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Subject Oriented Opinion Mining for Emotions Determination

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Abstract
The use of social networking sites is one of the approaches for putting views of user. In recent years several efforts were devoted to automatically mining opinions and sentiments from natural language in social media messages, news and commercial product reviews. To improve the textual methods of communication; it is needed to analyze the emotion of user by studying the input text and emotions of the user. Most of the work in this area of emotion determination from text has typically focused on detecting the polarity of sentiment (positive/ negative/ neutral) only. This paper presents a approach for emotion determination from the text entered by user with direct and indirect words. The work proposed in this paper uses feature extraction and emotion extraction methods for emotion determination. For designing the system some related work is review which provides the idea about previous work as well as comparison. It also deals with special word, emoji's, direct and indirect emotions. It also has effective function for finding the part of speech of the sentence. Also helps the users to effectively express their emotions and provides the score for entered review. On the basis of entered emotion by user it produces the result according to highest emotion extracted from class of positive, negative and neutral. Experimental results using a product review data set (dataset of Amazon) and some additional reviews enter at runtime show that the proposed technique is highly effective. It outperforms existing methods significantly.

Index Terms— Direct Words, Indirect Words, Feature Extraction, Emotion Extraction, Emotion Determination.

I. INTRODUCTION

The fast growth of the World Wide Web has increased the online communication. This work presents an approach for emotion determination from the text entered by user on communication networking sites or feedback about particular product on shopping website like flip-card, Amazon or home shop18; which may in the form of direct text or indirect text (emotions in smiley). Internet has become a need in every ones day to day life. It contains a large amount of textual data and is growing day by day. People communicate using internet through different online resources like facebook, blogs, online shopping site, etc. It has become very hard task to extract the important information rather than to access it in a sequential manner. It takes much time to gain the information manually and organizing it in a proper sequential format. Organizing the text in a proper format and to distinguish is very hard task. Textual data on the web are of two types, facts and opinion. Facts focuses on the objective data transmission and opinion express the sentiment of the person. Facts can be expressed with the any emotional word but very hard to find the emotion from the opinions. The work proposed uses feature extraction and emotion extraction methods for emotion determination. Also to help the users to properly express their emotion, now a day's emotion prediction is one of the considerable areas being studied on a large scale. Emotion prediction from text is the foremost requirement for such social networking services. It also enables the computer system to behave more intelligently based on the user's feedback/mood regarding any product/subject. The enormous amount of textual data is available on the web in the form of blogs, emails, and tweets as well as in indirect emotions.

A. Opinion Mining

Opinion analysis aims to obtain positive, negative and neutral sentiments from the comments or reviews or feedback. It gives the chance for companies to examine the feelings of the customers about their product and services by analyzing their reviews or feedback. Opinion mining is a discipline which deals with analysis of reviews giver by experience holder. Opinion mining is the computational study of people's opinions, appraisals

and emotions toward entities, events and their attributes. It involves techniques from different disciplines like information retrieval, natural language processing and data mining.

B. Text to Emotion Generation

In order to effectively generate opinion from a text, it is needed to analyze the emotion behind the text. This makes the recognition of emotions from the text a constructive area of research for emotion generation. By detecting the emotions from the text, actually thinking of the user extracted.

C. Better Computer Interaction System

In Human Computer Interaction systems emotion recognition techniques can be applied so that it can recognize the emotions of a user and make user to feel as if the system is more human to take their decision regarding some product or subject. Sentiment analysis also known as opinion mining plays an important role in determining the direction of sentiments also known as polarity. It is currently significant trend in natural language processing. As opinions are expressed in natural language, it involves machine learning processing i.e. to give artificial intelligence to computers. Opinion mining extracts emotions, sentiments, opinions from the document corpus and analyzes them.

