**SENTIMENTAL ANALYSIS**

**A Project Report**

## *Submitted by*

Deep Patel (190303105018)

Jeel Patel (190303105064)

Pranav Pal(190303105493)

***In partial fulfillment for the award of***

***the degree of***

**Bachelor of Engineering**

in

## COMPUTER SCIENCE AND ENGINEERING

***Under the guidance of***

*Snr.Asst.Prof. Mridul Mishra.*



**Department of Computer Science and Engineering**

**Parul University, Vadodara**



**Parul University**

***Certificate***

This is to Certify that Project of 6th Semester titled “Sentimental Analysis” of Group No. 39 has been successfully completed by

Deep Patel (190303105018)

Jeel Patel (190303105064)

Pranav Pal (190303105493)

under my guidance in partial fulfillment of the Bachelor of Technology (B.TECH) in

Computer Science and Engineering of Parul University in the Academic Year 2021-2022.

**Project Guide Project Coordinator Snr.Asst.Prof. Mridul Mishra Asst.Prof. Khushali Mistry**

**Head of Department External Examiner**

**CSE**

**Dr. Amit Barve**

# ACKNOWLEDGEMENT

Behind any major work undertaken by an individual there lies the contribution of the people who helped him to cross all the hurdles to achieve his goal. It gives me immense pleasure to express my sense of sincere gratitude towards my respected guide Mridul Mishra Sir, Senior Assistant Professor for his persistent, outstanding, invaluable co- operation and guidance. It is my achievement to be guided under him. He is a constant source of encouragement and momentum that any intricacy becomes simple. I gained a lot of invaluable guidance and prompt suggestions from him during the entire project work. I will be indebted to him forever and I take pride in working under him.

I also express my deep sense of regard and thanks to Dr. Amit Barve, Professor and Head of CSE Engineering Department. I feel very privileged to have had their precious advice, guidance and leadership.

|  |  |  |
| --- | --- | --- |
| Place : Vadodara | Student Name | Enrollment No. |
| Date : 08-03-22 | Deep Patel | 190303105018 |
|  | Jeel Patel | 190303105064 |
|  | Pranav Pal | 190303105493 |
|  |  |  |

# ABSTRACT

Human Computer interaction is a very powerful and most current area of research because the human world is getting more digitised. This needs the digital systems to imitate the human behaviour correctly. Emotion is one aspect of human behaviour which plays an important role in human computer interaction, the computer interfaces need to recognize the emotion of the users in order to exhibit a truly intelligent behaviour.There is still a question on how to detect emotion from a text input. To solve this problem, this project generates an Emotion Recognition Model to extract emotion from text at the sentence level. Our method detects emotion from a text-input by using different deep learning algorithms like CNN, LSTM, SVM and HAN. The experiments show that the method could generate a good result for emotion detection from text input. To recognize emotion from text we have considered six emotions class such as joy, sadness, anger, love, fear, surprise).

Keywords: Emotion recognition ,NLP, CNN, LSTM, SVM, HAN

**TABLE OF CONTENTS**

[Acknowledgement i](#_gjdgxs)

[Abstract ii](#_30j0zll)

List of Symbol, Abbreviation and Nomenclature Table of Content v

Chapter: 1 Introduction

1.1 Overview 4

1.2 Problem Statement 5

1.3 Aim and Objective 5

1.4 Scope 5

Chapter: 2 Literature Survey 7-22

Chapter: 3 Process flow and Methodology

3.1 Implementation Project Flow 24

3.1.1 Step 1: Setting up developing environment 24

3.1.2 Step 2: Choosing your Dataset 24

3.1.3 Step 3: Processing your data 24

3.1.4 Step 4: Feature Extraction 27

3.1.5 Step 5: Training Our Models 28

3.1.6 Step 6: Testing 28

References 29

**Chapter: 2**

**Literature Survey**

***AIM: - Semantic-Emotion Neural Network for Emotion Recognition From Text***

**AUTHOR:-** ERDENEBILEG BATBAATAR , KEUN HO RYU , MEIJING LI

**PUBLISHER:-**IEEE , 2019

**INTRODUCTION:-** In the fields of artificial intelligence and human-computer interaction, emotion recognition has a bright future [16]. Face expressions , bodily movements , blood pressure , heartbeat , and textual information are some of the approaches used to detect emotions in humans. From an application standpoint, the detection of human emotions in a text is becoming increasingly relevant in computational linguistics. There is an immense amount of textual data on the internet nowadays. Extraction of emotion from various aims, such as those of business, is fascinating [17]. For example, in the case of luxury goods, emotional factors such as brand, personality, and prestige are far more important than technical, practical, or pricing considerations .

**CONCLUSION:-** This paper explored an emotion recognition method from text based on the combined network which consists of CNN based emotion encoder and BiLSTM based semantic encoder called SENN, a novel model is proposed and applied on ten real-world datasets.For the SENN model, BiLSTM is designed to capture contextual information and CNN is designed to extract emotional information effectively. Experimental results show that the SENN model outperforms most of the baseline methods and state-of-the-art approaches. Compared with traditional machine learning models, authors proved that deep learning based models outperformed the machine learning models as reported in previous studies. Logistic regression and support vector machine shows the comparative result using bag-of-word and tf-idf vectors. Compared with the state-ofthe-art models in emotion classification, SENN gives the best performance on nine out of ten datasets except Tales-Emotion dataset. It performs F1-scores of 84.8%, 51.1%, 61.3%, 74.6%, 91.0%, 56.3%,59.3%, 98.8% and 70.8% on real-world datasets.

