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SENTIMENT ANALYSIS AND CLASSIFICATION USING LEXICON-BASED APPROACH AND ADDRESSING POLARITY SHIFT PROBLEM

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ABSTRACT

As we know that in recent years e-commerce has been growing, so volume of online reviews on the web is also increasing for different sides due to which we can understand that the particular product or things are good for use or not and their current status in market. In Natural Language Processing (NLP) and text mining, different models and methods are useful for text representation and categorization purposes. Bag-Of-Word (BOW) model is one such model used to model the text. But polarity shift problem is a major factor in Bag-Of-Word model which can effect on classification performance of Sentiment Analysis. In our methodology, we address the polarity shift problem by detecting, removing and modifying negation from extracted review to identify where the sentiment orientation is actually changing in given review. Our main idea is Sentiment analysis and classification which is based on machine learning approach using Lexicon based antonym dictionary. We build system for Sentence-level sentiment classification. We first extract product reviews from one of the customized shopping portal. When extracted reviews are simple sentences then system is trained to directly find its opinion target, and classify it according to its sentiment polarities i.e. is positive, negative and neutral class labels. When extracted reviews are compound and complex sentences then we first split it into subsentences and build a model based on some rules to detect, remove and modify polarity shift in contrast of negation to identify where the sentiment orientation is changing in compound or complex sentences. After that, we classify review according to its polarity and determine the targets of opinion given in review. Furthermore, we extend our system for opinion summarization based on opinion features or aspects and graphically represent overall summary of Positive, Negative and Neutral sentiments of customer for each product.

Keywords: *Natural Language Processing, Opinion Mining, Machine Learning, Sentiment Analysis, Polarity Shift.*

1. INTRODUCTION

Previously, Internet was not in much use. But nowadays, use of internet is growing very rapidly simultaneously users who are interesting to do their maximum work on internet. Online reviews available on the Internet help to decide and ensure the quality of any product, entity, individual or item. Sentiment is the way of expressing an attitude, opinion or feeling towards something such as a person, organization, product or location. Sentiment analysis and Opinion mining are the standardised tasks between themselves and proves their efficiency with NLP. Sentiment analysis also known as Opinion mining as they identify people's opinion about particular product or object given in comments, blogs reviews, tweets etc. [6] [12]. Online shopping mostly depends on customer's reviews, comments, and star rating for the product. Sentiment analysis plays a very crucial role in online shopping. Sentiment analysis is a study of people's opinion, attitude, and emotions about

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particular object or thing [11].Sentiment analysis is helpful to identify the sentiment of users behind those particular comments or reviews.

Sentiment analysis is a special text mining task used to determine and extract subjective attitude or sentiment of peoples from a given text [3][17]. Sentiment classification is a basic task in sentiment analysis to classify people's sentiment which is expressed in text format into different sentiment polarity classes (such as Positive and Negative class) [1] [2].Sentiment classification technique most commonly useful in traditional topic-based text classification, in which BOW model is useful to represent and model the text [1][2] and after that different classification algorithms such as naïve Bayes classifier, maximum entropy algorithm and support vector machines use to train to train a sentiment classifier[1]. BOW model is a conventional approach used to represent sentence into multi-set of words and also manage vector entry for each word. BOW model is very simple and efficient for modeling the text in topic-based text classification [1], but it is not proven best for sentiment classification because it has some disadvantages i.e., it does not consider order of words, grammar, and discards some syntactic structure and semantic information from original sentence [1] [2] [18].Polarity shift is one of the difficult problem to manage in BOW model. Polarity shift is a linguistic phenomenon which can shift or inverse the sentiment polarity of the text from positive to negative and vice versa. Polarity shift is also responsible to change the sentiment orientation of given text. Negation words are most important kind of polarity shifters.

