Opinion Summarization from Online Mobile Phone Reviews Using Feature Based Association Rule Mining

Vidisha M. Pradhan
Assistant Professor, Dept of Information Technology
VIE, Affiliated to G.T.U. Kotambi, Gujarat, India

Abstract- Opinion mining and sentiment analysis is rapidly growing area. There are numerous e-commerce sites available on internet which provides options to users to give feedback about specific product. These feedbacks are very much helpful to both the individuals, who are willing to buy that product and the organizations. An accurate method for predicting sentiments could enable us, to extract opinions from the internet and predict customer's preferences. Sometimes only knowing about the polarity related to specific product or service is not sufficient, summarized representation of these opinions is also very important to know about opinion related to specific feature of the product. There are various representations available for opinion summarization. Feature extraction is very crucial step in opinion summarization because based on extracted features summary can be generated. Opinion mining has three levels of granularities: Document level, Sentence level and Aspect level. In this paper ARM is used find features of product and then naive bayes algorithm is applied to find polarity of the reviews. And at the end, whole summary is generated from review dataset.

Keywords- Sentiment Analysis, Opinion Mining, ARM, Naïve Bayes.

I. INTRODUCTION

Sentiment Analysis (SA) or Opinion Mining (OM) is the computational study of people's opinions, attitudes and emotions toward an entity [3]. In general, opinion mining helps to collect information about the positive and negative aspects of a particular topic. Finally, the positive and highly scored opinions obtained about a particular product are recommended to the user. In order to promote marketing, large companies and business people are making use of opinion mining [4] .

Much research exists on sentiment analysis of user opinion data, which mainly judges the polarities of user reviews. In these studies, sentiment analysis is often conducted at one of the three levels: the document level, sentence level, or attribute level. In relation to sentiment analysis, the literature survey done indicates two types of techniques including machine learning and semantic orientation are important [3].These techniques are shown in figure 1.
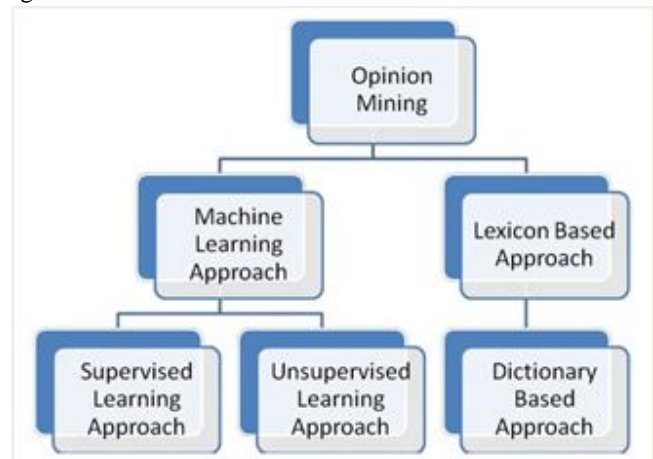

Fig. 1 Opinion Mining Techniques

There are several challenges in Sentiment analysis. The first is a opinion word that is considered to be positive in one situation may be considered negative in another situation. A second challenge is that people don't always express opinions in a same way. Most traditional text processing relies on the fact that small differences between two pieces of text don't change the meaning very much. In Sentiment analysis, however, "the picture was great" is very different from "the picture was not great". People can be contradictory in their statements [4]. Most reviews will have both positive and negative comments, which is somewhat manageable by analyzing sentences one at a time.

Users express their opinions about products or services they consume in blog posts, shopping sites, or review sites. It is useful for both the consumers as well as for the producers to know what general public think about a particular product or service [6] . In the informal medium like twitter or blogs, the more likely people are to combine different opinions in the same sentence which is easy for a human to understand, but more difficult for a computer to parse. Sometimes even other people have difficulty understanding what someone thought based on a short piece of text because it lacks context [5] .

- Aspects that are explicitly mentioned as nouns or noun phrases in a sentence are called as **explicit aspects**.
- **Implicit aspects** are not explicitly mentioned in a sentence but are implied

Opinion summarization contains various algorithms based on categories of opinion summarization. The figure 2 shows basic categories of opinion summarization. Opinion summarization can be at document level, sentence level or aspect/feature level.

The rest of the paper is organized in the following way. Section 2 gives the overview of related work in the field of opinion mining and summarization. Section 3 contains proposed problem definition. Section 4 contains proposed methodology and technique used in the system. Section 4 contains experimental results. Section 5 contains conclusion and future work.

