analyzing the data in terms of grammar and parts of speech.

Step 4: The analysis is further made more resourceful by refining it in terms of the synonyms, verbs and nouns.

Step 5: The final step involves scoring the data so analyzed. The phrases and words that carry the sentiments are highlighted and scored based on their polarity. Scoring is a procedure through which the magnitude of the emotion is given a score.



Figure:2 General Workflow of Sentiment Analysis

VII. METHODOLOGY

A study was conducted on a restaurant business in order to judge the efficiency of the process before applying it to a particular financial institution. A restaurant was selected at random from the various food outlets that are reviewed by consumers on a daily basis on Zomato.

A total of top 3 reviews were chosen. The reviews were collected and entered into the sentiment analysis tool, that generates the true sentiment highlighted by the opinion given along with an interpretation of the review. The technique used was secondary analysis through real and honest reviews given by many consumers spread across UAE. The tool used for sentiment analysis is called "Intencheck." [21]. It highlights various factors in the text in order to understand its sentiment, the results are displayed with a meter and a chart along with an insight table that shows the important words in the text that have determined its sentiment.

Restaurant Selected: Tea Connect Café, originated in Jaipur, India in the year 2004 has seen success and profit in the short period of 4 years as they have expanded to Dubai, UAE. Founded by Baldev Lilani and Kishan Jainani, Tea connect aims to provide satisfaction to all the snackers there are.

Findings: Each review will be analyzed on the basis of the following-

1. Attitude (Positive/Negative/Strong/Weak)
2. Emotion Expressed (Anger/Sad/Joy/Disgust/Fear)
3. Communication Style
(Visual/Audio/Kinesthetic/Rational)

A. Experiments Performed:

The reviews were put through the Intencheck analyzer and the following results were achieved:

Review #1: "I loved the taste of tea and snacks of this outlet, this town has many outlets to try out but my favorite is this one, I will recommend this to everyone. Prices are affordable and one can fulfill his hunger at cheap rates. It has many branches but this one is my favorite." - Manoj Pandita **Document size (characters)**

278 Number of words in the document 53 Moods: Joy, Surprise

ATTITUDE GROUP					
Category	Grade	Value	Words	Highlighted words	
POSITIVE	HIGH	83	3	affordable, favorite, taste	
NEGATIVE	NORM	38	1	cheap	
STRONG	NORM	46	2	fulfill, recommend	
WEAK	NORM	50	1	cheap	

Results Interpretation1: The review focuses on personal pronouns and establishes a rational cum kinesthetic communication style by using words such as "taste", "hunger", "try" and recommend." As we see, it is important to understand the tone of the message, as the analyzer sees the word "cheap" as negative and weak whereas the phrase was used here to show that the prices offered at the café are reasonable.

Review #2: "Items ordered: Mango lassi: The lassi was having a thick texture and it was pretty filling.

Fresh lime soda: The drink was not having much soda but it was still having good flavor."- Venky Kataru **Document size (characters) 189**

Number of words in the document 31 Moods: Joy, Partial sadness

ATTITUDE GROUP					
Category	Grade	Value	Words	Highlighted words	
POSITIVE	HIGH	87	3	fresh, good, pretty	
NEGATIVE	NORM	29	0		
STRONG	NORM	77	3	much, still, thick	
WEAK	NORM	48	0		

Results Interpretation2: The review is filled with positive feedback, the communication style here is visual and kinesthetic to a certain level which is displayed by use of words such as "texture," "pretty" and "flavor." The review is rather encouraging the café to do better.

Review #3: "Delivery was very late unfortunately which made food cold. The food itself was okay tasted nice little salty though. Packaging average. The chili potato was delicious, out of everything we ordered it was the best. Also they send lots of little extras like channa yogurt pickle and green chutney these where nice touches. The paratha was too dough- ey and lacked filling so bits of it were lumpy aata. The salsa was good with the baked nachos."- Dipa **Document size (characters) 439**

Number of words in the document 76 Moods: Joy, Sad, Surprise

ATTITUDE GROUP					
Category	Grade	Value	Words	Highlighted words	
POSITIVE	HIGH	81	4	delicious, good, nice, okay	
NEGATIVE	NORM	50	2	cold, little	
STRONG	LOW	9	1	delivery	
WEAK	NORM	73	2	average, little	

Results Interpretation3: The review is quite positive with the communication style being more towards kinesthetic and rational which is being displayed through usage of words such as "salty," "delicious," "cold," "tasted" and "dough-ey." The review expects the café to be better at deliveries.