For example, we have a positive review "I like Dell Inspiron laptop having a long battery life". Polarity shift of this sentence will become reverse review of original review by adding negation word "don't" in front of like and replacing word "long" with its dictionary antonym word "short" to positive text. Here, we can see that sentiment orientation is gets converted from positive to negative by shifting the polarity of text "I don't like Dell Inspiron laptop having a short battery life". Here we can clearly understand that polarity shift changes the orientation of text.

Polarity shift produces sentiment opposite text as it change the sentiment orientation so in BOW model representation two sentiment-opposite texts is to be consider very similar [1], because BOW model represent text in vector of independent words format. In this paper we have proposed system for sentiment analysis and classification using dictionary based approach and also focus on addressing polarity shift problem, though polarity shift is very complex problem in sentiment analysis and provide feasible solution to BOW model. Polarity shift is a linguistic phenomenon; it is used to shift the polarity of sentiment from positive to negative and vice versa.

Fig (1) represents the process of sentiment analysis and classification, in which we can observe that NLP combines different steps to classify the customer's sentiment into positive, negative and neutral polarities. The first task is to fetch the customer's reviews from the web. After fetching the reviews, data preparation or pre-processing task is to be applied on the fetched data. It removes noisy and unwanted data and prepares clean data for next step. Sentiment identification is the third step in which system identifies the sentiment phrases or words for feature selection purpose. Feature selection step is a very crucial task that will be performed on words, sentences or documents and identifies features which indicates user's sentiment about particular think. After that, classify the user's sentiment according to three polarities those are represented in fig (1).

When text represents subjective attitude then sentiment analysis and classification tasks would be carried out. Objective attitude means it just represents factual information. For Example, "(1) I bought Samsung galaxy E5 mobile phone. (2) This phone was suggested to me by my friend (3) the camera quality is very good and I like it."The above given review has number of opinions and sentimental features. When we take a look at sentence (1) and (2), it has only factual information as it has objective opinion, and sentence (3) expresses positive opinion about camera quality of the phone. In this paper we introduce our methodology and build a system which incorporates three tasks together.

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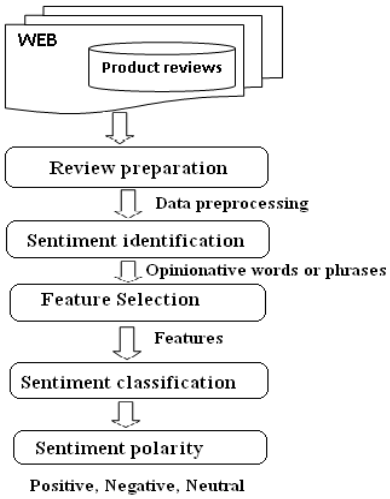

Figure 1: "Process of sentiment analysis"

Task 1: In case of removing negation, we train model for Detecting, Removing and Modifying negation polarity shifters for better classification performance using BOW model for sentiment analysis in contrast of Negative reviews and represents where the actual text orientation is changing in sentence-level sentiment classification where reviews are too large (Compound and complex sentences). Here, our main aim is to focus on negation that can appear in product reviews given by customer. It determines the polarity shifter or valence shifter which presents inside reviews such as negation words like *not*, *never*, *none*, *nobody*, *nowhere*, *neither*, and *cannot* these are the most common types of polarity shifters. After determining that, we eliminate that polarity shifter from review and replace the sentiment word in the scope of negation with its antonyms using WordNet dictionary to modify it.