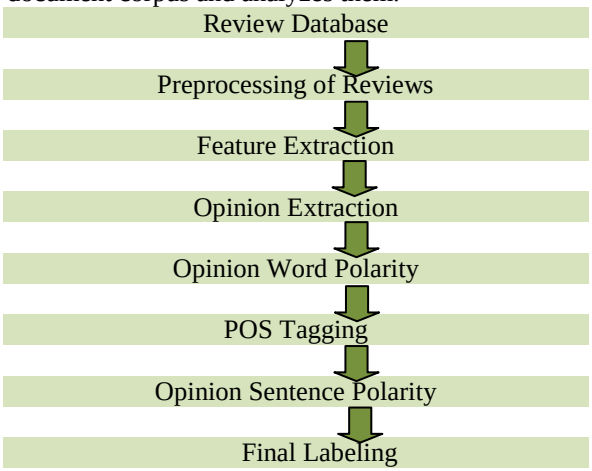

Figure1: Basic Steps for Subject Oriented Opinion Mining for Emotions Determination

D. Review Database

Reviews are extracted from Amazon websites and then store those reviews into review database. Each website has its own structure. After this preprocessing is done where unwanted text (other than product reviews) is removed and then reviews are stored into database.

E. Feature Extraction

In feature extraction, product features are extracted from each sentence. In Reviews, Product features are mostly nouns, so each noun is extracted from sentence and opinion is mostly verb, so verb is retrieve.. Features which are mentioned in a sentence directly are called as explicit features and features which are not mentioned directly are called implicit features. For example,

"Battery Life of a camera is less"

In this sentence reviewer has mentioned battery life directly so it is explicit feature. It is easy to extract such features. Now consider following sentence,

"This camera needs to charge many times in a day"

In this sentence user is talking about battery of camera but it is not given directly in the sentence. So here battery is implicit feature. It is hard to understand and extract such features from sentence.

F. Opinion Extraction

In opinion word extraction, opinion words are identified. If a sentence contains one or more product features and one or more opinion words, then the sentence is called an opinion sentence. Opinion words are generally adjectives.

G. Opinion Word Polarity

In opinion word polarity, semantic orientation of each opinion word is identified. Semantic orientation means identifying whether opinion word is expressing positive opinion, negative opinion or neutral opinion.

H. Part-of-Speech Tagging (POS Tagging)

The aim of opinion mining is to find out product features and opinion words and then find polarity of opinion word. In general, opinion words are adjectives and product features are nouns. Consider following example

"This is bad camera"

In above sentence, camera (product feature) is noun and bad (opinion word) is adjective. In part-of-speech (POS tagging), each word in review is tagged with its part- of- speech (such as noun NN, adjective JJ, adverb, verb RB etc). After POS tagging now it is possible to retrieve nouns as product features and adjectives as opinion words [4]. In tagged sentence, bad is tagged with tag JJ which indicates 'bad' is an adjective where a 'camera' is tagged as NN which indicates noun.

I. Opinion Sentence Polarity

Opinion sentence polarity identification predicts the orientation of an opinion sentence. Consider following sentence- "This is not bad camera", sentence contains opinion word 'bad' which expresses negative opinion. But sentence expresses positive opinion because of negation word 'not'.

Therefore after finding opinion word polarity identification it is necessary to find polarity of opinion sentence. For opinion sentence polarity identification a list of negation words such as 'no', 'not', 'but', 'nor', 'too' etc. can be prepared and negation rules can be formed. For example, if a sentence contains odd number of negation words then it's polarity will be opposite of polarity opinion word in that sentence. Otherwise sentence will have same polarity as that of polarity of opinion word in it.

J. Final Labeling

Summary is generated after opinion sentence extraction. This summary is based on features of product. With the help of information retrieve in previous steps summary can be generated.

This work aims at recognizing the emotions from the text on a social networking websites or online shopping sites. When user writes blogs that data is generally rich in emotional content; it contains the sentences with affective words such as happy, amazing, sad and angry. Also sometime that text does not contain any emotional word but it contributes for the emotion of a user when user express their feelings indirectly. In such cases only traditional approaches that make use of emotion words are not useful. The proposed work deals with finding out the emotion based on affective words in the sentences and for sentences that does not contain any emotional words but it produces certain emotion; the emotion feature estimation is done based on the sentence context analysis. The context analysis of sentence is done for extracting the hidden knowledge in the sentence by using the Natural Language Processing technologies. So with this proposed system it is possible to capture the emotions effectively. And providing label to the prediction based on the emotions from users text. The proposed system uses NLP techniques, POS tagger and SentiWordNet dictionary for emotion determination.