II. RELATED WORK

In [7] Movie review features obtained from IMDb was extracted using inverse document frequency and the importance of the word found. Principal component analysis and CART were used for feature selection based on the importance of the work with respect to the entire document. The classification accuracy obtained by LVQ was 75%.

Exploring emotional variation in adolescent age and reasons behind these changes using data mining techniques is proposed in [11]. By classifying emotions and using decision tree different emotional variations are analyzed. If-then rules are also generated from decision tree. Outlier analysis is used to identify emotion variation in child having any kind of disability.

In [10], machine learning (SVM) combined with domain specific lexicons is implemented for aspect classification and polarity identification of product review. SVM is trained to model aspect classification and this trained SVM is used for polarity classification per aspect. The experimental results indicate that the proposed techniques have achieved about 78% accuracy. Web based data are applied to emotion cause extraction sub system and complementary feature selection method, based on the output of these features are merged. In training process, web post with unknown emotions are given to SVM and SVR classification model and the output gives information about the type of emotion [13].

[8] proposes a rule-based approach to emotion cause component detection for Chinese micro-blogs. It presents the emotion model and extracts the corresponding cause components in fine-grained emotions. The emotional lexicon can be constructed manually and automatically from the corpus. Meanwhile, the proportions of cause components can be calculated in the influence of the multi-language features based on Bayesian probability. The experiment results show the feasibility of the approach.

The system which is proposed in [6] extracts aspects in product customer reviews. The nouns and noun phrases are extracted from each review sentence. Minimum support threshold is used to find all frequent aspects for the given review sentences. Naïve Bayesian algorithm using supervised term counting based approach is used to identify whether sentence is positive or negative opinion and also identifies the number of it.

The paper [12] presents a method of sentiment analysis, on the review made by users to movies. Classification of reviews in both positive and negative classes is done based on a naive Bayes algorithm. As training data we used a collection (pre-classified in positive and negative) of sentences taken from the movie reviews. To improve classification we removed insignificant words and introduced in classification groups of words (n-grams). For n = 2 groups we achieved a substantial improvement in classification.

In [11], a novel method is used to collect various learners twitter messages On this dataset preprocessing for sentiment analysis is performed It involves various intermediate operations remove ambiguity. The pre-procceeed dataset is used to built user"s emotional state classification and SVM, ME and naïve bayes classifiers are applied and the results are very efficient.
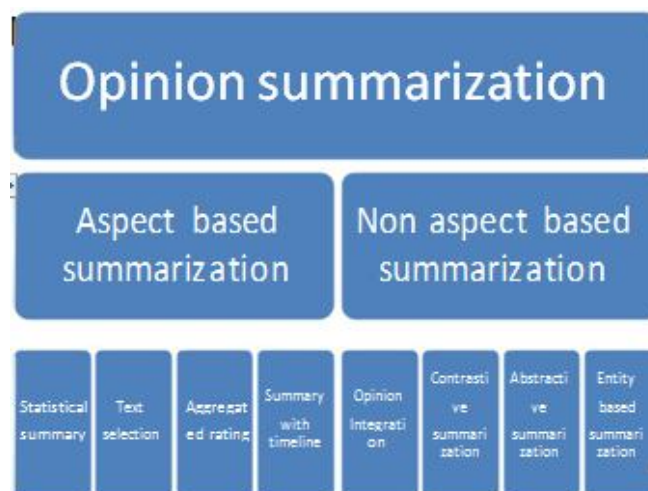

Fig. 2 Opinion Summarization Methods

In [18], Wordnet is used as dictionary Author uses mobile phone reviews from amazon website. It is input to the system. Polarity is calculated on the basis of majority of opinion words. Experimental results of „AIRC Sentiment analyzer system" is compared with proposed system and proposed system provides better accuracy. In future, some enhancements in this technique will be carried out. It would deal with the sentences contain relative clauses like not only-but also and the sentences contain clauses neither-nor, either-or etc.

In paper [19] an Aspect based Opinion Mining system named as "Aspect based Sentiment Orientation System" is proposed which extracts the feature and opinions from sentences and determines whether the given sentences are positive, negative or neutral for each feature. Negation is also handled by the system. To determine the semantic orientation of the sentences a dictionary based technique of the unsupervised approach is adopted. To determine the opinion words and their synonyms and antonyms WordNet is used as a dictionary. All the features of the product on which reviews are given would be identified and the orientation of the sentence for each feature would be determined. The polarity of the given sentence is determined on the basis of the majority of opinion words. In the end the system will generate the feature wise summary of positive, negative and neutral sentences which will be easier for users to read, analyse and help them in taking the decision whether the product is to be purchased or not.