B. Research Analysis

Based on the study, we can say that an analysis based on personal remarks made by customers can be very beneficial for the financial sector. Tea connect as such used these reviews to improve their quality and match it to the tastes preferred by the people of UAE. Sentiment Analysis allowed them to understand the market they are working in and hence narrow it down to their preferences, through this analysis various weak points revealed itself. What we see is that sometimes even when the review seems positive, it is difficult to understand the true emotion of the writer, this analysis as such highlights the emotions as well as the communication style, this way Tea connect is able to know the type of consumers that prefer their café and what they should do to invite potential targets. On Zomato, some reviews matter more than the others and this is because they have been written by "Food Experts" or "Bloggers," they act like opinion leaders of their circles and hence a positive recommendation would mean an influx of many potential consumers.

You can observe that all 3 reviewers have a kinesthetic communication style which would mean that they rate their food on the basis of the "look" and "feel" and knowing this gives the café a chance to build on that aspect. The submitting author is responsible for obtaining agreement of all coauthors and any consent required from sponsors before submitting a paper. It is the obligation of the authors to cite relevant prior work.

VIII. PROPOSED FRAMEWORK

The secondary research conducted through Zomato on Tea connect is based on the model discussed above, namely: General Workflow of Sentiment Analysis. It is observed that the model used gave efficient results but such a process cannot be stopped. It has to be a continuous process in order to attain the desired results. Once the analyzed data has been put to use, the next set of data should be put into the process so as to achieve unparalleled results.

The whole idea behind conducting an analysis is to understand the gap between what is offered and what is actually asked for. So, like the controlling function of management that involves comparing the set standards to the achieved results, in order to know the variation from the actual

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level of quality in every aspect; sentiment analysis should also be considered as a process that has to be repeated after each cycle is completed. Figure:3 represents what a continuous sentiment analysis cycle would look like-

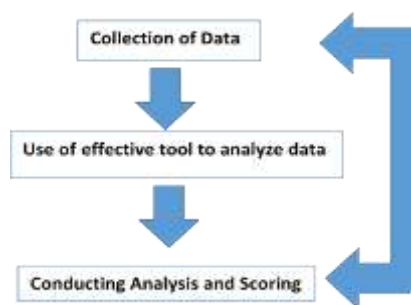


Figure3:

Continuous Sentiment Analysis (CSA)

Step:1 Collection of Data- This step requires all the related data to be collected so that the analysis can be conducted. The data so obtained should be refined and prepared for the analysis.

Step:2 Use of effective tool to analyze data- Any tool at the disposal of the firm can be used. However, the tool selected should be accurate and tested. If required, the tool can be familiarized with certain words and phrases that can be classified as “Good” or “Bad.”

Step:3 Conducting Analysis, Scoring and Repetition- This step requires the firm to further use the data processed through sentiment analysis for their benefit and score the polarity of the opinions mentioned in the text entered. After the completion of the first set of data, the next set should follow the same process. The cycle should continue.

IX. CONCLUSION

Sentiment Analysis is a fairly new concept in terms of business technologies, but has a wide scope in terms of fields that it can be applied to. Through the use of this tool, business institutions can finally get the insight that they have been looking for over these years. There are many applications of Sentiment Analysis as discussed and many more that can be created by understanding the depth of this process. The analysis conducted on Zomato revealed the fact that such an analysis can help in establishing a link between the management and the consumers. This can be the new method for customer relationship management. The new age of business environment can be in fact the first one to fully understand the wants of those for whom they create. The framework CSA thus proposed can be a method used to repeatedly analyze where one stands in terms of sentiment values of customers.

Our future works we will be extending the study to stock market speculation and specific issues related to financial institutions.