Task 2: In second task, we train system for opinion summarization. Here, we identify the feature's means opinion targets present in the individual review and rate the product by scoring it based on different sentiment features appearing inside given review. Feature of product also referred to as target or aspect of opinion. Consider example, "I like this phone, its camera quality is excellent. Reasonable in price" for smartphone and summarization of this review is given below by considering different features or targets.
Aspect: **GENERAL**
Positive: 100<individual reviews>
Negative: 9 <individual reviews>
Neutral: 5<Individual reviews>
Feature: "**Picture quality"**
Positive: 200<individual reviews>
Negative: 5<individual reviews>
Neutral: 3<individual reviews>
Feature: "**Size"**
Positive: 100<Individual reviews>
Negative: 50 <Individual reviews>
Neutral: 8<individual reviews>

In this example, we can see that single review has more than one sentiment which is expressed by customer about one of the smartphones. First, this original review is split into three subsentences. Each subsentence has different opinion aspect or feature. Above given review includes three features or aspects such as General, Picture quality and Size of smartphone. General aspect considers the product as a whole. Here, 100 reviews expressed positive opinions and 9 expressed negative opinion for whole product itself. Summarization for Picture quality and Size we can see in the above example. Furthermore, we extend this system to represent this summarization, feature or target wise in graphical representation format which is mentioned in the third task.

Task 3: Graphical representation for products is based on overall reviews of that particular product by considering the score of products according to positive (very positive), negative (very negative) and neutral polarity classes. The basic idea behind graphical representation is to show how many customers has given positive, negative and neutral sentiment for each product so because of this new user can take fast decision about product buying by considering these reference reviews and the related features.

The flow of this paper is as follows step by step in different sections. In section 2 we have cover literature survey and introduce different methodologies and techniques proposed by different authors for sentiment analysis and addressing polarity shift problem. In section 3 we introduce and represent our proposed system and flow of our proposed work. We have discussed on experimental results in section 4. Finally we have outline conclusion and future work in section 5

2. LITERATURE SERVEY

In literature, we have found a number of methodologies and techniques proposed by different authors for sentiment analysis and polarity shift problems. The main problem in sentiment analysis and classification is polarity shifting. Sentiment shifter, also called as polarity shifter or valence shifter, is used to change the orientations of

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sentiment. E.g. from positive polarity to negative and vice versa, existence of some valence shifter/ polarity shifter in this term makes it possible to change the sentiment orientations of a customer's opinion. Such polarity shifters are negation words like not, never, nowhere, nobody, neither, none, etc. Negation words plays very important role in polarity shifting. Sentiment analysis is derived from three main classification levels: Sentence-level, Document-level, and Aspect-level SA. Each of which performs a different task to find sentiment contents in sentence, document and aspect or sentiment features of given text. Sentiment analysis can be done in two ways viz. machine learning approach and lexicon based approach. In our methodology, we use dictionary based approach by taking help of external dictionary i.e. WordNet dictionary to create opposite reviews. In sentiment analysis and classification, it is possible to easily classify the sentiment of users according to its polarity with respective particular sentiment word, but in SA it's somewhat difficult to tackle the polarity shift problems. . To tackle the problem of polarities, researchers Das and Chen [7] proposed a system by simply attaching polarity shifter "NOT" to the words in the scope of negation, for example consider text "I don't like this computer" here the word "like" in the scope of negation become new word "like-NOT" . . But this approach is not suitable in some cases of sentiment analysis for managing sentiment granularity levels and sentiment classification accuracy.