In [20] graph based approach is used for showing opinion. Each node in the graph contains review by user and by calculating polarity of opinion, if neighbour node contains same polarity then aggregation is performed. Based on type of aggregation (horizontal or vertical) rules of aggregation are applied. Parsing is performed on forum posts dataset by standford parser. After that feature extraction is carried out. From these extracted features, filtering is performed to extract opinion words for opinion orientation identification. Then nodes that do not contain any opinion are discarded from graph and at the end aggregation of nodes containing same polarity of opinions is carried out.

In [21] technique for summarizing web reviews as document summarization problem is proposed. Ranks are given to sentences of the documents for summarization purpose. Sentences with low ranked reviews are discarded while generating summary. By combining existing summarization method with rank information summary related to product becomes more informative.

In [22] automatic mining on trending topics of twitter is done to generate summary. These extracted topics are compared with news articles to find its relevance. The main feature of this method is that it refines the trending topics to make it mutually exclusive. Sentiment analysis is carried out on twits to find mass reaction and after that short summary is generated from extracted twits. This method has good accuracy in summarizing trends.

The paper [23] contains novel feature level review summarization method to visualize mined features with associated opinions and polarity. In first step subjectivity and objectivity classification of review is generated with the use of supervised machine learning technique which prevents noisy and irrelevant reviews. After this rule based approach for feature-opinion pair extraction is used. Summarization method is applied on these pairs. Summary is shown with review list, its description and review result. Bar and pie charts can be used as visualization purpose.

Paper [24] uses statistical model for opinion summarization. The entire system is made up of 3 main modules: Text extraction, sentence extraction and summarization. In this method parser is applied to blog documents to extract text from document. On this extracted text, opinion extraction algorithm is applied with the use of sentiment Wordlist to decide polarity of sentences. The output of extracted opinion with the sentences used to decide the polarity is used check against word limit of summary. If word limit is not exceeded then summary remains as it is and if it is exceeded then summary extraction algorithm is applied to these extracted opinion sentences to get final summary within word limit.

In [25] Latent semantic analysis (LSA) technique is used for text summarization and evaluation of summarizes text. LSA based two new summary evaluation parameters are introduced to know the quality of summary based on its length. Based on experiments it is proved that LSA is sensitive on stop list and lemmatization process so working on improved version of lemmatizers is necessary.

Informative sentence selection for opinion summarization is proposed in [26]. In this paper, aspect coverage and view point coverage are used as evaluation parameters. Sentence graph is generated with the use of amazone dataset. Leaders and communities are found from this graph with use of community leader detection algorithm. Various product comments are summarized with this methods to know about accuracy of the algorithm.

III. PROBLEM DEFINITION

User reviews are very important for knowing polarity of users regarding product. Summarization of generated reviews is also important for users to know other People"s view about aspects. Extraction of features is very crucial phase for summarization. ARM can reduce number of features and considers only relevant features. From this, proposed definition is "Opinion Summarization from Online Mobile Phone Reviews using Feature based Association Rule Mining".

IV. SIMULATION RESULTS

Review database used as an input to the system. As reviews are unstructured text, pre-processing is applied on this review dataset.

1. Preprocessing:

Three Preprocessing steps applied over here are described as follows:

A. Remove Stop Words, so that text database will no longer contain words like the, a, an etc.
B. Stemming is used to convert each word of review to its root word. For example, words like Purifying, purity, purified, purest are converted to its root word "Pure". For this purpose Porter Stemmer
Algorithm is used.
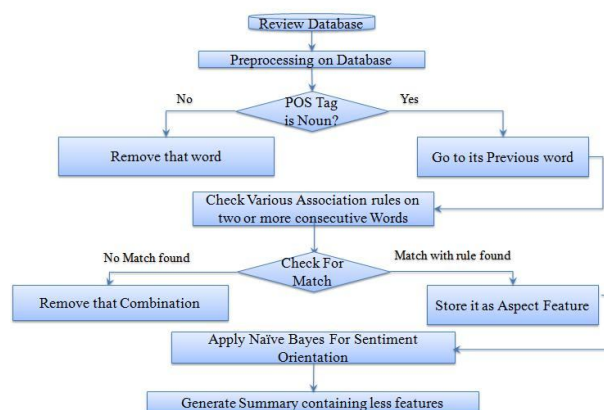C. Pos Tagger is applied to tag words with its part of speech. StanFord POS Tagger is used for this purpose.

Fig. 3 Proposed Workflow

2. Extract Frequent Aspects using ARM:

The proposed method introduces different association rules for POS Tagged output. By doing this, combination of words is taken as feature which is more beneficial for summary generation.

