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Sentiment Classification for Product Review Analysis

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***Abstract*— In today's world many of people spend their most of time on internet for net surfing. Internet becomes a new media of education, communication, shopping etc.while dealing with websites users leave their feedback on plenty of sites. So large amount of user written electronic text is available which can be beneficial to retailers and customers for business intelligence as well as decision making. Sentiment mapping or opinion mining is a Natural Language processing and retrieval of information task which finds out customer opinion in the category of positive, negative and natural. Here sentence level sentiment classification divides document into number of sentence and classify opinion for each feature.**

Keywords*— Business Intelligence, Sentiment Mapping, Natural Language Processing, Opinion Mining.

I. INTRODUCTION

Opinion mining is related with sentiment or attitude of the writer's common method to use this technology is to find out what people think about particular thing[1].
For example, do people on facebook think that street food in Aurangabad is good or bad?
by processing the sentiments of the comments you will get answer of your question. Here one can also study why people think that food is bad or good by searching out exact word which denote why particular like or dislike the food.
Example:"So oily."
This is one of the types for the market research analysis [2].Now you can find out what pitfalls are there and try to minimize the problems and find out new ways. Sentiment mining can be use to find out opinions at different levels. It will score whole document into positive and negative, it can also score sentiment of each and every phrases or words in the whole document [3].
For example, if someone writes in tweeter, "I love winter season but hate summer."
Individual score will show "love winter" as positive and "hate summer" as negative. However sentiment for whole sentences as neutral, positive opinion for the word love will cancel negative opinion for word hate[4]. Opinion mining track particular topic, many firms use this technique to monitor their goods, services [5].

Accuracy of sentiment mining can be measured in different number of ways, but one of the most common way is score accuracy with the comparison of human [6]. A research from University of Pittsburgh demonstrated that humans can only agree on whether a sentence has positive or negative sentiment, up to 80% of the time. Because of this any Natural Language Processing technique which scores up to 80% is working greatly with high accuracy [7]. Even human being is having problem as they can analyses up to 80% accuracy. Major problem occurs when one word has multiple definitions. Few engines are there which help to

Snapshot 1: Different platforms where user can write opinion

understand the context of text. For example, if someone is talking about apple then they are talking about mobile phone/they are talking about fruit [8].

II. EXPERIMENTAL WORK

• *Loading Pros and Cons:* First of all we have to load the 'Pros" and 'Cons" dataset. The words usually provided with XML or TEXT version. Developer has to design a XML or a TEXT parser to read the statement serially. These statements should be loaded into arrays of string data type [9].

• *Train Naive Bayes:* As we know the 'Pros" and 'Cons" statement provides the sentiment as positive and negative over an issue respectively. Here we train a Classifier i.e. Naive Bayes as a Sentiment Classifier. The string arrays are loaded as training instances[10]. Nave Bayes creates a trained model. This classifier based on applying Bayes' theorem (from Bayesian statistics) with strong (naive) independence assumptions. A more descriptive term for the underlying probability model would be "independent feature model". Depending on the precise nature of the probability model, naive Bayes classifiers can be trained very efficiently in a supervised learning setting [11]. In many practical applications, parameter estimation for naive Bayes models uses the method of maximum likelihood; in other words, one can work with the naive Bayes model without believing in Bayesian probability or using any Bayesian methods [12].

• Part-Of-Speech Tagging (POST): A Part-Of-Speech Tagger (POS Tagger) is a piece of software that reads text in some language and assigns parts of speech to each word (and other token), such as noun, verb, adjective, etc., although generally computational applications use more fine-grained POS tags like "noun-plural". We use open source Stanford NLP parser for POST. The parser is instantiated with English Model [13]. As it is free licensed with Java programming language, we use IKVMC to port Java class files into .NET library. By using these libraries we can POST a sentence with its grammatical tags [14].

• Feature Identification: For the Pros and Cons opinions, we will identify the features by extracting the frequent noun terms in the reviews. For identifying features in the free text reviews, a solution is to employ an existing feature identification approach existing approach that first identifies the "Nouns" and "Noun phrases" in the reviews [15]. The occurrence frequencies of the nouns and noun phrases are counted, and only the frequent ones are kept as features. The most frequently occurred Nouns and Noun phrases usually refers to aspects or features in our consideration [16].

• Sentiment Classification on Features: The Pros and Cons reviews can be categorized positive and negative opinions on the feature [17]. These reviews are valuable training samples for learning a sentiment classification. Thus the Pros and Cons reviews used to train a sentiment classifier, which is in turn used to determine consumer opinions (positive or negative) on the aspects in free text Reviews[18].