II. RELATED WORK

Cristina Bosco, Viviana Patti, Andrea olioli[1] proposed Irony, exploitation of a corpus, Annotation, Morphological and syntactic annotation for opinion mining and focuses on the main issues related to the preparation of a corpus for opinion mining and sentiment analysis. they gives special attention to irony, and presents as a case study for Senti- TUT, an ongoing project for Italian aimed at investigating sentiments and irony effect about politics in social media. They introduce analysis of the Senti-TUT corpus, a collection of texts from Twitter blogs annotated morpho-syntactically and with sentiment polarity like positive and negative. They describe the dataset, the annotation, the methodologies applied for analysis. And provides investigations on two important features of irony corpus: reversing of polarity and expressions of emotions.

Tejasvini Patil ,Sachin Patil[2] suggested an approach for Affective Words, Emotion Classification and Sentence Analysis. The emotion prediction is visual image generation based on particular emotion. They applied emotion estimation method on textual data of social networking websites. The multiple images are retrieved according to emotion and words of sentence, then user can select the particular image to express the emotion.

Walaa Medhat, Ahmed Hassan, Hoda Korashy [3] introduce Machine Learning Approach, Lexicon-based Approach, Transfer learning, Building resources, Emotion detection. They work on Sentiment Analysis (SA), which is an ongoing field of research in text mining field. Sentiment Analysis is the treatment of opinions, sentiments and subjective text. They tackle a comprehensive overview of the last update in this field. Many recently proposed algorithms enhancements and various Sentiment Analysis applications are investigated and presented briefly. The related fields to SA (transfer learning, emotion detection, and building resources) that attracted researchers recently are discussed. The main target they have put is to give nearly full image of Sentiment Analysis techniques and the related fields. The main contributions include the sophisticated categorizations of a large number of recent articles and the illustration of the recent trend of research in the sentiment analysis and its related areas.

Padmapani P. Tribhuvan, S.G. Bhirud, Amrapali P. Tribhuvan, [4] proposed A Peer Review of Feature Based Opinion Mining and Summarization, This is dedicated to construct the multi-label emotion topic model for recognizing the different emotions of weblog sentences based on Chinese emotion corpus Ren-CECps. They employ latent topic variables and emotion variables to find complex emotions of the sentence. The results of experiments indicate the model is reasonable and effective in recognizing the mixed emotions of weblog sentences and blogs.

I.Hemalatha, Dr. G.P.S.Varma, Dr. A.Govardhan [5] suggested usefulness of Analyzing social, media data, SentiWord- Net dictionary, overall weight Classification using maximum, and entropy classifier. The main objective of this technology is to prove the usefulness of analyzing social media data. The approach combines the preprocessing and machine learning techniques in a system which collects Tweets from social networking sites, perform preprocessing techniques to remove noise in the data and applying machine learning techniques on those Tweets and thus provide some prediction for decision making to improve business intelligence. Results of specific issue analysis will be classified as Positive, Negative and Neutral.

I.Hemalatha, Dr. G. P Saradhi Varma, Dr.A.Govardhan [6] proposed Social Network Analysis on Twitter, Preprocessing Process, Machine Learning Algorithms (nave bayes). They present a system which collects Tweets from social networking sites, able to do analysis on those Tweets and thus provide some prediction of business intelligence. Results of trend analysis will be display as tweets with different sections presenting positive, Negative and neutral. An effective way to perform distant supervised learning. Machine learning algorithms can achieve high accuracy for classifying sentiment when using this method. Although Twitter messages have unique characteristics compared to other corpora, machine learning algorithms are shown to classify tweet sentiment with similar performance.

Neha S. Joshi, Suhasini A. Itkar [16] proposed emotions i.e. Sentiments, Expressions that are stated in natural language. Natural language techniques are applied to extract emotions from unstructured data. In this paper, a feature level analysis is considered which is known as fine grained analysis and takes each and every entity in review and its corresponding polarity. In proposed work, Artificial Neural Network approach with Jaccard similarity measure is presented. Jaccard similarity measure performs well in measuring the similarity of words when comparing with each letter of the word. This approach is similar to existing Support Vector Machine (SVM) approach. But SVM approach has certain disadvantages like limited parameter selection. Also when more number of features are selected then its performance is degraded. Hence new approach with similarity measure is proposed.