For every review in dataset, tag of words is checked. If tag of word is noun, noun phrase or nouns then tag of previous word of these selected words are checked. And if tags are noun, noun phrase or nouns then the whole combination is considered as single feature by concatenating two words.

To prune features for finding only small number of relevant features different combination of pos tagged words is checked. These combinations can be:

1) Adjective, Noun,
2) Determiner, Noun, Noun,
3) Determiner, Noun, Noun, Preposition,
4) Determiner, Adjective, Noun, Personal pronoun,
5) Preposition, Noun Phrase, Noun etc.

All theses combinations are checked to find features. Adjective and noun combination provides good list of features which help in generating good summary about any product. Thus we get small set of features than that we get from existing method.

3. Opinion Orientation:

Naïve bayes algorithm is used for Sentiment Orientation. Steps of Naïve bayes:

• Separate Text files are of Positive words, Negative words and Review sentences are used.

- First, combination of two words is compared and then single word is compared.
- If word is available on opinion word list then opinion word rule is applied.
- If word that is to be checked is near to the negation word then negation rule is applied.

Opinion Word Rule:

If word is matched with one of the words from positive opinion word list then positive count is increased. And if it is matched with negative opinion word list then negative count is increased.

Negation Rules:

• If previous word of negative opinion word is negative, then positive count is increased.

• If previous word of positive opinion word is negative, then negative count is increased.

4. Get Summarized Review:

At the end summary is generated which contains total number of positive and negative sentences with orientation of features in review dataset. The summary, thus generated provides good results which is discussed in following section.

V. EXPERIMENTAL RESULTS

To calculate accuracy of proposed method and to compare it with existing work following parameters are used:

1) Precision:

Precision shows exactness. It is the measure of reviews that are correctly classified or relevant from total retrieved reviews.

$$Precision = \frac{TP}{TP + FP}$$

2) Recall:

It shows completeness. It means, it is the measure of relevant instances that are retrieved.

$$Recall = \frac{TP}{TP + FN}$$

3) F-Measure

It is the measure of overall accuracy.

$$F\text{-}Measure = \frac{2 \cdot Precision \cdot Recall}{Precision + Recall}$$
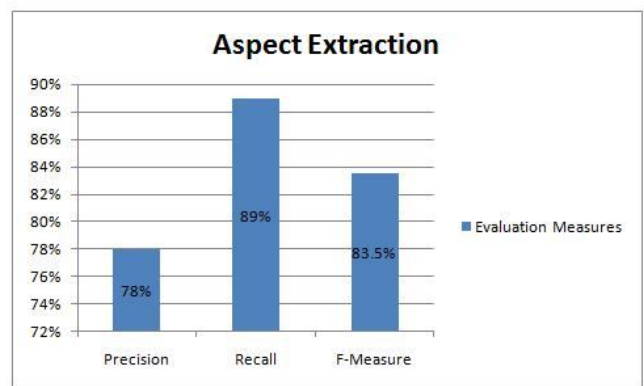

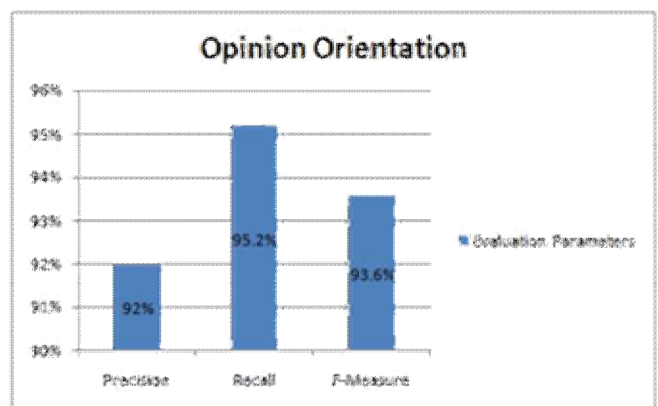Fig. 4 Parameters for Evaluation for Aspect Extraction

Fig. 5 Parameters for Evaluation for Opinion Orientation

Aspect extraction provides accuracy of 83.5% using Association Rule Mining. Sentiment orientation provides accuracy of 93.6% for given dataset. Precision, Recall and F-measure for aspect extraction and sentiment orientation are shown in figures 4 and 5 respectively.

VI. CONCLUSION

Proposed method extracts more relevant features as it checks previous word of features extracted. Analysis of experimental results for proposed method is done with parameters like precision, recall and F- measure. Some existing methods consider only nouns as features but all nouns are not necessarily be the features. So proposed method overcomes this limitation by checking various associations among pos tagged words and thus generates final summary.

