A Survey on Sentiment Analysis using Machine Learning Algorithms

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Abstract— Clients create informal communities, online portals, audits, reviews, ideas, assessments, and feedback as the web network grows, and it may be about anything such as books, people, things, research, events, and so on. Organizations, governmental bodies, and individuals benefit from these viewpoints. While this is meant to be useful, the majority of this client-created information necessitates the use of opinion mining otherwise sentiment analysis. Sentiment Analysis is a branch of psychology that studies emotions, judgments, and the subjectivity of opinions. This review article is a comparative assessment of several recently offered calculating improvements and various slant examination applications. Specifically, I'm interested in how sentiment analysis may be utilized to propose a product based on customer evaluations. The associated disciplines of estimation study that have recently attracted professionals are investigated. The main goal of this study is to provide a near-complete description of sentiment analysis, its types, and characterization. The complicated ordering of late papers and the overview of the current pattern of research in the sentiment analysis and associated regions are the key obligations of this study.

Keywords—*Machine Learning, Algorithms, Future extraction, NLP, SVM, Naive Bayees, Random Forest*

Introduction

The world is becoming increasingly digitalized these days. In our digitalized age, ecommerce is gaining traction due to the accessibility of items to clients. Furthermore, the ecommerce website allows users to express their thoughts and feelings. In reality, more and more consumers are depending on the experiences of other customers. The opinions and purchase decisions of others are influenced by their product experiences and feedback. We frequently inquire about others' opinions in order to get insight into their experiences; as a result, the value of

evaluations has increased. The computer exploration of people's thoughts, frames of mind, and feelings about a drug is known as sentiment analysis. The element can refer to any individuals, events, or topics. Surveys will be used to obtain these subjects.

The fundamental technique may be done to preserve the data as time progressed, and as time progressed, so did the advancement. Technology was likewise changing at a breakneck pace from year to year. As a result, users have become accustomed to paying a high price to the supplier due to added costs since the nineteenth century. As a result, the E-commerce business has begun to emphasize service and product quality as customer expectations, with users being able to trust an e-commerce site to purchase things online. Thus, the e-commerce business used numerous strategies to gain client trust, such giving "cash on delivery" and product ratings, so that the user may recommend his colleges, friends, and relatives about the product review and other facts that are available on the ecommerce website[1]. The practice of identifying feelings and views in a text for a certain topic is called sentiment analysis. It enables us to comprehend attitudes, opinions, and feelings[2].

Literature review

The ground truth involves labelling data with positive or negative attitudes. Amazon is one of the world's largest internet retailers. The information in this research comes from online user evaluations of items acquired from Amazon [3] between February 2012 and July 2017. The faults were overcome by verification prior to posting the evaluations, and the ground truth is ratings on a scale of one to five.

Xing et al. [4] presented a study based on Amazon product evaluations to find negation phrases. Data is classified at the sentence and review levels for data gathered between February and April 2014. Aashutosh Bhatt et al. [5] used Amazon reviews of the iPhone 5 to propose a rule-based extraction of product feature sentiment analysis. The POS approach is applied to every sentence level, and the results are displayed in graphs. To harvest the opinions from online product evaluations, Ahmad Kamal [6] employed supervised and rule-based approaches. Bhumika et al.[7] examined machine learning algorithms and showed how

their efficiency differed when applied to Twitter data. Amazon was an adventure in and of itself (Jeff Bozos in Bellevue, 1994). He chooses Seattle as his destination because Microsoft is nearby. Amazon was made available to the general public in 1997. The product was first available as music and video in 1998. In the year (2002), firms that provide cloud services, online services, and internet patterns were widespread. In 2006, the organization was granted permission to accept virtual payments from customers and to retain data on the internet. The firm that makes mobile robotics was purchased by the organization in 2012. Amazon's origins may be traced back to an online system that distributes things such as books, groceries, movie products, sports, toys, and jewellery to customers. In 2015, Amazon's reach was greater than that of "Wal-Mart, Bigbox-store, and Super-market," all of which offered significant discounts and food goods to customers. In 2017, Amazon purchased a total of 13.4 billion dollars in the food business.