***AIM:-*** ***Classification Model To Determine The Polarity Of Movie Review Using Logistic Regression.***

**AUTHOR:-** Priyanka HS , Ramya BV , Dr. Ashok Kumar

**PUBLISHER:-** International Research Journal Of Computer Science (IRJCS)

**INTRODUCTION:-** Making decisions plays a crucial role in human life; making good and proper decisions can improve our lives. Decisions can be founded on the opinions of others. When picking which movie to buy or see, individuals consult websites that offer reviews and ratings of the films. This forces individuals to make a decision about which film to buy or watch. People may have positive or negative feelings about the film, and they express their feelings through online review sites such as Amazon, BookMyShow, and others. People use reviews and ratings to help them decide which movies to watch or buy. Positive movie reviews are labelled as such, while unfavourable reviews are labelled as such. The term "good," "great," and "enjoyed" refers to a review that includes phrases like "good," "wonderful," and "enjoyed."

**CONCLUSION:-** In this paper, feature extraction has been done using bag of words specifically bi-grams, which has powerful impact on determining the polarity of the movie review. The model is then trained using logistic regression machine learning classification algorithm , which is showing the accuracy of 88% .When a new set of reviews are feed into the model the model will predict the polarity of the movie reviews. This can enhance the feature extraction process so that model can have more precise features and also by applying different machine learning classification algorithm, accuracy of the model can be improved.

***AIM:-*** ***Emotion Analysis: A Survey***

**AUTHOR:-** Nida Manzoor Hakak , Mohsin Mohd , Mahira Kirmani , Mudasir mohd

**PUBLISHER:-** Manipal University Jaipur , IEEE

**INTRODUCTION:-**. Emotional analysis is a crucial component of affective computing. "Computing" means to calculate or measure, while "affect" indicates emotion. Affective computing encompasses everything required to create devices or systems that process, recognise, interpret, and imitate human affects[18][19], allowing us to study human-machine interactions. This information can be in the form of text, voice, facial expressions, and so on. Analyzing the emotions and sentiments of various textual data over the Internet has its own significance; for example, we can measure a community's well-being, we can prevent suicides [20], and it can also be very useful for businesses to measure customer satisfaction by analysing the comments or feedback they provide.

**CONCLUSION:-** Upon reviewing the previous works in the domain of the emotion analysis, it was conclude that much of the work has been done in the field especially in the domain of textual datasets. The experimentation result of some of the works for various computational models with their overall system accuracy was high compared to other models. It was noted that there has been a significant improvement in the system accuracies over the time with the improvement or modification of traditional computational approaches, the lexical resources and the features generated.

***AIM:-*** . ***EmoTxt: A toolkit for emotion recognition from text***

**AUTHOR:-** Fabio Calefato , Filippo Lanubile , Nicole Novielli

**PUBLISHER:-** University of Bari , IEEE

**INTRODUCTION:-** Sentiment analysis is considered a critical task in a variety of application fields, including business, social well-being, politics, security, and software development [21]. Several off-the-shelf methods for categorising the sentiment polarity of an input text, that is, its positive, negative, or neutral semantic orientation, are currently accessible for free [22]. None of them, however, support the recognition of distinct emotions like joy, love, or hate. We provide EmoTxt, the first open-source toolbox for emotion identification from text, in this work. Researchers can use the toolkit to detect emotions in input text as well as train a bespoke emotion classifier from scratch using manually annotated data.

**CONCLUSION:-**

Its training approach leverages a suite of features that are independent of the theoretical model adopted for labeling the data. They provided empirical evidence that EmoTxt achieves comparable performance with different datasets. As future work, they planned to validate it on gold standards from different sources, to further assess the generality and robustness of the approach implemented.

***AIM:- A Corpus for Sentiment Analysis and Emotion Recognition for a Learning Environment***

**AUTHOR:-** Raúl Oramas-Bustillos, Maria Lucia Barron-Estrada, Ramon Zatarain-Cabada, Sandra Lucia Ramírez-Ávila.

**PUBLISHER:-** Technological Institute of Culiacan , Spain

**INTRODUCTION:-** To meet the requirement to integrate emotions into the teaching-learning process, many technologies have been developed. Intelligent Tutoring Systems (ITS) and Intelligent Learning Environments (ILE) are two technologies that were meant to record and detect users' emotions, yet most of these traditional systems only function with fundamental emotions [28]. Basic emotions such as anger, happiness, sadness, and fear have been examined by Ekman [29]. There are, however, emotions that arise during deep learning activities, which are referred to as emotions centred on learning [30]. Learning-related emotions are crucial in students because they affect several characteristics such as cognitive processing and information retention [31].

**CONCLUSION:-** The corpus generated with the ERAS system contains 851 textual opinions. The system remains available for more participants to express their opinions on educational resources. This model will helped Intelligent Tutoring Systems to detect emotions through text and make the teaching process more efficient for students, adjusting the content to the particular needs of each of them.