There are some researchers, example Na et al. they proposed a system to model negation by simply considering POS (Part-Of-Speech) pattern [1].Researcher McDonald et. al. (in 2007) proposed a method to analyze and classify document at different levels of granularity. They used structured models for this task and the main feature of this system is that it is used for different levels of classifications. Polarity shifting is a linguistic phenomenon actually used to change the polarity of sentiment features and improve the accuracy of Sentiment classification. To manage polarity shift problem and detect the polarity shifter, some of the researchers have developed and built several complex linguistic and novel approaches. Machine learning technique with supervised learning is most commonly useful for sentiment classification and to address the negative polarity shifters. It provides some dictionary and corpus-based approaches. In our system, we have used dictionary based approach. It is one of the lexicon based approaches, in which a small set of words is collected with its known orientation and it makes searches for words with their respected antonym and synonym in known corpora that is WordNet dictionary. Here, we focused on managing polarity shift problem for unigram features. A. Kennedy and D. Inkpen [15] proposed a system for sentiment classification of movie review by using two methods i.e., term-counting and machine learning methods. They identify the effect of polarity shifter or valence shifter on the performance of classification. Their research is based on the combination of term-counting method with valence shifters. To improve the accuracy of classification, their system captures three types of valence shifters i.e., negation, intensifiers, and diminishers. In our proposed system, we have also done opinion summarization based on opinion targets or features. Opinion target is also referred as opinion feature or aspect of opinion. Bing Liu [17] introduced and described in their book on Sentiment analysis and opinion mining about different concept of opinion summarization and feature-based opinion mining. Feature-based sentiment analysis is also referred to as aspect-based sentiment analysis. It is actually the study of extracting or mining the opinion targets from product reviews given by customer. Aspect extraction is usually based on mining of nouns, noun phrases, verb, adverb, verb phrases, and adjective. Verb, adjective, adverb, noun are actually parts of speech (POS) [17]. Aspect expression can be of two type's first one is implicit aspect expression and second is explicit aspect expression, implicit aspect expressions are those expressions which don't have noun and noun phrases whereas explicit aspect expressions explicitly contain noun and noun phrases [17].Researchers Minqing Hu and Bing Liu was proposed their system for mining the features in customer review in which they have built their system to study the problem of feature-based opinion summarization using POS tagging and frequent features generation technique etc. [16]

3. PROPOSED SYSTEM

We proposed a system for sentiment analysis and classification by managing the problem of polarity shift in contrast of negation by considering negative reviews Here we implemented a system which first extracts the reviews from online shopping portal for sentiment analysis. We proposed system for sentence-level sentiment classification to classify user's sentiment into positive, negative and Neutral class labels. Similarly, for applying SCA we first need to identify whether the extracted reviews are simple, compound or complex sentences. When the

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extracted review is a simple sentence and expresses a single sentiment, we train classifier to directly find its sentiment according to its polarities i.e. positive, negative and neutral class labels and also find its opinion target on which customers have expressed their reviews. Our system performs three tasks shown in fig (2). In addition, we address polarity shift problem in case of negation to detect, remove and modify polarity or valence shifter which appear in review and because of that we can provide feasible and easier BOW representation for classification and identify change in sentiment orientation because of negative polarity shifter. Three tasks in case of large reviews are given below:

Task 1: Polarity shift detection, elimination and modification to identify change in sentiment orientation and addressing polarity shift problem by considering negation. For understanding, consider the following example of a customer review on digital camera Extracted review: "I don't like this digital camera. Picture quality of this camera is excellent. It is too expensive."

Polarity shift detection: "I don't like this digital camera"
Polarity shifter elimination and modification: "I dislike this digital camera"

In this example, we can understand that this review includes more than one sentiment, which are expressed by individual customer about the product digital camera here. For addressing polarity shift problem, we detect subsentence with negation keyword "don't" which represents where actually the sentiment orientation is changing. After that, we eliminate polarity shifter "don't" and make modification into extracted text by replacing sentiment word in the scope of negation (i.e. sentiment word "like" replaced with its antonym "dislike") with its antonym by using WordNet libraries. This technique removes the negation. So this would be a more feasible BOW representation and solve polarity shift problem while using BOW model for sentiment classification.

Task 2: opinion summarization, here we first find out the features of product or opinion targets on which customers have put their opinions after that apply sentiment classification to classify customer's sentiment into positive, negative, and neutral class labels. We also train system to calculate sentiment score based on given text.

Task3: In this task, we graphically represent the number of positive, negative and neutral opinion of customers for each product based on opinion summarization.