Callen Rain [14] has done extensive study in the domain of natural language processing. Naive Bayesian and decision list classifiers are being used in the research. These mechanisms have been used to classify the reviews that have been submitted. These reviews might be favorable or unfavorable. Deep-learning neural networks are being used in research. In the field of sentiment analysis, neural networks have become well-known. Convolution networks were used by Ronan Collobert [15] et al. The job of semantic role labeling was completed with the goal of avoiding excessive operation-oriented engineering of features.

I. ARCHITECUTRE

Customers leaving reviews on Amazon or commenting on a movie on social media platforms are the key applications that have been addressed in numerous articles. Sentiment analysis is used to better comprehend these product reviews. Further parts go through how the text is pre-processed, feature selection methods, and what classifier modals are required. These reviews are translated into plain English that is easy to comprehend, and they are categorized as favorable, negative, or neutral. The key phases in sentiment analysis are feature extraction methods and classifiers.
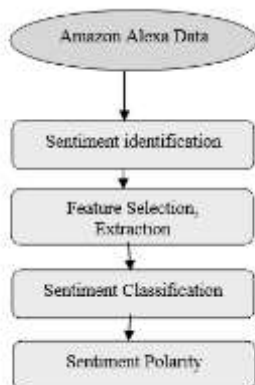

Fig 1: Process flow for sentiment analysis

II. DIFFERENT LEVELS OF SENTIMENT ANALYSIS

Sentiment analysis is often done at many degrees of granularity, which may be summarized as follows:
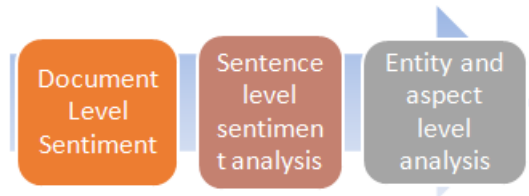

Fig 2: Levels of Sentiment Analysis

a. **Document level sentiment analysis:** The overall opinion of the document is determined through document sentiment analysis. It identifies the sentiment communicated by the entire document in addition to the sentiment orientation of individual sentences. The categorization is based on whether the sentiment is positive or negative [16]. Only if the document is about a single entity will this level analysis be useful. Because it expresses a single entity's point of view (E.g. Product, Person). The analysis that determines a document's polarity is done at the document level. It is a more challenging level than the others because as the number of words grows, the quantity of noise words increases, distorting learning and complicating polarity prediction[17].

b. **Sentence level sentiment Analysis:** Sentiment analysis at the sentence level is also known as subjectivity classification [18]. It distinguishes between subjective and objective knowledge. It treats each sentence as a distinct unit and predicts that each sentence will only include one point of view. It iterates over each statement, determining if the sentiment orientation is positive, negative, or neutral.

c. **Entity and Aspect level analysis:** Sentiment analysis at the entity and aspect level captures the range of emotions expressed in the review phrase. It does fine-grained sentiment analysis and distinguishes between what users genuinely want and what they don't want. One of the most distinguishing features of aspect level sentiment analysis is that it examines the opinion directly rather than the paragraph, sentence, phrase, or document. The purpose is to discover feelings about entities and their attributes. To put it another way, aspect level sentiment analysis focuses on a target (opinion) and a sentiment (positive or negative) [19].

III. METHODOLOGY

The research strategy is as follows: a brief overview of well-known feature selection methods and sentiment classification computations, as well as several relevant disciplines to sentiment analysis, are investigated. The dedication of these publications to these calculations is then highlighted, along with how they use these methods to address unusual difficulties in sentiment analysis. The primary goal of this research is to determine how sentiment analysis is applied to product evaluations. The following methods were employed in this study:

3.1 Random Forest

A supervised learning technique is the random forest classifier. It's a classifier that uses a huge number of decision trees on different subsets of data, with the majority of them being utilized to increase the model's accuracy. Random forest assembles predictions from individual trees and predicts ultimate output based on the majority votes of projections, relying on a single decision tree to some extent. The more trees in the forest, the more exact it becomes. It takes a short amount of time to train the additional algorithm. Even considering enormous datasets, it reliably predicts output and runs quickly. It can maintain accuracy even when a large amount of data is missing.