***AIM:-*** ***Emotion Recognition from Text Based on Automatically Generated Rules***

***Level Sensing.***

**AUTHOR:-** Shadi Shaheen , Wassim El-Hajj , Hazem Hajj , Shady Elbassuoni

**PUBLISHER:-** American University of Beirut , Lebanon

**INTRODUCTION:-** Emotion recognition is a difficult task for both people and technology. On the one hand, people may not always be able to perceive or express their own emotions.

Machines, on the other hand, require accurate ground truth for emotion modelling as well as advanced machine learning algorithms to construct emotion models. To recognise user emotions, hard sensing and soft sensing technologies have typically been used.

Sensors provide data sources related to emotion recognition, such as audio, gestures, eye gazes, and brain signals, using hard sensing methods [23-26]. Additional sensors, such as heart rate monitors, may be added to the user to offer personal physiological indications.

**CONCLUSION:-** In this work, authors introduced a new approach for classifying emotions from textual data based on a fine grained level. Their contribution lies in performing complex syntactic and semantic analysis of the sentence and using various ontologies such as Wordnet and ConceptNet in the process of emotion recognition. Syntactic and semantic analysis of the sentence makes their classifier context sensitive, while using Wordent and ConceptNet helps the classifier generalize the training set, which leads to better coverage of emotion rules.

***AIM:- Emotion Detection From Text Documents***

**AUTHOR:-** [SN Shivhare](https://scholar.google.com/citations?user=sQEvrD8AAAAJ&hl=en&oi=sra) , [SK Saritha](https://scholar.google.com/citations?user=gyu7KAgAAAAJ&hl=en&oi=sra)

**PUBLISHER:-** International Journal of Data Mining

**INTRODUCTION:-** Detecting emotional state of a person by analyzing a text document written by him/her appear challenging but also essential many times due to the fact that most of the times textual expressions are not only direct using emotion words but also result from the interpretation of the meaning of concepts and interaction of concepts which are described in the text document. Recognizing the emotion of the text plays a key role in the human-computer interaction [27]. Emotions may be expressed by a person’s speech, face expression and written text known as speech, facial and text based emotion respectively. Sufficient amount of work has been done regarding to speech and facial emotion recognition but text based emotion recognition system still needs attraction of researchers [28]. In computational linguistics, the detection of human emotions in text is becoming increasingly important from an applicative point of view.

**CONCLUSION:-** In this paper, existing research of emotion detection based on textual data is surveyed and limitations of existing methods are reviewed. System architecture is proposed to improve detection capabilities and perform the task efficiently. Proposed system by the authors is based on keyword spotting technique as well as having rich features of ontology. Not all the limitations of existing methods are overcome by this architecture but use of ontology improves the detection capability by applying semantic approach.

This model is based on keyword spotting technique, apart from that it also uses the concept of ontology. Use of ontology makes this model more efficient than other methods in recognizing emotions from text input. This has been created to overcome following limitations:

• Ambiguity in Keyword Definitions: The meanings of keywords could be 4 multiple and vague, as most of the words could change their meanings according to different usages and contexts.

• Incapability of Recognizing Sentences without Keywords: ”I passed my qualify exam today” and ”Hooray! I passed my qualify exam today” should imply the same emotion (joy), but the former sentence without “hooray” could remain undetected if ”hooray” is the only keyword to detect this emotion.

• Lack of Linguistic Information: Syntax structures and semantics also have influences on expressed emotions. For example, ”I laughed at him” and ”He laughed at me” would suggest different emotions from the first person’s perspective. As a result, ignoring linguistic information also poses a problem to keyword-based methods.

• Difficulties in Determining Emotion Indicators Learning-based methods can automatically determine the probabilities between features and emotions but the methods still need keywords in the form of features. The most intuitive features may be emoticons which can be seen as author’s emotion annotations in the texts.

***AIM:-*** ***Text Based Emotion Recognition: A Survey***

**AUTHOR:-** ECC Kao, [CC Liu](https://scholar.google.com/citations?user=2EWeXbAAAAAJ&hl=en&oi=sra), TH Yang, CT Hsieh

**PUBLISHER:-** IEEE

**INTRODUCTION:-** This paper is mainly focused on an overview of emotion detection from text and describes the emotion detection methods. These methods are divided into the following four main categories: keyword-based, Lexical Affinity method, learning based, and hybrid based approach. Limitations of these emotion recognition methods are presented in this paper and also, addresses the text normalization using different handling techniques for both plain text and short messaging language. This approach is easy to implement and intuitive since it involves identifying words to search for in text. These words are classified into categories such as disgust, sadness, happy, anger, fear, surprise etc. Existing system make use of plain text only. This paper describes the different text based emotion recognition methods and their limitations. The problems are faced by the emotion recognition system while processing raw text which contain both plain text and short messaging language. This paper addresses the existing different approaches for resolving processing of 5 raw textual data which contain combination of both plain text and short messaging language.