Xiu Li, Liping Gao [15] proposed a complete framework of an Internet Public Opinion Monitoring and Analyzing System. The system is composed of web crawler, information preprocessing, public opinion information analyzing and mining module, and information services module. This system can collect web pages from the entire Web space, including news groups, portal website, forum, BBS, blogs, micro-blogging and etc. Furthermore, through processing and analyzing the collected information, the system can give the public opinion information analysis results as stereoscopic, intuitive, natural way to the user. Finally, this paper describes the implementation of key technology used in this system. The system presented in this paper can help supervisors to timely monitor the concerned public opinion and guide them. They employ latent topic variables and emotion variables.

III. PROPOSED WORK

The proposed work deals with finding the emotions from the blogs data. The proposed system uses emotion and feature extraction methods. This modified approach can be applied to the following types of sentences-

1) Sentences containing the direct (Explicit Feature) emotional words (words such as amazing). E.g. “Battery Life of a camera is less”

2) Sentences which do not contain any emotion words (Implicit Feature/Indirect word) but those contributing for the emotion. E.g. “This camera needs to charge many times in a day”

The overall framework of the proposed system is shown in Figure 2 bellow. It consists of input data, preprocessing of data, finding out the emotion and features of the sentences with emotion dictionary, Categorization using NLP techniques, Emotion Prediction and Labeling. If the sentence does not contain any emotion word then the extraction of emotion features in the sentence is done by analyzing the sentence structure.

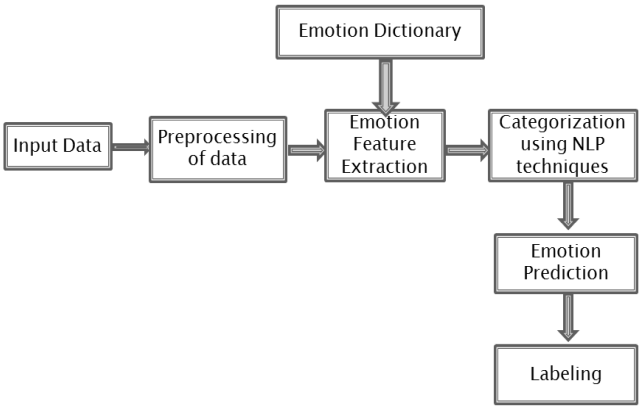

Figure 2: Work Flow

A. Input Data

Input data is any subject oriented data (feedback of user which expresses opinion regarding particular subject). The input data may be related to any product or topic. Amazon dataset [18] is considered in this paper. The dataset is updatable new user of the system can also put their views in the proposed system. As shown bellow,

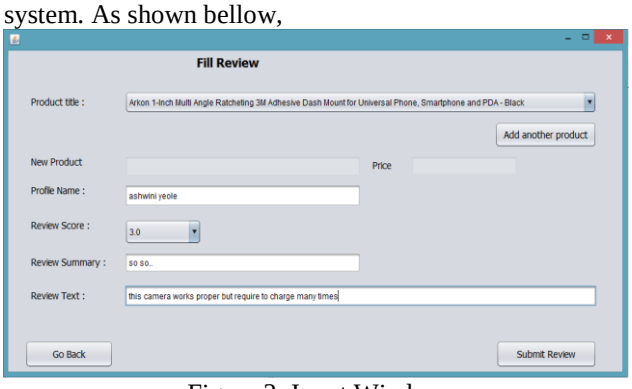

Figure 3: Input Window

B. Preprocessing of Text

The analysis of the sentence for recognizing emotion with the help of system requires the input text to be preprocessed. In the preprocessing first the stop words such as a, an, the etc. are removed using manually collected stop word dictionary. These stop words do not contribute for emotion in sentence. After applying the pre-processing, the text is represented as a set of meaningful terms. This process reduces the time complexity prescribed. Following Figure 5 shows the preprocessing (stopwords removal/filtering & stemming).