In future, the work can be done to find features and classification of various models of mobile phone by combining various methods of classification.

REFERENCES

[1] Jiawei Han, Micheline Kamber and Jian Pei, "Data mining Concepts and Techniques", Third Edition, Morgan Kaufmann Series in Data management Systems

[2] Charu C. Aggarwal, "Data Mining: The Textbook", Springer, 2015

[3] Walaa Medhat, Ahmed Hassan, Hoda Korashy, "Sentiment Analysis Algorithms And Applications: A Survey", Ain Shams Engineering Journal, 2014

[4] Blessy Selvam1 , S.Abirami2, "A Survey On Opinion Mining Framework", International Journal of Advanced Research in Computer and Communication Engineering, 2013

[5] G.Vinodhini, R.M.Chandrasekaran, "Sentiment Analysis And Opinion Mining: A Survey", International Journal of Advanced Research in Computer Science and Software Engineering, June 2012

[6] A.Jeyapriya, C.S.Kanimozhi Selvi,"Extracting Aspects And Mining Opinions In Product Reviews Using Supervised Learning Algorithm", IEEE, 2015

[7] Jeevanandam Jotheeswaran, Dr. Y. S. Kumaraswamy, "Opinion Mining Using Decision Tree Based Feature Selection Through Manhattan Hierarchical Cluster Measure", Journal of Theoretical and Applied Information Technology, 2013

[8] Kai Gao, Hua Xu, Jiushuo Wanga, "A Rule-Based Approach To Emotion Cause Detection For Chinese Micro-Blogs", ELSEVIER, 2015

[9] M.Ravichandran, G.Kulanthaivel, "Twitter Sentiment Mining (Tsm) Framework Based Learners Emotional State Classification And Visualization For E-Learning System",Journal of Theoretical and Applied Information Technology, 2014

[10] Chetashri Bhadane,Hardi Dalal, Heenal Doshi, "Sentiment Analysis: Measuring Opinions", Science Direct, 2015

[11] Jasakaran Kaur, Sheveta Vashisht, "Analysis And Indentifying Variation In Human Emotion Through Data Mining", Int.J.Computer Technology & Applications, 2012

[12] Ion Smeureanu, Cristian Bucur, "Applying Supervised Opinion Mining Techniques On Online User Reviews", Informatica Economică, 2012

[13] Weiyuan Li, Hua Xu, "Text-based emotion classification using emotion cause extraction", ELSEVIER, 2013

[14] Rizvaan Irfan, Christine K. King ,"A Survey on Text Mining in Social Networks", The Knowledge Engineering Review, 2004

[15] Diksha Sahni, Gaurav Aggarwal, "Recognizing Emotions and Sentiments in Text: A Survey ", International Journal of Advanced Research in Computer Science and Software Engineering , 2015

[16] Faiza Belbachir, B´en´edicte Le Grand, "Opinion Detection: Influence Factors", IEEE, 2015.

[17] Reshma Bhonde, Binita Bhagwat, Sayali Ingulkar, Apeksha Pande,"Sentiment Analysis Based on Dictionary Approach", International Journal of Emerging Engineering Research and Technology Volume 3, Issue 1,2015

[18] Richa Sharma, Shweta Nigam, Rekha Jain, "Polarity Detection at Sentence Level", International Journal of Computer Applications, Volume 86- No 11, 2014

[19] Richa Sharma,Shweta Nigam and Rekha Jain, "Mining Of Product Reviews At Aspect Level", International Journal in Foundations of Computer Science & Technology (IJFCST), Vol.4, No.3, May 2014

[20] Dumitru-Clementin Cercel, Stefan, "The Features-Based Evolution of the Opinions in Forums Using a Semantic Summarization Approach", IEEE,2013

[21] Alpana Dubey, Atul Kumar, "A Technique for Summarizing Web Reviews", IEEE,2008

[22] Srishti Sharma, Kanika Aggarwal, Palak Papneja, Saheb Singh, "Extraction, Summarization and Sentiment Analysis of Trending Topics on Twitter", IEEE,2015

[23] Ahmad Kamal, "Review Mining for Feature Based Opinion Summarization and Visualization"

[24] Sushant Kumar and Diptesh Chatterjee, "Statistical Model for Opinion Summarization", IIT Kharagpur, 2008

[25] Josef Steinberger, "Using Latent Semantic Analysis in Text Summarization and Summary Evaluation".

[26] Linhong Zhu, Sheng Gao, Sinno Jialin Pan, Haizhou Li, Dingxiong Deng and Cyrus Shahabi, "Graph-based Informative-Sentence Selection for Opinion Summarizati