Dictionary based approach

Here we used dictionary based approach by exploiting benefit of external dictionary, that contains antonyms and synonyms for each word .This technique uses the lexicon-based antonym dictionary which contains set of well-lexicons such as WordNet dictionary in English [1].WordNet dictionary maintains the set of lexical dataset for English words and also keep record of semantic relationship between words. In our proposed system we used WordNet libraries while implementing task of addressing polarity shift problem. Implementation of proposed system is done by using following techniques and methods.

3.1 Pre-processing with parsing

Fig (2) represents step by step process for proposed system in which pre-processing task plays very important role in sentiment analysis to clean extracted reviews. This is the first process which applies extracted text to removal of unwanted data and noise, which appear inside given text. Pre-processing is the first process in SA which perform different tasks like tokenization, data filtering, stop word removing and stemming. Pre-processing performs text tokenization task to separate each word and apply parsing to detect negation in given text. In proposed system we created our own parser to identify negation polarity shifters.

3.2 Segmentation

When given reviews are compound or complex sentences i.e., combination of more than one sentences and express number of sentiments on different features of particular product. Here, our first step is to split the whole sentence into a set of subsentences. System performs sentence segmentation by considering commas, periods, hyphens, semicolons, and, but, etc. After performing segmentation on original review, we get a set of subsentences. In this we also address polarity shift problem in case of negation if there any negative subsentence. This is helpful to represent where actually the sentiment orientation is changing.

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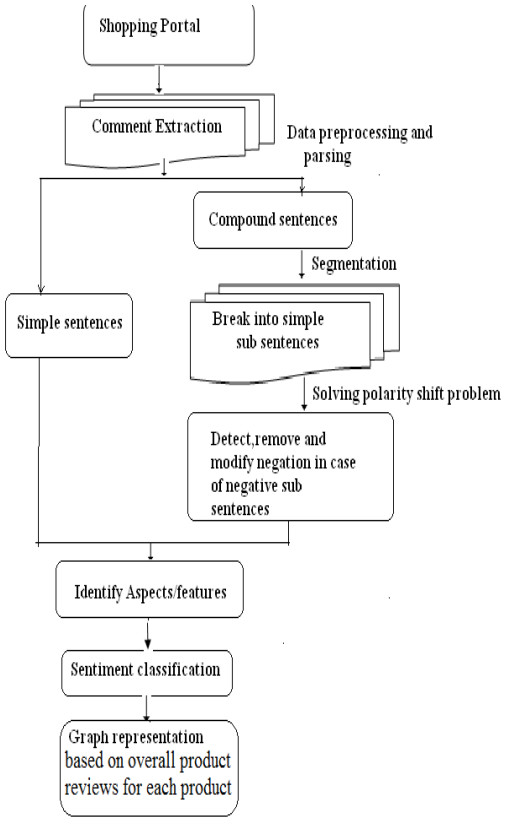

Figure2: "Flow of proposed system"

3.3 POS Tagging

Part-Of-Speech tagging (POS) is required to identify Verb, Noun and Noun Phrases in features-based opinion summarization and polarity shift management. As we know that grammatical texts are classified by considering eight different POS. So our system uses this tagging to perform some task. POS parses each word of given text and identifies that word according to its category (whether the word is a noun, verb adjective, etc.)

3.4 Dataset, Features and Resource settings

For sentiment classification, we extract reviews from customized shopping portal i.e. distributed portal which includes four English datasets including four different domains such as Book, Home appliances, Computers, and Electronics. For each domain, opinion and reviews of the people may be different; some sentiment words may have unique meaning for each domain. Customers can give their response in terms of likes and dislikes for a particular product by star rating or scoring that product. Users can score particular product between range 1-5 star rating levels. Star-1 and star-2 represents negative polarity reviews, star-4 and star-5 represents positive polarity reviews and reviews with star-3 are labeled as neutral polarity reviews [1]. Here, we focus on extracting two types of features such as unigram and bigram. Unigram features are simply BOW features and represent by using BOW model to form the text into multiset of words by eliminating noisy characters and extra spaces. Every two consecutive words of text are represented by using Bigram features. We implement this system by using OpenNLP tool and their libraries. We also required some external resources such as WordNet dictionary and sentiment classification API services (Stanford core NLP library) etc.

