**A MODERN APPROACH TO SENTIMENT ANALYSIS IN BIG DATA: METHODS, TOOLS, APPLICATIONS, AND OPEN CHALLENGE**

**Sentiment analysis**

Sentiment analysis which is also alluded to as opinion mining is the branch of knowledge that scrutinizes mankind’s point of view, emotions, sentiments, assessments, and attitude behind a body of text or kindred with big data. It illustrates a massive problem scope. opinion mining, opinion extraction, sentiment mining, subjectivity analysis, emotion analysis, and review mining are the different titles and obscurely different tasks of sentiment analysis. Determining and categorizing opinions about a product, service, or idea sentiment analysis might be an approachable way for organizations.

Pre-eminence of sentiment analysis in big data

The expressions positive and negative take a predominant part every day. Indeed, positive feedback is a confidence booster that shows people you value them. To steer you back on the right path negative feedback helps. The process of descrying positive or negative sentiment in the text is known as sentiment analysis. To get a clear picture of what the user end thinks, feedback on the product is vital. Imagine devoting your weekend to your family, usually, the first and foremost item on your list would be a movie, as people always want things to be worth it when they spend their money and time what they do next is search for the review of the movie, and after that, you compare and decide which one to buff. Limited sources of user feedback data are available if talking about a product’s review. For data sources, we could peer deeper into shopping portals like Amazon, Alibaba, Flipkart, Myntra, etc. among other social media platforms like Twitter, Twitch, and Facebook. Sentiment Analysis helps to decipher the mood and emotions of the public and gather insightful information regarding the context.

1. **Levels**

Within several levels sentiment analysis has been investigated: Document Level, Sentence Level, Phrase Level, and Aspect Level.

**Document-level:** Sentiment analysis of the document level is performed throughout the document, and one variation is provided throughout the text. This type of emotional analysis is not widely used. To classify a book as positive, negative, or neutral this level could be a beginner one. In this way, both supervised and unchecked reading levels can be used to separate text. Sentiment analysis of different domains and different languages ​​are two of the most important issues in analyzing the emotions of a documentary approach. Domain-specific emotional analysis shows astonishing accuracy while it remains highly sensitive to the domain. For this level, the feature vectors are needed which are limited and define a domain. The input features of the predicting machine learning model are represented by the feature vector.

**Sentence level:** Here, each sentence is determined and analyzed by the correlating polarity. This is especially useful if the document has a wide range and a wide range of emotions associated with it. This level of classification is associated with the classification. The variety of each sentence will be determined independently using the same levels as the document level but with larger training data and processing resources. The differences in each sentence can be combined to get the feel of the document to be used individually.

**Phrase level:** Sentiment analysis is also done when the words of ideas are drafted in the form of sentences and will be divided into categories. Each phrase may contain more than one element. This may be a useful product review for many lines as it is recognized that one element is expressed in a sentence. It has been a hot topic for researchers in recent times. Although textual analysis focuses on classifying the whole document as self-centered, good, or bad, analyzing sentence structure has great benefits, as the document contains both positive and negative statements. The word is the most basic part of language, its diversity is closely related to the subjugation of the sentence or document from which it originates. A sentence that contains an adjective has a greater chance of being a straight sentence. Furthermore, the term chosen to represent represents the mathematical characteristics of individuals, such as gender and age, as well as their desire, social status, and personality, other psychological and social factors. As a result, the term serves as the basis for the emotional analysis of the text.

**Aspect level:** Sentiment analysis is also done in the form of an aspect. Each sentence may contain many elements, therefore, analyzing the emotions of the Aspect level. The focus is on all the elements used in the sentence and assigns variation in all aspects after which the aggregate sentiment is calculated across the sentence.

1. **Methods**

In this section, we confer on the methods involved in Sentiment analysis.

1. KEYWORD-BASED METHOD

This method classifies text based on the presence of positive or negative words such as happiness, joy, happiness, sadness, sadness, shock, and indifference. The main drawback of keyword-based segregation is the inability to firmly differentiate opposing words and polarity, as this approach depends on more factors. Another drawback is that this method is based on the obvious presence of positive or negative polarity. Occasionally, however, a post may convey a feeling or an idea in a lower sense than the obvious variation in words.

1. LEXICON-BASED METHOD

Dictionary-based methods create a list of automatically labeled words that have both positive and negative polarity, and the polarity effect of each word is constructed. This built-in dictionary is used to calculate the full range of sentiments of a post or text. A significant advantage of the lexicon-based method is that these methods do not require training data. The lexicon-based approach is widely used in general texts such as reviews, forums, and blogs. For the enormous amounts of data published on social media websites, this method is less likely to be used. The main reason is the irregular format and nature of social media websites. Although this method exceeds the keyword separation, it still has its drawbacks. As it works at the word level, discarded posts and descriptive posts mislead lexicon polarity score estimates. Second, lexicography and polarity schools tend to be biased toward texts of some kind, cited by the source of the linguistic organization. Therefore, it is challenging to build a standard model regardless of application background.