***AIM:- Sentiment Analysis of Twitter Data***

**AUTHOR:-** Apoorv Agarwal , Boyi Xie , Ilia Vovsha , Owen Rambow , Rebecca Passonneau

**PUBLISHER:-**Columbia University , New York

**INTRODUCTION:-** Microblogging websites have evolved to become a source of varied kind of information. This is due to nature of microblogs on which people post real time messages about their opinions on a variety of topics, discuss current issues, complain, and express positive sentiment for products they use in daily life. In fact, companies manufacturing such products have started to poll these microblogs to get a sense of general sentiment for their product. Many times these companies study user reactions and reply to users on microblogs. One challenge is to build technology to detect and summarize an overall sentiment.

In this paper, authors look at one such popular microblog called Twitter and build models for classifying “tweets” into positive, negative and neutral sentiment. They built models for two classification tasks: a binary task of classifying sentiment into positive and negative classes and a 3-way task of classifying sentiment into positive, negative and neutral classes.

They experimented with three types of models: unigram model, a feature based model and a tree kernel based model. For the feature based model they used some of the features proposed in past literature and propose new features. For the tree kernel based model they designed a new tree representation for tweets. At last they used a unigram model, previously shown to work well for sentiment analysis for Twitter data, as their baseline.

**CONCLUSION:-** They presented results for sentiment analysis on Twitter. Use previously proposed state-of-the-art unigram model as baseline and report an overall gain of over 4% for two classification tasks: a binary, positive versus negative and a 3-way positive versus negative versus neutral. They presented a comprehensive set of experiments for both these tasks on manually annotated data that is a random sample of stream of tweets and investigated two kinds of models: tree kernel and feature based models and demonstrate that both these models outperform the unigram baseline. For feature-based approach, they did feature analysis which reveals that the most important features are those that combine the prior polarity of words and their parts-of-speech tags. They tentatively concluded that sentiment analysis for Twitter data is not that different from sentiment analysis for other genres.

***AIM:-Sentiment Analysis Algorithms And Applications : A Survey***

**AUTHOR:-** [W Medhat](https://scholar.google.com/citations?user=59Wiuq8AAAAJ&hl=en&oi=sra), [A Hassan](https://scholar.google.com/citations?user=uyrs20AAAAAJ&hl=en&oi=sra), H Korashy

**PUBLISHER:-** Ain Shams engineering journal

**INTRODUCTION:-** This survey, which includes the most well-known SA approaches and applications in one research publication, may be valuable for newcomer researchers in this subject. This survey is unusual in that it categorises the numerous SA approaches in a way that other surveys do not. It also examines emerging relevant disciplines in South Africa that have recently piqued the interest of scholars, as well as the articles that go with them. Emotion Detection (ED), Building Resources (BR), and Transfer Learning are some of these fields (TL). Emotion detection seeks to extract and interpret emotions from phrases, which might be explicit or implicit. The goal of transfer learning, also known as cross-domain categorization, is to analyse data from one domain and then apply the conclusions to a different domain.[32] The goal of Building Resources is to create lexica and corpora in a variety of languages.in which opinion expressions are annotated according to their polarity, and sometimes dictionaries. In this paper, the authors give a closer look on these fields.

**CONCLUSION:-** This survey paper presented an overview on the recent updates in SA algorithms and applications. Fifty-four of the recently published and cited articles were categorized and summarized. These articles give contributions to many SA related fields that use SA techniques for various real-world applications. After analyzing these articles, it is clear that the enhancements of SC and FS algorithms are still an open field for research. Naïve Bayes and Support Vector Machines are the most frequently used ML algorithms for solving SC problem. They are considered a reference model where many proposed algorithms are compared to. The interest in languages other than English in this field is growing as there is still a lack of resources and researches concerning these languages. The most common lexicon source used is WordNet which exists in languages other than English. Building resources, used in SA tasks, is still needed for many natural languages.

***AIM: - Survey on Aspect-Level Sentiment Analysis***

**AUTHOR:-** Kim Schouten and Flavius Frasincar

**PUBLISHER:-** IEEE

**INTRODUCTION:-** The digital age, also referred to as the information society, is characterized by ever growing volumes of information. Moreover, information provided by individuals on the net is thought to be more trustworthy than information provided by the seller [39]. From a producers point of view, every body may be a potential customer. Hence, knowing their likes and dislikes is of great help in developing new products [40], in addition as managing and improving existing ones [41]. Furthermore, understanding how the data in, for instance, product reviews interacts with the data provided by companies enables the latter to require advantage of those reviews and improve sales. In fact, opinions on the net became a resource to be harnessed by companies, similar to the traditional word-of-mouth. Additionally to the current traditional producer/consumer model, sentiment analysis is additionally important for other economic areas, like for instance financial markets.

**CONCLUSION:-** From the overview of the state-of-the-art in aspect-level sentiment analysis presented in this survey, it was clear that the field is transcending its early stages. While in some cases, a holistic approach was presented that was able to jointly perform aspect detection and sentiment analysis, in others dedicated algorithms for each of those two tasks are provided. Most approaches that are described in this survey are using machine learning to model language, which is not surprising given the fact that language is a non-random, very complex phenomenon for which a lot of data is available. The latter is especially true for unsupervised models, which are very well represented in this survey.