4. EXPERIMENTAL RESULTS

Here we have shown experimental results for our proposed system, we apply this experiment on four different dataset that we have mention above. fig(3) represent the graph for sentiment summary for Computer domain in which we have shown that evaluation of Dell Laptop(Inspiron 15) to show that number of positive, negative, and neutral sentiments of customers on it. In fig (3) X axis represent the sentiment polarities (classes) and Y axis represents the sentiment score. We generate same graphs for remaining domains also (i.e. is book, Electronic, and Home Appliances). Table.1 shows the result of opinion summarization. In which we have shown the summary of customer's opinion by counting positive, negative and neutral sentiments of customers by determining different features from given comments. We perform here Opinion summarization by identifying different features from given comments and evaluate numbers of positive, negative and neutral sentiments for each feature on particular product.

Table.2 shows the result for detecting, removing and modifying negative polarity shifters to represent that where actually text orientation is changing in original review, and this is also simpler solution we can use to improve the classification performance using BOW model. Here we also have shown the result of finding opinion targets from customer review, score the customer reviews according to their sentiment and opinion targets on which customer has expressed their opinion. For sentiment analysis we use Stanford core NLP jar file to access sentiment analysis services. Other results of proposed system which shown in result table 2

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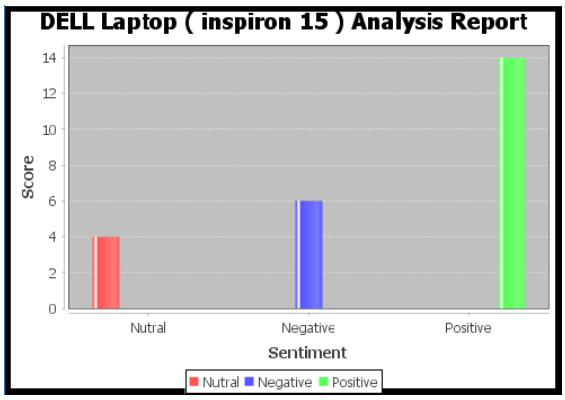

Figure 3: "Graph based on customers sentiment for DELL Laptop"

Table 1: "Result of opinion summarization"

Feature	Neutral Points	Negative Points	Positive Points
product	1	2	2
price	2	0	0
quality	0	0	5
laptop	2	1	0
memory	0	2	6

Table 2: "Result of negation detection, elimination, and modification"

Original review as input X	Negation detection elimination and modification as output	Opinion as output	Target as output	Sentiment based on original review as output	Sentiment Score as output
1.This computer is not good, but memory is good	This computer is evil. (removed negation word "not" and modify word in the scope of negation with its antonym)	[good]	[Computer, memory]	[Negative]	2
2. I like this book. Nice story	-	[like, nice]	[book, story]	[positive]	4

5. CONCLUSION AND FUTURE WORK

Here, we have propose system for sentiment analysis and classification using NLP, machine learning technique and dictionary based approach, our proposed methodology classify peoples sentiment into different polarity classes (positive, negative, and neutral).The main objective of proposed system is to address and solve polarity shift problem to provide feasible solution to the BOW model in sentiment classification, that objective we have achieved by Detecting, Eliminating, and Modifying negation polarity shifter from a given text. In our proposed methodology we have also determine opinion features and targets on which peoples has expressed their opinions or thoughts in text format.

In our proposed system we have performed experiments for sentence-level sentiment classification but in future this experiment can apply on Document-level sentiment classification. Our system is limited within our customized portal only but in future one can apply this experiment on large freely available data set of different online shopping sites.