REFERENCES

- Shodhganga.inflibnet.ac.in. (2009). [online] Available at: http://shodhganga.inflibnet.ac.in/bitstream/10603/49602/8/08_chepter%201.pdf [Accessed 14 Dec. 2018].
- Kotler, P. and Keller, K., 2006. Marketing Management 12e.
- Business Studies (Business Finance and Marketing). (2007). Delhi: NCERT.
- Symeonidis, S. (2018). 5 Things You Need to Know about Sentiment Analysis and Classification. [online] Kdnuggets.com. Available at: <https://www.kdnuggets.com/2018/03/5-things-sentiment-analysis-classification.html> [Accessed 20 Dec. 2018].
- Deulgaonkar, P. (2017). Uber vs Careem: Which is most talked about in the Middle East? [online] ArabianBusiness.com. Available at: <https://www.arabianbusiness.com/uber-vs-careem-which-is-most-talked-about-in-middle-east--665326.html> [Accessed 20 Dec. 2018].
- Hu, G., Bhargava, P., Fuhrmann, S., Ellinger, S. and Spasojevic, N. (2013). Analyzing users’ sentiment towards popular consumer industries and brands on Twitter. San Francisco: Lithium technologies, Klout.
- Bharathi, S. and Geetha, A. (2017). Sentiment Analysis for Effective Stock Market Prediction. Tamil Nadu: International Journal of Intelligent Engineering and Systems.
- Erik Cambria, National University of Singapore, Bjorn Schuller, Technical University of Munich, Yunqing Xia, Tsinghua University, Catherine Havasi, Massachusetts Institute of Technology, New Avenues in Opinion Mining and Sentiment Analysis, Issue No.02 - March- April (2013 vol.28) pp: 15-21; Published by the IEEE Computer Society.
- Pang, B. and Lee, L. (2004). A Sentimental Education: Sentiment Analysis Using Subjectivity Summarization Based on Minimum Cuts. Barcelona, Spain: ACM Digital Library.
- Feldman, R. (2013). Techniques and Applications For Sentiment Analysis. [online] Communications of ACM. Available at: <https://cacm.acm.org/magazines/2013/4/162501-techniques-and-applications-for-sentiment-analysis/fulltext> [Accessed 27 Dec. 2018].
- Liu, B. (2012). Sentiment Analysis and Opinion Mining Synthesis Lectures on Human Language Technologies. Morgan and Claypool Publishers.
- Uae.souq.com. (2018). Maybelline New York Instant Age Rewind Eraser Dark Circles Treatment Eye Concealer - 0.2 oz., 110 Fair. [online] Available at: <https://uae.souq.com/ae-en/maybelline-new-york-instant-age-rewind-eraser-dark-circles-treatment-eye-concealer-0-2-oz-110-fair-10420881/i/#Reviews> [Accessed 23 Dec. 2018].
- Godsay, M. (2015). The Process of Sentiment Analysis: A Study. International Journal of Computer Applications, Volume:126.[Accessed 24 Dec. 2018]
- Pang, B., Lee, L. and Vaithyanathan, S. (2002). Thumbs up? Sentiment Classification using Machine Learning Techniques. [ebook] Philadelphia: Proceedings of the Conference on Empirical Methods in Natural Language Processing (EMNLP). Available at: <http://www.aclweb.org/anthology/W02-1011> [Accessed 25 Dec. 2018].
- Taboada, M., Brooke, J., Tofiloski, M., Voll, K. and Stede, M. (2010). Lexicon-Based Methods for Sentiment Analysis. Canada: Association for Computational Linguistics
- Kagan, V., Rossini, E. and Sapounas, D. (2013). Sentiment analysis for PTSD signals. New York, NY: Springer.
- Ling Lo, S., Cambria, E., Chiong, R. and Cornforth, D. (2016). Multilingual sentiment analysis: from formal to informal and scarce resource languages. Springer.
- Majumdera, N., Hazarikab, D., Gelbukha, A., Cambria, E. and Poria, S. (2018). Multimodal sentiment analysis using hierarchical fusion with context modeling. Elsevier Journal.
- Powell, W. (n.d.). Push and Pull Marketing — Why You Need Both. TMR Direct. [Accessed 12 Dec. 2018]
- Kotler, P. and Keller, K. (n.d.). Marketing Management.
- App.intencheck.com. (n.d.). Intencheck. [online] Available at: <https://app.intencheck.com/analyze/> [Accessed 2 Jan 2019]
- Sadath, L., Karim, K. and Gill, S., 2018, February. Extreme programming implementation in academia for software engineering sustainability. In Advances in Science and Engineering Technology International Conferences (ASET), 2018 (pp. 1-6). IEEE.
- Hirschberg, J. and D. Manning, C. (n.d.). Advances in natural language processing.

26. Maas, A., Daly, R., Pham, P.,
Huang, D., Ng, A. and Potts,
C. (2011). Learning Word Vectors
for Sentiment Analysis.
Portland: Association for
Computational Linguistics.