***AIM:- A survey on sentiment analysis challenges***

**AUTHOR:-** Doaa Mohey El-Din Mohamed Hussein

**PUBLISHER:-** Faculty of Computers and Information, Cairo University, Cairo, Egypt

**INTRODUCTION:-** Sentiment analysis uses the natural language processing text analysis and computational techniques to automate the extraction or classification of sentiment from sentiment reviews. Hundreds of thousands of users depend on online sentiment reviews. 90% of customer’s decisions depended on online Reviews in April 2013.The main goal of analyzing sentiment is to analyze the reviews and examine the scores of sentiments. This analysis is divided into many documents level, sentence level, word/term level or aspect level. The sequence processes are of sentiment analysis evaluation and detection of the sentiment polarity.

The evaluation sentiment drawbacks that Reflected in language coverage. This paper summarizes keys of sentiment challenges with respect to the type of review structure. It also divides the challenges into two types to ease to deal with them and focus on the degree of accurate meaning. This research discusses these sentiment challenges, the factors affecting them, and their importance.

As a result a large number of studies and research have helped monitor the trending new research increasing year by year. The focus in this research, has been to achieve the most suitable challenges facing sentiment evaluation to be useful for researchers and facilitate their relationships.

**CONCLUSION:-** This survey discusses the importance and effects of sentiment analysis challenges in sentiment evaluation based on two com parisons among forty-seven papers. The first comparison is based on the relationship between the sentiment review structure and sentiment analysis challenges. The result of this comparison reveals another essential factor to recognize the sentiment challenges which is domain dependence. Moreover, the negation challenge became popular in all types of reviews structured just differs in implicit or explicit meaning

***AIM:- Music Sentiment and Stock Returns Around the World***

**AUTHOR:-** Alex Edmans, Adrian Fernandez-Perez, Alexandre Garel, Ivan Indriawan

**PUBLISHER:-** Journal of Financial Economics (JFE), Forthcoming

**INTRODUCTION:-**To measure music sentiment, we collect data from Spotify. [37] ranging from January 1, 2017, Spotify has released, per country, daily statistics of the top-200 songs by the overall number of streams. [38] A stream is counted in Spotify one time a song is played for a minimum of 30 seconds; thus, if may be a user “passively” listens to a song because it's suggested by Spotify or a part of a playlist but promptly skips it, it's not in our data. As of December 2020, Spotify provides data for 70 countries. We only select countries where Spotify data are available since January 1, 2017, and MSCI securities market indices are available from Refinitiv (formerly Thomson Reuters). This procedure leads to a complete sample of 40 countries over the sample period from January 1, 2017, to New Year's Eve, 2020.7 We identify over 58,000 unique songs with over 500 billion streams. On average, we have 8.6 million streams daily per country, with around 43,000 streams per song. In addition to the top-200 songs, Spotify also provides a metric of a song’s musical positivity referred to as valence. This metric is measured by Spotify’s music intelligence division, The Echo Nest, which was initially a groundwork spin-off from the MIT Media Lab and so acquired by Spotify in 2014. The Echo Nest assigned positivity scores to a sample of 5,000 songs, and so used machine learning to form an algorithm that's then applied to the remainder of [37] Readers and seminar audiences have suggested additional measures of mood sentiment to supplement the Spotify data, but none seem suitable. Record sales are less suitable because they're partly driven by a replacement record becoming available (e.g., if it's by an artist the purchaser likes) instead of sentiment; additionally, most current music consumption occurs through streaming instead of purchases. Ticket sales similarly are driven by when tickets are released (because popular concerts often sell out) instead of sentiment. Airplay is driven by the selection of the station, instead of a full of life listening choice by the individual.

**CONCLUSION:-**This study introduces a novel measure of investor sentiment, which captures actual sentiment rather than shocks to sentiment. Our main result is a positive and significant relation between music sentiment and contemporaneous market returns, controlling for world market returns, seasonality, and macroeconomic variables. We also find a significant price reversal the following week. Taken together, our findings are consistent with sentiment-induced temporary mispricing that subsequently reverses. We show that the relationship between music sentiment and market returns is stronger when countries implemented trading restrictions such as short-sale bans during the COVID-19 pandemic, consistent with greater limits to arbitrage. Music sentiment also predicts increases in net mutual fund flows and decreases in government bond returns, and absolute sentiment precedes a rise in stock market volatility. Overall, our study provides evidence that a proxy for the actual sentiment of a country’s citizens is significantly correlated with asset prices.

***AIM:-*** ***Sentiment analysis: A combined approach***

**AUTHOR:-** Rudy Prabowo , Mike Thelwall

**PUBLISHER:-** School of Computing and Information Technology, University of Wolverhampton Wulfruna Street

**INTRODUCTION:-** The sentiment found within comments, feedback or critiques provide useful indicators for several different purposes. These sentiments are often categorised either into two categories: positive and negative or into an n-point scale, e.g. very good, good, satisfactory, bad, very bad. during this respect, a sentiment analysis task are often interpreted as a classification task where each category represents a sentiment. Sentiment analysis provides companies with a method to estimate the extent of product acceptance and to work out strategies to enhance product quality. It also facilitates policy makers or politicians to analyse public sentiments with reference to policies, public services or political issues. This paper presents the empirical results of a comparative study that evaluates the effectiveness of various classifiers, and shows that the employment of multiple classifiers during a hybrid manner can improve the effectiveness of sentiment analysis. The procedure is that if one classifier fails to classify a document, the classifier will pass the document onto the following classifier, until the document is classed or no other classifier exists.