C. Detection of Emotion Features

The detection of the emotion features of the sentence is the most important step in emotion recognition. This process of extracting the text having emotion deals with finding the emotion feature set from the sentence. As proposed previously, in order to find the emotion from nearly all sentences the method of extraction of emotional features is use. This detection of emotion feature is divided into two approaches first detection of emotion features using affective word, second using sentence context level processing.

SentiWordNet[13] is a lexical resource for opinion mining. SentiWordNet assigns to each word of three sentiment scores: positivity, negativity, objectivity. Following Figure 4 describe how strongly the terms contained in Sentence (s).

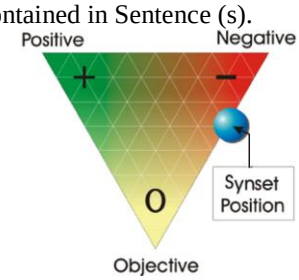

Figure 4: Graphical Representation of Senti Word Net

D. Categorization, Emotion Prediction, Labeling

The words are categorized according to their meaning. Synonyms of the keywords are searched to prepare the affective words and emotions are predicted using fuzzy theory (using rule based and fuzzy logic) and final prediction will label according to the maximum predictions.

Rule-Based approach: In the Rule-Based approach, rules are to be defined which contains some defined relation. In this methodology, certain rules are to be defined and then the sentiments should be viewed or analyzed depending on rules. **Negation Rules**: The negation word or phrase usually reverses the opinion expressed in a sentence. Negation words include traditional words such as “no”, “not”, and “never”,

Following are some sequence,
Negation Negative → Positive //e.g., “no problem”
Negation Positive → Negative // e.g., “not good”
Negation Neutral → Negative // e.g., “does not work”, where
“work” is a neutral verb.

Non-negation containing negation words: There are also non-negation phrases that contain negation words, e.g., “not” in “I like this camera *not just* because it is beautiful” does not mean negation because of the phrase “not just”.

“But” Clause Rules: A sentence containing “but” also needs special treatment. The opinion before “but” and after “but” are usually the opposite to each other.

Emotion Determination

Opinion analyzer obtains the collective sentiments of statements. There is an algorithms from that we judge the quality or usefulness of documents. It extracts all the sentences created by users which are of type comments and count total number of polarity present on the document. Then it computes collective sentiment of sentences.

Algorithm EmotionDetermination()
Step 1 Find the total count of review found in the document.

Input: Unstructured review document

Output: Total Count of polarity present in the Document

1. **for** each review document **do**
   posscore = ∑ positive feature
   negscore = ∑ negative feature
2. **End for**
3. Tpos = ∑posscore
4. Tneg = ∑negscore
5. Output Count = Tpos + Tneg

Step 2 Find the average score of each Review found in document

Input: List of sentiment words extracted from document

Output: Final Sentiment score and Sentiment Summary

1. **for** each sentiment word from List **do**
   Get polarity as well as sentiment scores using *SentiWordNet*.
2. Compute the intensity of each word using SentiWordNet & Rule based Function
3. Final Sentiment Score[13] (SS)

$$SS = \sum_{I=0}^{N} \frac{Max(Polarity)}{Count}$$

4. Output Overall Sentiment Summary

IV. EVALUATION MEASURES

The simple and easy way to validate the performance of the system is to calculate the accuracy by using the known emotion dataset [18] (Amazon sentiment dataset is used) into prediction model for evaluation of the proposed system's ability to correctly predict the emotion class. In the proposed system each sentence in the document is represented as a set of emotion features and then Opinion Orientation Algorithm is used to capture the features. Figure 6 shows the processing of Reviews for Emotion Determination. It classifies the review according to the nature as positive, negative or neutral. For classification, system categorized the sentence according to adverb/verb/noun/adjective with the help of PartOfSpeech tagger and calculates score of a sentence with the help of SentiWordNet3.0.0 dictionary and final score is compare with the class (positive/negative/neutral).

