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# Sentiment Analysis at Document Level

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**Abstract**—The Sentiment Analysis at document level analyzes the text from a given document and indicated the value of sentiment whether it showed positive or negative sentiment. Sentiment Analysis (SA) can be performed at three levels: at the document level, the sentence level and aspect level. The Supervised methods consists of two stages the first stage is extraction/selection of informative features and the second stage consists of classification of evaluations by using machine learning models like Support Vector Machines (SVM) and Naive Bayes (NB). We perform comparison analysis using different techniques and at the end conclude which techniques is better, Comparisons also shows that which techniques are better for balanced and unbalanced data.

## I. INTRODUCTION

In Text mining field Sentiment analysis becomes a very active research area for the reviews analyzation. This field gets recognition by due to the rise of some new platforms like blogs, social media and the user based reviews. It also offers many opportunities in developing new applications, mainly when there is huge amount of information available in sources (blogs, social networks). At three different levels on which sentiment analysis is performed i.e. sentiment analysis at document level, sentiment analysis at sentence level and sentiment analysis at aspect level. Document level sentiment analysis automates a textual review by classifying it. It indicates the results by giving positive or negative sentiment. Different types of classifiers are used to perform sentiment analysis but among all of them SVM is the most commonly used classifier. [1]



Fig. 1. Sentiment Analysis Model

Different levels in Sentiment Analysis are discussed in Section II. The other parts in paper are organized as follows.

Section III contains related work on sentiment analysis and provides a summary of Literature review that is shown in Table 1. Section IV contains conclusions this work.

## II. SENTIMENT ANALYSIS LEVELS

The levels on which Sentiment Analysis is performed are as follows:

### A. Document Level Sentiment Analysis

Sentiment Analysis at document level classify the review we got from a document and indicated that the whole document expressed a positive sentiment value or negative sentiment value. For example, when a product is reviewed by users the system determines an overall opinion and shows the results. The opinions that are expressed on each document is assumed to be a single entity and if there are multiple entities on which the result is evaluated or made comparison then it is not applicable. Different machine learning approaches are used for classifying a document that includes Nave Bayes, Maximum Entropy classification, and Support Vector Machines (SVM).

### B. Sentence level sentiment analysis

As clear from its name it implies that sentiment analysis is performed on the sentences rather than performed on the whole document. This level determined that each sentence shows a positive sentence level sentiment, negative sentence level sentiment or neutral sentence level sentiment. Neutral opinion in general usually means no opinion. The two tasks are performed at Sentence Level are subjectivity classification and sentiment classification.

### C. Feature level sentiment analysis

In a sentence the object features sometimes are commented the first two levels of sentiment analysis didn't consider them. At both levels it does not discover what people like or not so at feature level sentiment analysis is more appropriate. This level was earlier called feature level and it performs more accurate analysis. The aspect level classification provides summary of multiple reviews based on the feature based opinion in aspect level sentiment analysis [2].

Aspect level performed three main tasks:

1. Identification and extraction of the features that are commented on an object by user.
2. Indicated the polarization of opinions from the classes

of features which includes positive value, negative value and neutral value.

3. Relate to the group feature synonyms.

The model of Sentiment Analysis that have different steps shown In Figure 1. At the first stage reviews are taken then the data is preprocessed in the second stage The preprocessing also includes some other steps by removing the markup tags from HTML pages, the information which is not necessary for the reviews, other non-textual content information which includes dates and names of the users that reviewed the content. At the 3rd stage which is called review analysis it identified the reviews about the product, opinions, the features of product on which the review is based. Two main tasks are performed at review analysis stage are 1.POS (part-of-speech) tagging 2. Negation tagging. Sentiment classification is the 3rd stage where learning models are used to classify the sentiment and after this stage is used to get the analysis results. [1]

### III. LITERATURE REVIEW

Many researchers have addressed sentiment classification problem in different ways. Different datasets are available and used by the researchers to do comparison of different algorithms. Document-level sentiment classification express reviews in positive value or negative value. This research paper aims to review previous research on sentimental analysis. Some of main research work perform by researchers are discussed below:

Dhande, L. L., & Patnaik, G. K. extracted peoples opinion about the product or the service provided. In these cases, sentiment analysis has become active field in research area. To review products, sentiment classification became the most useful technique. The sentiment classification is used to classify reviews of user in two ways positive way or negative way from textual information. They also proposed two different classifiers namely Nave Bayes (NB) and Neural Network Classifier (NNC). And these classifiers are combined for the sentiment classification. Their Experimental results show classified results on movie review data set on positive or negative sentiment when using classifiers. Their accuracy rate is increased up to 80.65% when combined Naive Bayes classifier with Neural Network. In the end authors concluded that by their proposed system the Accuracy of sentiment analysis is increased [3].

In another research work done by McCallum, A., & Nigam, K. for text classification include two models Multi-variate Bernoulli model and multinomial model [4]. Author describes the differences and details of these two models and compares the classification performance. Two ways in which document is represented by using a vector attributes and binary attributes. And they indicates which words should occur in document and which words are to be excluded. as specified in Multi-variate model. This approach is used by many other researchers. This approach also called the traditional statistical modeling and is used in speech recognition and it is called the unigram language model. Classification and feature selection are two

processes applied on the models to get the results. The research paper concludes that the result of multinomial model is better than the multi-variate [4].