**CONCLUSION:-** The use of multiple classifiers in a hybrid manner can result in a better effectiveness in terms of micro and macro-averaged F1 than any individual classifier. By using a Sentiment Analysis Tool, we can apply a semi-automatic, complementary approach. The induction algorithm can generate a set of induced antecedents that are too sparse for a deeper analysis. Therefore, in a real-world scenario, it is desirable to have two rule sets, one is the original set, and another one is the induced rule set.

***AIM:- Sentiment analysis: A review and comparative analysis of web services***

**AUTHOR:-** Jesus Serrano-Guerrero , Jose A. Olivas a , Francisco P. Romero a , Enrique Herrera-Viedma

**PUBLISHER:-** Department of Computer Science and Artificial Intelligence, University of Granada, 18071 Granada, Spain

**INTRODUCTION**:- Sentiment Analysis, also called Opinion Mining, is one in all the foremost recent research topics within the sector of knowledge. Processing. Textual information retrieval techniques are mainly focused on processing, searching or mining factual information. Facts have an objective component; however, there are other textual elements which express subjective characteristics. These elements are mainly opinions, sentiments, appraisals, attitudes, and emotions, which are the main focus of Sentiment Analysis [33]. All of them are closely related, however, they present slight differences. This fact involves the birth of the many related tasks during this new research field, like opinion mining, subjectivity analysis, emotion detection or opinion spam detection, among others. Sentiment Analysis offers many opportunities to develop new applications, especially because of the massive growth of obtainable information in sources like blogs and social networks. for instance, recommendations of things proposed by any recommender system may be computed taking into consideration aspects like positive or negative opinions about those items.Review- and opinion-aggregation websites could collect information from different sources so as to summary or compose an opinion a couple of candidate, product, etc., thus replacing systems which require explicitly opinions or summaries. Question answering systems represent another field where opinions play a vital role. Detection of opinion-oriented questions and possible answers, and its treatment are essential to compute good answers. Detection of subjective information is de facto important in fields associated with argumentation where objective sentences are usually more valuable. But certainly, one of the most important fields where Sentiment Analysis encompasses a greater impact is within the industrial field. Small and massive companies, as well as other organizations such as governments, desire to know what people say about their marques, products or members[34,35,36].

**CONCLUSION**:- This work presents a detailed review of 15 web services which include functionalities related to Sentiment Analysis. Some of these services belong to private companies, but even so, they allow restricted free access to their functionalities, and the others are totally free services. This fact is interesting to those users who desire to include Sentiment Analysis capabilities within their own platforms without having to develop their own algorithms; hence, these tools are especially interesting for researching purposes and rapid prototyping.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Title | Method | Advantages | Limitations | Future Work |
| [1] | Emotion model | Detect the presence/absence of a given emotion based on the labels. | Identify a robust technique for extracting this contextual information from text. | It will create structured data out of free text content. |
| [2] | Feature extraction and Classification using Machine learning approach | Machine learning allows computers to learn new tasks without being expressly programmed to perform them | One drawback of feature extraction is that the new features generated are not interpretable by humans. | Enhance the feature extraction process so that model can have more precise features and also by applying different machine learning classification algorithm, accuracy of the model can be improved. |
| [3] | Analyze the human and machine interactions | - Expression of emotions  -The various emotional models.  -Data sets  -The various computational approaches in emotion detection | Text emotion analysis introduces some challenges in our work in the sense that emotions and the ways to express these emotions are all subjective. | The machine learning approach relies on machine learning algorithms that can learn from data by making use of linguistic features of text. |
| [4] | Measured using a tool which is developed | The training approach implemented by EmoTxt is independent of the classification framework and learns how to detect the presence/absence of a given emotion based on the labels. | Tone can be difficult to interrupt and even more difficult to figure out in written words. | plan to validate it on gold standards from different sources, to further assess the generality and robustness of the approach implemented. |
| [5] | Corpus  Pre-Processing  Transformation  Classification  Evaluation | Microblogging platforms are used by different people to express there opinion about different topics. | Social organization may ask peoples opinion on current debates. All these information can be obtained from microblogging services and there opinion s and many aspects of there life | Corpus will be used later for the administrator of an Intelligent Learning Environment to make decisions about the relevance of the educational resources contained in the system and to propose changes or improvements. |
| [6] | Keyword based detection  Learning based detection  Hybrid detection | Better coverage of emotion rules as we use Wordent and ConceptNet | A major issue identified is the necessity to propose a robust technique for extracting this contextual information from text. | This article presents open issues and future research directions for researchers in the domain of text-based ED. |
| [7] | Opinion mining | Emotion detection can be seen as important field in human computer interaction to detect emotions from facial and audio information | Sometimes it is not able to detect and recognize types of feelings through the expression of text. | It will create structured data out of free text content. |
| [8] | Case-Based Reasoning  And Emotion model | Validate psychological theories via objective computer programs, and applications such as artificial pets may participate in blogs with the input of masters’ emotion states from texts. | Ambiguity in Keyword Definitions  Incapability of Recognizing Sentences without Keywords | Emotion detection from texts will be  refocused as an important research issue in affective  computing. |
| [9] | -Create a twitter sentiment analysis model  -Choose a model type  -Decide what type of classification you’d like to do  -Import your twitter data. | It allows you to keep track of words being said about your service on social media. | It is difficult to analyze whether the given information Is fake or not. | If there is fake news then Twitter data sentimental will be able to detect it before posting online. |
| [10] | Opinion Mining (OM) | Semantic methods can be mixed with the statistical methods  to perform SA | The uses of hybrid methods are not yet frequent  because its computational complexity is higher | Using TL techniques, we  can use related data to the domain in question as a training data.  Using NLP tools to reinforce the SA process has attracted  researchers recently and still needs some enhancements. |
| [11] | Opinion mining | Aspect level sentimental analysis yields very fine grind sentiment information which can be useful for other applications in various domains | Sarcasm emojis  idioms | IT will help companies automatically solve and analyze customer data |
| [12] | - | - | - | The future work is the expansion of the comparison circle larger with the new research continuously. |
| [13] | Audio Valence | Capture the extent to which events affect investor mood | Combat negative sentiment by playing an upbeat song | Study the impact of sentiment on volatility, mutual fund flows, and government bond indices, also helping to ensure out-of-sample validity and greater generalizability. |
| [14] | Multiple classifiers such as GIBC RBC SBC, etc. | The use of multiple classifiers in a hybrid manner can result in better effectiveness in terms of micro and macro averaged. | public services or political issues | Sentiment analysis provides companies with a means to estimate the extent of product acceptance and to determine strategies to improve product quality |
| [15] | Opinion mining | It is one of the most studied research field which aims to analyze peoples sentiments, emotions, attitude. Etc. towards topics or products | NLP techniques are always necessary to achieve good results. | researching purposes and rapid prototyping |