REFRENCES

[1] Rui Xia, Feng Xu, Chengqing Zong, Qianmu Li, Yong Qi, and Tao Li, "Dual Sentiment Analysis: considering Two sides of One Review", IEEE transaction on knowledge and data Engineering, Vol 27, No.8,August 2015.

[2] Rui Xia, Tao Wang, Xuelei Hu , Shoushan Li , Chengqing Zong, "Dual Training and Dual Prediction for Polarity Classification", in Proceedings of the 51st Annual Meeting of the Association for Computational Linguistics, 2013

[3] Ahmed Abbasi, Stephen France, Zhu Zhang, and Hsinchun Chen, "Selecting Attributes for Sentiment Classification Using Feature Relation Networks" , IEEE On Knowledge edge and data engineering, vol. 23, No.3, march 2011

[4] Kushal Dave, Steve Lawrence and, D. Pennock, "Mining the peanut gallery: Opinion extraction and semantic classification of product reviews", in Proc. Int. World Wide Web Conf , pp. 519–528 , 2003.

[5] Vincent Ng, S. Dasgupta and S. Arifin, "Examining the role of linguistic knowledge sources in the automatic identification and classification of reviews," in Proc. Int. Conf. Comput. Linguistics Annu. Meeting Assoc. Comput. Linguistics, 2006, pp. 611–618.

[6] G.Vinodhini and RM.chandrasekaran, "Sentiment Analysis and Opinion Mining: A Survey", www.ijarcsse.com , ISSN: 2277 128X,Volume 2, Issue 6, June 2012

ISSN: 1992-8645 www.jatit.org E-ISSN: 1817-3195

[7] S. Das and M. Chen, "Yahoo! for Amazon: Extracting market sentiment from stock message boards," in Proc. Asia Pacific Finance Assoc. Annu. Conf., 2001.

[8] Asst.Prof.A Kowcika, Aditi Gupta, Karthik Sondhi, Nishit Shivhre, Raunaq Kumar, "Sentiment Analysis for Social Media". www.ijarcsse.com, ISSN: 2277 128X , Volume 3, Issue 7, July 2013

[9] Shoushan Li, Sophia Yat Mei Lee,Ying Chen, Chu-Ren Huang, Guodong Zhou, "Sentiment classification and polarity shifting", in International Conference on Computational Linguistics, 2010.

[10] Chloe Clavel and Z. Callejas, "Sentiment Analysis: From opinion mining to human-agent Interaction" , IEEE transaction on affective computing, 2015.

[11] Walaa Medhat , Ahmed Hassan , HodaKorashy, "Sentiment analysis algorithms and applications: A survey" , Ain Shams Engineering Journal (www.sciencedirect.com), pp. 1093–1113,2014

[12] Georgios Paltoglou, Mike Thelwall, "More than Bag-of-Words: Sentence-based Document Representation for Sentiment Analysis", Proceedings of Recent Advance in Natural Language Processing, page546-552, Hissar, Bulgaria, 7-13 September 2013.

[13] S. Li and C. Huang, "Sentiment classification considering negation and contrast transition," in Proceeding of the Pacific Asia Conference on Language, Information and Computation, 2009.

[14] Soo-Min Kim and Eduard Hovy, "Determining the sentiment of opinions", Proceeding of the COLING conference,Geneva,2004.

[15] A. Kennedy and D. Inkpen, "Sentiment classification of movie reviews using contextual valence shifters," Comput. Intell., vol. 22, pp. 110–125, 2006.

[16] Minqing Hu and Bing Liu, "Mining Opinion Features in Cutomer Reviews", American association for Artificial Intelligence, 2004.

[17] Bing Liu, "Sentiment analysis and opinion mining", Morgan & Claypool Publishers, May 2012[Book].

[18] Rui xia,Feng Xu,Jianfei Yu,Yong Qi,ErikCambria, "Polarity shift detection Elimination and ensemble: A three-stage model for document-level sentiment analysis.", ScienceDirect, 2016, 36-45