Total no. of records in dataset = 64,317(proposed system is able to add more record according to the need)

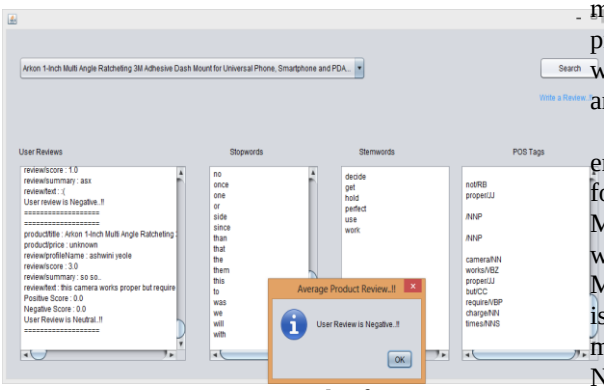

Figure 5: Result of Emotion Determination

Performance Measurement

The classification performance can be evaluated in three terms

accuracy, recall and precision as defined below[16]. A confusion matrix is used for this. Here 200 records are consider,

TABLE I. CONFUSION MATRIX TABLE

	Machine says yes	Machine says no
Human says yes	True positive(TP)	False negative (FN)
Human says no	False positive(FP)	True negative (TN)

$$Accuracy = \frac{\text{True positive samples + True Negative samples}}{\text{Total number of samples}}$$

$$Recall = \frac{\text{True positive sample}}{\text{True positive samples+ false negative samples}}$$

$$Precision = \frac{\text{True positive sample}}{\text{True positive sample+ false positive samples}}$$

TABLE II. RESULT OF PROPOSED SYSTEM

Emotion Category	Precision	Recall	Accuracy
Positive	0.912	0.928	0.924
Negative	0.897	0.887	0.938

Table bellow shows the specifications of dictionary used, which shows the word used in proposed work is more than previous work. Table specifications indicate that proposed system consider more synonyms and antonyms as well as emoji's and process it. The proposed system deals with the total words 2, 159, 49. All the dictionaries are updatable and also have the ability to add new words.

Average accuracy of the proposed system of emotion classification is obtained by test set validation for classification of sentences. By comparing the Mean classification accuracy of the proposed system with other traditional techniques it appears, that the Mean classification accuracy for the proposed system is improved as compared with the other references mentioned. Tools used for development is jdk1.8, Netbeans IDE 7.4 & MATLAB to draw the graphs.

TABLE III. SPECIFICATIONS OF DICTIONARIES

Type of Word Dictionary	**Count**
Negative Synonyms	8908
Positive Synonyms	10508
Stopword	394
Stemword	925
Sentiword(with score)	2,138,756
Total Count	2,159,491

So after evaluation of the proposed system performance we can say that it works better for the emotion prediction from text. Following graph shows the accuracy of difference Emotion Determination algorithms.

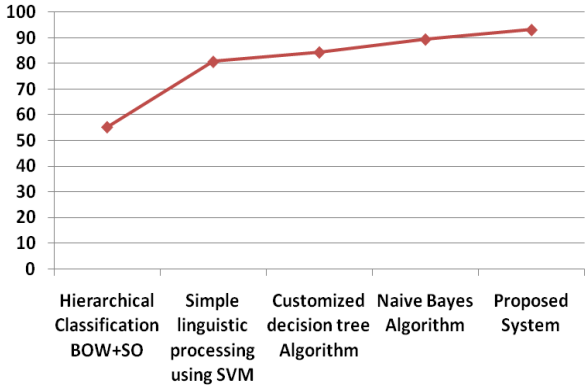

Figure 6: Comparison of Different Emotion Determination Algorithms by Accuracy

V. CONCLUSION & FUTURE WORK

An effective approach for emotion prediction that works on the sentences which contain the direct and indirect emotion words, also it can be effectively applied to the sentences that does not contain affective words but represent some emotion, and emotions can predict and well label using various NLP techniques. A advanced features for emotion classification and recognize emotion more precisely from sentences which contains negation. The goal of this work is to classify the sentence according to its emotion. The proposed system involves the finer grain emotion classification. The detection of the emotion features of the sentence is the most important step in emotion recognition. This process of extracting the text having emotion deals with finding the emotion feature set from the sentence. As a part of the future work, the plan is to consider more advanced features for emotion classification and recognize emotion more precisely from sentences which contains more rules, symbols and images.

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