**References**

[1]M. Li E. Batbaatar and K. H. Ryu. Semantic-emotion neural network for emotion recognition from text. *IEEE Access*, 2019.

[2]Dr. Ashok Kumar R Priyanka H S, Ramya B V. Classification model to determine the polarity of movie review using logistic regression. *International Research Journal of Computer Science (IRJCS)*, 2019.

[3] Mahira Kirmani Mudasir mohd Nida Manzoor Hakak, Mohsin Mohd. *Emotion Analysis: A Survey*. International Conference on Computer, Communications and Electronics (Comptelix)Manipal University Jaipur, Malaviya National Institute of Technology Jaipur and IRISWORLD, 2017.

[4]F. Lanubile F. Calefato and N. Novielli. In *EmoTxt: A toolkit for emotion recognition from text*, 2017.

[5]R. Zatarain-Cabada R. Oramas-Bustillos, M. L. Barron-Estrada and S. L. Ram´ırez-Avila. A corpus for sentiment analysis and´ emotion recognition for a learning environment. 2018.

[6]H. Hajj S. Shaheen, W. El-Hajj and S. Elbassuoni. Emotion recognition from text based on automatically generated rules. *IEEE International Conference on Data Mining Workshop, 2014*, 2014.

[7]S. N. Shivhare and S. K. Saritha. Emotion detection from text documents. In *International Journal of Data Mining and Knowledge Management Process*, 2014.

[8]Chetan R. Chopade. Text based emotion recognition: A survey. *International Journal of Science and Research (IJSR)*, 2013

[9] Agarwal, A., Xie, B., Vovsha, I., Rambow, O. and Passonneau, R.J., 2011, June. Sentiment analysis of twitter data. In Proceedings of the workshop on language in social media (LSM 2011) (pp. 30-38).

[10]Medhat, W., Hassan, A. and Korashy, H., 2014. Sentiment analysis algorithms and applications: A survey. Ain Shams engineering journal, 5(4), pp.1093-1113.

[11]Schouten, K. and Frasincar, F., 2015. Survey on aspect-level sentiment analysis. IEEE Transactions on Knowledge and Data Engineering, 28(3), pp.813-830.

[12]Hussein, D.M.E.D.M., 2018. A survey on sentiment analysis challenges. Journal of King Saud University-Engineering Sciences, 30(4), pp.330-338.

[13]Edmans, A., Fernandez-Perez, A., Garel, A. and Indriawan, I., 2021. Music sentiment and stock returns around the world. Journal of Financial Economics.

[14]Prabowo, R. and Thelwall, M., 2009. Sentiment analysis: A combined approach. Journal of Informetrics, 3(2), pp.143-157.

[15]Serrano-Guerrero, J., Olivas, J.A., Romero, F.P. and Herrera-Viedma, E., 2015. Sentiment analysis: A review and comparative analysis of web services. Information Sciences, 311, pp.18-38.

[16] P. Rodriguez, A. Ortigosa, and R. M. Carro, ‘‘Extracting emotions from texts in e-learning environments,’’ in Proc. 6th Int. Conf. Complex, Intell., Softw. Intensive Syst., Jul. 2012, pp. 887–892

[17] A. Jamshidnejad and A. Jamshidined, ‘‘Facial emotion recognition for human computer interaction using a fuzzy model in the e-business,’’ in Proc. Innov. Technol. Intell. Syst. Ind. Appl. (CITISIA), Jul. 2009, pp. 202–204.

[18] Rosalind W. Picard-Affective computing: MIT Press Cambridge, MA, USAc, (1997).