III. RESULT ANALYSIS

Training and testing dataset is downloaded from http://www.cs.uic.edu/~liub/FBS/sentiment-analysis.html

Training Dataset consist of Total 6824 words in which Pros word count is 2012 and cons word count is 4812.

Table1: Statistics of data Corpus, # indicates the Number of Reviews/Sentences

Product Name	Domain	#of reviews	#of sentences
Nikon Coolpix s9200	Camera	107	505
Canon 60D		17	175
Hp5550	Printer	186	976
Panasonic VIERA	TV	244	3502
Samsung S4	Mobile	149	2294
LG 840G		767	3891
Nokia 520		882	4367
MotoG		906	3657
	Total	3258	19367

Below snapshot shows result of part of speech tagging of sentence as well as classifier output. Classifier classify each sentence into 3 classes

1. Positive
2. Negative
3. Neutral

Snapshot 2: Classifier output

For positive and negative sentence we have training dataset, but for neutral sentence no dataset is available so for neutral classification stetted up two thresholds for positive and negative .In order for a sentence to be flagged as either its chance for that class must be equal or above the threshold set for that class. If it is not, the sentence is classified as neutral.
Here total 300 sentences are picked up randomly from the data set from which 100 are positive, 100 are negative and 100 are neutral.
Below table shows confusion matrix for sentence level sentiment classification.

In which,
Predicted_Pos=Predicted Positive Sentence
Predicted_Neg= Predicted Negative Sentence
Predicted_Neu=Predicted Neutral Sentence
TotalPredPos=Total Positive Predicted Sentence
TotalPredNeg= Total Negative Predicted Sentence
TotalPredNeu= Total Neutral Predicted Sentence
Total_Pos=Total Positive Sentence
Total_Neg= Total Negative Sentence
Total_Neu= Total Neutral Sentence

Table 2: Confusion matrix for sentence classification

	Positive	Negative	Neutral	Total
Predicted_Pos	90	08	12	TotalPredPos=110
Predicted_Neg	04	82	09	TotalPredNeg=95
Predicted_Neu	06	10	79	TotalPredNeu=95
	Total_Pos=100	Total_Neg=100	Total_Neu=100	

Precision for positive sentence
Precision= TP_Positive /Total_Pos
=90/100
=0.9
Recall for Positive sentence
Recall=TP_Positive/TotalPredPos
=90/110
=0.8181
Here ,
TP_Positive=True positive for positive sentence

Table 3: Result of precision and recall for positive sentence

Precision	0.9
Recall	0.81

Precision for Negative sentence
Precision= TP_Negative /Total_Neg
=82/100
=0.82
Here
TP_Negative =True negative for negative sentence

Table 4: Result of precision and recall for positive sentence

Precision	0.82
Recall	0.86

Precision for Neutral sentence
Precision= TP_ Neutral /Total_Neu
=79/100
=0.79
Recall for Neutral sentence
Recall=TP_ Neutral /TotalPredNeu
=79/95
=0.8315
Here ,
TP_Neutral =True neutral for neutral sentence

Table 5: Result of precision and recall for positive sentence

Precision	0.79
Recall	0.83

Total Average Precision for sentence classifying

=TP_Positive + TP_Negative_ TP_Neutral/ (Total_Pos+Total_Neg+Total_Neu)

=90+82+79/300

=251/300

=0.8366

Below table shows graphical representation of precision and recall for sentiment classification

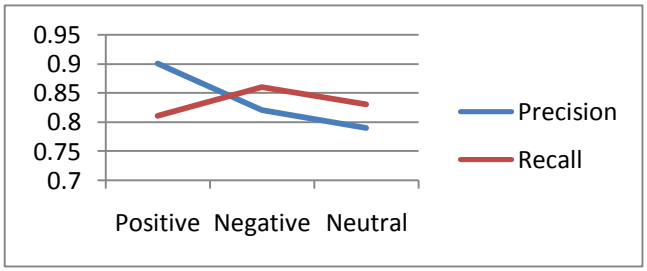

Figure 1:Precision and Recall graph

IV. CONCLUSION

Mobile, Camera, Printer ,TV are dominating product in now days so we have taken their reviews for sentiment mining . The Stanford parser is used for identify product features. Sentence level sentiment classification is used for identify sentiment of each sentence separately.

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