Random Forest is a method for supervised learning. It builds a forest out of a set of decision trees that have been refined through the bagging process. The main assumption behind the bagging technique is that combining different learning models improves overall performance [8].

Random forest is a well-known supervised learning technique that belongs to the machine learning category. Machine Learning is a term that refers to the study of Random forest is a classifier that enhances dataset prediction accuracy by averaging the outcomes of numerous decision trees across distinct dataset subsets [9]. In ensemble classification systems, learning techniques are used to create a group of classifiers instead of a single classifier, which then categorizes new data points by voting on their predictions. The majority of ensemble classifiers are used, including bagging, boosting, and random forest [10]. The random forest algorithm builds a forest of trees by mixing similar approaches, such as multiple decision trees. The RF technique may be used in both regression and classification applications. The RF classifier is a tree-structured set of classifiers. It's a more complicated type of bagging that considers unpredictability [11].

RF divides each node using the best split among a set of predictors randomly chosen at the node, rather than utilizing the top split among all variables. Each choice is considered as an independent predictor in a random forest method, which is a type of family set approach. The outputs include random subspace boosting, bagging, and randomization. [12]. RF is a sophisticated classification technique that can correctly categorize massive amounts of data. It's a classification and regression ensemble learning approach that generates a large number of decision trees during training and outputs a class (mode of classes) via different trees. [13]

3.2 SVM

SVMs are a machine learning classification approach that uses a kernel function to transfer a space of data points that are not linearly separable onto a new space that is, with allowances for erroneous classification. Burges (1998) and Cristiani and Shawe-Tailor (1998) provide tutorials on SVMs and information on their formulation (2000). Joachims (2001) [20] gives a thorough study of these models' application to text categorization.

3.3 Navie Bayees

It is a method to approach the following segments of the review that the customer provides such that the review contains several unwanted words such that the classifier is looking for the tag words such that the defined tag words in the vectors which are positive and negative such that there are several conditions to calculate the following probability of calculating the points to determines about the classification of the major review where there are several conditions to calculate the following probability of calculating the points to determines about the classification of the major review where there are several conditions to calculate the following

IV. FEATURE SELECTION AND EXTRACTION

It's vital to keep in mind that creating a classification model necessitates first identifying relevant dataset characteristics (Ritter et al. 2012). As a result, during model training, a review may be decoded into words and inserted to the feature vector. The technique is referred to as a "Uni-gram" when only one word is considered; a "Bi-gram" when two words are considered; and a "Tri-gram" when three words are considered. The combination of unigram and bigram is helpful for analysis (Razon and Barnden 2015); the context feature is helpful for getting the most accurate results. Pragmatic characteristics are those that place a greater emphasis on the use of words than on a methodological foundation. In linguistics and allied fields, pragmatics is the study of how context affects perception. The study of phenomena like as implicature, speech actions, relevance, and dialogues is known as pragmatics. Emojis are animated face expressions that are used to indicate emotions in sentiment analysis. Many different emoticons are used to represent a wide range of human emotions (Tian et al. 2017). Emoticons help in sentiment analysis by indicating a person's tone while writing a statement. Replace the emoticons with their meanings: Happiness, despair, and fury are among the feelings expressed in the review. Positive and negative feeling emotions are divided into two groups using emoticons. Negative emoticons are made up of negative emotions like melancholy, depression, and anger, whereas positive emoticons are made up of positive emotions like love, happiness, and joy. Punctuation marks, or exclamation marks, serve to highlight the force of a positive or negative remark. Similarly, the apostrophe and the question mark are other punctuation marks. Words in slang, such as lol and

rof. These are frequently used to introduce a sense of humor into a remark. Given the nature of opinion tweets, it is plausible to assume that a slang expression in the text suggests sentiment analysis. Substitute their meaning for the slang term. Punctuation marks, like exclamation marks, serve to highlight the force of a positive or negative remark. Similarly, the apostrophe and the question mark are other punctuation marks