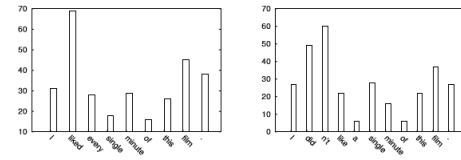


Fig. 2. sentence-level-representation. In this example, we have a positive sentence (left) and its negation (right)

Dos Santos, C. N., & Gatti, M applied two approaches to corpora from two different domains the 1. Stanford Sentiment Treebank 2. Stanford Twitter Sentiment corpus. In the first domain it contains sentences from movie reviews and the 2nd domain contains Twitter messages [5]. The architecture of deep neural network uses three representations namely character-level representation, word level representation and sentence-level representation (Dos Santos, 2014). The Authors main contributions in this paper are: (1) the idea of using convolutional neural networks to extract from character- to sentence level features; (2) the demonstration that a feed-forward neural network architecture can be as effective as RNTN for sentiment analysis of sentences (3) the definition of new state-of-the-art results for SSTb and STS corpora and result is represented in the form of histogram in (Figure.3) [5].

The research of document sentiment analysis presented by



Fig. 3. Steps and techniques that are commonly use in sentimental analysis

Moraes, R., Valiati, J. F., & Neto, W. P. G. in this research author aims that on a single topic the textual review is classified by automating it and it expressed a positive sentiment or a negative sentiment. This paper performs comparison between SVM and ANN on the sentiment analysis at document level. Authors discussed about which approach achieves better results in terms of classification accuracy. They used supervised methods for performing feature selection and weighting of bag-of-words. Except for using some unbalanced data their experiments indicated that ANN produce better or comparable results to SVMs. ANN outperformed SVM by a marginal difference, even on the context of unbalanced data [6].

Pang, B., Lee, L., & Vaithyanathan, S. suggested that documents are classified not by their topic but they should be classified by overall sentiment [7]. They used Movie Review Data set and applied some machine learning techniques which gave more accurate results. They used three different machine

learning algorithms to classify the sentiments 1.Naive Bayes classification 2.maximum entropy classification 3. Support vector machines. In comparison of human-based standard approach the machine learning techniques produced better results. Naive Bayes performs the worst and SVMs outperforms the best [7].

Another research work done by Wang, Z., Li, S., Zhou, G., Li, P., & Zhu, Q. They deal with the imbalanced situation of the class distribution of samples in Sentiment classification, to overcome this problem the authors proposed a multi-strategy this approach integrates three ensemble methods including sample ensemble, feature-ensemble, and classifier-ensemble by exploiting multiple classification algorithms [8]. The evaluation is performed in four different domains it shows that their proposed multi-strategy ensemble approach outperforms the other approaches discussed in paper. For imbalanced sentiment classification they get more accurate results [8].

#### IV. CONCLUSIONS

Sentiment Analysis is a progressive field. Its a process in which peoples gave opinion about a product or an object and extract the information from that opinion.. Support Vector Machine is commonly used in sentiment analysis for getting the accuracy and optimal results and neural networks ANNs grabs less attention as compared to SVM. Literature Review reports the comparisons between these learning models includes SVM, NB and ANN in different researches performed by different researchers. At the end it is concluded that NB give better results when data is balance and when the data is unbalance then SVM and ANN gives better results. Overall ANN gives best result in classification.

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TABLE I  
LITERATURE REVIEW SUMMARY

Title	Year	Techniques	Dataset	Evaluation
Analyzing Sentiment of Movie Review Data using NaiveBayes Neural Classifier	2014	Naive Bayes Classifier, Neural Network Classifier	Movie Review Dataset	Sentimental analysis accuracy increases up to 80.65% by combining the two method Naive Bayes classifier and neural network.
Deep Convolutional Neural Networks for Sentiment Analysis of Short Texts	2014	deep convolutional neural network	Stanford Sentiment Treebank, Stanford Twitter Sentiment corpus	Classification accuracy 85.7% and prediction accuracy 86.4%
Document-level sentiment-classification: An empirical comparison between SVM and ANN	2012	Support Vector Machine, ANN	Movie Review Dataset	SVM is good algorithm for sentimental analysis but ANN is performing well when data is unbalances.
Imbalanced Sentiment Classification with Multi-Strategy Ensemble Learning	2011	Multi-strategy ensemble learning		Ensemble learning approach perform better than cost-sensitive and re-sampling approach
Sentiment Classification using Machine Learning Techniques	2002	Naive Bayes, Maximum entropy classification, support vector machines	Website data	Machine learning techniques are good but in relative performance Nave Bayes is worst and SVM is better
A Comparison of Event Models for Naive Bayes Text Classification	1998	Multinomial model, Probabilistic framework of Nave Bayes, Multi-variate Bernoulli Model	Yahoo data set, News-groups dataset, Industry Sector dataset, WebKB data set	Multinomial model performs better at large vocabulary then Multi-variate Bernoulli model