[19] A Calvo and Senior Member-Affect Detection: An Interdisciplinary Review of Models, Methods, and Their Applications. IEEE Transactions on Affective Computing, 1(1):18–37, (2010).

[20] Bart Desmet and V´eronique Hoste- Emotion detection in suicide notes. Expert Systems with Applications, 40(16):6351–6358, November, (2013).

[21] P. Basile, V. Basile, M. Nissim, N. Novielli, V. Patti. “Sentiment Analysis of Microblogging Data”. To appear in Encyclopedia of Social Network Analysis and Mining, Springer. In press.

[22] M. Thelwall, K. Buckley, G. Paltoglou. “Sentiment strength detection for the social web”. J Am Soc Inf Sci Technol 63(1):163–173, 2012

[23] Zahra Khalili, and Mohammad Hasan Moradi. "Emotion recognition system using brain and peripheral signals: using correlation dimension to improve the results of EEG." Neural Networks, 2009. IJCNN 2009. International Joint Conference on. IEEE, 2009.

[24] Jeffrey F. Cohn, and Gary S. Katz. "Bimodal expression of emotion by face and voice." Proceedings of the sixth ACM international conference on Multimedia: Face/gesture recognition and their applications. ACM, 1998.

[25] Liyanage C. De Silva, and Pei Chi Ng. "Bimodal emotion recognition." Automatic Face and Gesture Recognition, 2000. Proceedings. Fourth IEEE International Conference on. IEEE, 2000.

[26] Torao Yanaru, "An emotion processing system based on fuzzy inference and subjective observations." Artificial Neural Networks and Expert Systems, 1995. Proceedings., Second New Zealand International Two-Stream Conference on. IEEE, 1995

[27] R. Cowie, E. Douglas-Cowie, N. Tsapatsoulis, G. Votsis, S. Kollias, “Emotion recognition in humancomputer interaction,” in IEEE Signal Processing Magazine, vol. 18(1), Jan. 2001, pp. 32-80, doi: 10.1109/79.911197

[28] Nicu Sebea, Ira Cohenb, Theo Geversa, and Thomas S. Huangc “Multimodal Approaches for Emotion Recognition: A Survey”, USA

[29] S. D’Mello, T. Jackson, S. Craig, B. Morgan, P. Chipman, H. White,... & A. Graesser, “AutoTutor detects and responds to learners affective and cognitive states”, in Workshop on emotional and cognitive issues at the international conference on intelligent tutoring systems, pp. 306-308, 2008. [30] P. Ekman, “An argument for basic emotions”, Cognition and Emotion, vol. 6, pp. 169-200, 1992. [31] R. S. Baker, S. K. D'Mello, M. M. T. Rodrigo, & A. C. Graesser, “Better to be frustrated than bored: The incidence, persistence, and impact of learners' cognitive affective states during interactions with three different computer-based learning environments”, Int. J. Hum.-Comput. Stud., 68(4), pp. 223-241, 2010. [4] S. D’Mello, & A. Graesser, “Dynamics of affective states during complex learning”, Learning and Instruction, 22(2), pp. 145-157, 2012

[32] Mikalai Tsytsarau, Themis Palpanas Survey on mining subjective data on the web ,Data Min Knowl Discov, 24 (2012), pp. 478-514

[33] B. Liu, Sentiment analysis and subjectivity, Handbook Nat. Lang. Process. 5 (1) (2010) 1–38

[34] M. McGlohon, N. Glance, Z. Reiter, Star quality: aggregating reviews to rank products and merchants, in: Proceedings of Fourth International Conference on Weblogs and Social Media (ICWSM), 2010, pp. 114–121.

[35] A. Tumasjan, T.O. Sprenger, P.G. Sandner, M. Isabell Welpe, Predicting elections with twitter: What 140 characters reveal about political sentiment, in: Proceedings of International Conference on Weblogs and Social Media (ICWSM-2010), 2010, pp. 178–185.

[36] B. Chen, L. Zhu, D. Kifer, D. Lee, What is an opinion about? Exploring political standpoints using opinion scoring model, in: Proceedings of AAAI Conference on Artificial Intelligence (AAAI-2010), 2010, pp. 1007–1012

[37]Baker, S. R., Bloom, N., Davis, S. J., 2016. Measuring economic policy uncertainty. Q. J. Econ.131, 1593–1636.

[38]Ben-Rephael, A., Kandel, S., Wohl, A., 2011. The price pressure of aggregate mutual fund flows. J. Financial Quant. Anal. 46, 585–603.

[39] B. Bickart and R. M. Schindler, “Internet forums as influential sources of consumer information,” J. Interactive Marketing, vol. 15, no. 3, pp. 31–40, 2001.

[40] E. van Kleef, H. C. M. van Trijp, and P. Luning, “Consumer research in the early Stages of new product development: A critical review of methods and techniques,” Food Quality Preference, vol. 16, no. 3, pp. 181–201, 2005. SCHOUTEN AND FRASINCAR: SURVEY ON ASPECT-LEVEL SENTIMENT ANALYSIS 827

[41] B. Pang and L. Lee, “Opinion mining and sentiment analysis,” Found. Trends Inf. Retrieval, vol. 2, no. 1-2, pp. 1–135, 2008.