Feature extraction

Feature extraction is an important operation in sentiment classification since it entails extracting relevant information from text input and has a direct influence on the model's performance. The method aims to extract useful information that captures the text's most important characteristics. Venugopalan and Gupta (2015) introduced other aspects because extracting features from the text is difficult. Punctuation is usually eliminated from text after it is lowered in the pre-processing step, but they utilized it to extract features, hashtags, and emoticons, which are among the most often used strategies for feature extractions described below. Frequency is a term that refers to It's one of the easiest methods to represent characteristics that are more commonly utilized in NLP applications for information retrieval, such as Sentiment Analysis. It considers a single word (unigram) or a set of two to three words (bigram and trigram), with the number of terms reflecting characteristics (Sharma et al. 2013). The existence of a term gives the word a value of 0 or 1. The integer value of term frequency represents its count in the provided document. For better results, TF-IDF may be utilized as a weighted system that measures the relevance of any token in a given text. For better results, TF-IDF may be utilized as a weighted system that measures the relevance of any token in a given text. Tags for parts of speech Grammatical tagging is the process of tagging a word in a text (corpus) based on its definition and context. Nouns, verbs, pronouns, adverbs, adjectives, and prepositions are all types of tokens. For example, "This mobile is incredible" may be labeled as follows: (Straka and colleagues, 2016) is:verb, amazing:adjective, this:determiner, mobile:noun An adjective is utilized more frequently in sentiment mining since it expresses the mood of the view. PoS taggers, which are available in NLTK or Spacy, can be used for this job. Stanford PoS-tagger is the most often used tool in research (Weerasooriya et al. 2016). Negations These are the words that may transform the meaning of a phrase and change or reverse the polarity of an opinion. Not, can't, neither, never, nowhere, none, and other negation terms are often employed. Because every word in the sentence does not change the polarity, deleting all negation words from stop-words may raise the computational cost and reduce the model's accuracy. Negative words require extreme caution (George et al. 2013). Negative words like not, neither, nor, and others are important in sentiment analysis because they can flip a phrase's polarity. "This movie is good." is a positive statement, whereas "This movie is not good." is a negative sentence. Unfortunately, some systems are ineffective. Unfortunately, some systems exclude negation words because they are included in stop word lists or are unintentionally removed since they have a neutral emotion value in a lexicon and have no effect on absolute polarity. Reversing the polarity, on the other hand, is more difficult since negation words can be in a phrase without affecting the text's emotional tone..

CONCLUSION

This survey article has an influence on the continuing research and development in sentiment analysis calculations and applications. These articles include commitments to a variety of feeling examination-related disciplines that make use of Sentiment analysis systems in real-world settings. After contrasting these studies, it's clear that the advancements of concept exploration computations are still a work in progress. These assumptions can provide data that can be included into an existing informal organization inquiry. Vocabulary-based methodologies can be used for assessment research to identify possibly radicalized clients and to highlight expressively charged content. Another approach that may be implemented is a thorough vocabulary-based approach to assessment mining. It should also be feasible to depict phrases and reports in an appropriate manner. Another strategy for approaching sentiment analysis is to use computational exploration. The most often used machine learning algorithms for dealing with sentiment categorization issues are Navie Bayes, Random Forest, and Support Vector Machines. In the choreographed assessment approach, the detailed lexicon and emotions list are accessorial to increase the precision of determining the inclination farthest point. To determine if the tweets are good, negative, or balanced Amazon evaluations.

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