1. MACHINE LEARNING-BASED METHOD

Machine learning research has become an important activity in many workplaces. Machine learning in recent years has been wonderfully designed with high-volume data management algorithms to solve real-world problems. The machine learning algorithms collected were supervised learning as well as non-supervised learning algorithms. Supervised learning algorithms would help the end-users to train and learn from a training model that is re-evaluated and analyzed using test data. The main answer to the supervised machine learning algorithms is the obligation to create a training model. The training model must be sufficient to make the algorithm operational and reliable enough to separate the sample into test data. One more type of machine learning algorithm is an unsupervised learning algorithm. The working principle of this algorithm is to identify hidden entities in unwritten data. Supervised learning methods are based on calculating similarity differences between data. For example, it calculates k-methods in which similarities between data are calculated based on proximity measurements, such as the Euclidean distance.

**Tools**

In this area, we would be indulging in the various available tools in sentiment analysis

1. Brandwatch
2. Critical Mention
3. Lexalytics
4. Repustate
5. Talkwalker
6. Sentiment analyser
7. Social Mention

**A. Brandwatch**

The "photo detail" tool which could identify images related to your product is the most considerable tool of Brandwatch. For example, suppose you upload a logo for your product. Brandwatch uses the web to find images that embody that logo. Then, blend the images into a list and highlight where your product logo comes from.

Additionally, the Brandwatch software provides exciting information on every image we receive. This includes metrics like spoken volume, integrated fans, and recent activity. With Brandwatch, your team sees where your product images come from and how those images work with your target audience.

**B. Critical Mention**

Keywords are different from the other options in this list because they analyze news and other publications that refer to your business. This way, you can see the feelings behind the immediately visible news in the community. With news coverage now becoming a 24/7 issue, it helps to have software that can monitor the internet and warn you of any buzz your business is doing.

Critical Mention can alert you to news reports on television. You can search through video files to find out about your company and easily paste videos to share with other employees. If your business has a good reputation in live streaming, quickly access the video section and share it on your social media channels. This can help you to create effective online content that takes advantage of timely marketing opportunities.

**C. Lexalytics**

Lexalytics provides a text analysis tool focused on explaining why a customer responds to your business in a certain way. It uses natural language processing to analyze text and then uses emotional analysis to determine the purpose of a customer message. In the end, Lexalytics finishes the process by combining the information it receives from the user into an easy-to-read and shared display. While many emotional analysis tools tell you how customers feel, Lexalytics distinguishes itself by telling you why customers feel the way they do.

**D. Repustate**

Repustate has a sophisticated text analysis API that validly assesses the emotions behind a client's responses. Its software can take short and slang forms of text like ROFL, LOL, or SMH. It also analyzes emojis and determines their purpose within the context of the message. For example, if I use ;( emoji, Repustate predicts, if that is a good or negative sign based on what it finds in every conversation. A language filter that might be specific to your industry could be customized in Repustate API. If there is a slang word or different meanings of words, you can edit those secrets into the Repustate program. This way you have full control over how the software analyzes your customers' responses.

**E. Talkwalker**

A large customer service platform is associated with “Talkwalker Quick search”. This tool works best with your social media channels because it can tell you exactly how people feel about your company accounts on social media. Quick Search looks at comments, comments, engagements, and other data to give your team a broader understanding of how customers respond to your social media activity. This helps your team plan and produce effective campaigns that attract your target audience.

**F. Sentiment analyser**

Working with Sentiment Analyzer is a breeze. Just navigate to their site, copy the text you want to analyze, and paste the text into the box. Select "Update!" and the website will check your text and give you an "emotional school."

While that may sound mystic, Sentiment Analyzer uses "computer languages ​​and text mining" to determine the emotions behind your piece of text. He then compiles and compares his findings to produce a complete score. This makes it a great tool for companies who want to quickly clarify the purpose behind confusing feedback from the customer.

**G. Social Mention**

Social Mention is a free social media analysis tool that gives users one of the best bangs for their money. First, users are not required to create an account or download software. Instead, you just need to navigate to their site and search for your keyword as you would with any search engine. When you submit your search, Social Mention pulls data about your keyword from all social networking sites and is compiled it into a comprehensive summary.

This summary is not new either. It can tell you useful things like the number of people who speak well of your keyword compared to those who speak badly of you. It can also tell you what percentage of people are likely to keep saying your keyword and how popular your brand is on social media. While you may not be able to analyze individual data fragments, Social Mention is a great way for people who want to get a glimpse of their social media reputation.

1. **Applications**

In this section, we discuss the numerous applications of Sentiment analysis using big data

* **Sentiment analysis in business as business intelligence**

Business information can help achieve a competitive edge when you start using the information on your product and processes within the company. Sentiment analysis could help you find this information and understand what your customers want in your product. To use it properly, you need to understand what emotions are used in the analysis and how to analyze emotions to benefit the cause. Predicting future market conditions is one of the major factors to be done nowadays in a competitive business environment. Business intelligence is something that is of complete corporate knowledge and understanding of features, both within and outside the organization. This affects the company's ability to increase revenue growth, efficiency, market share, and overall profitability. The real basis for business intelligence is data. Data-driven solutions help in driving strategies using real, past, and present facts and statistics. By using data processing, your business can create solutions and make changes in those areas of the business that would have a greater impact on achieving business objectives. But data is only one part of the story. The true art of big data lies in its ability to use the technology to uncover important details which were buried in random internal and external data. To uncover the information, the company must find the fastest and most accurate way to obtain important information, wherever it is stored, and analyze the patterns and trends that enable it to better predict future market conditions. Instead of the traditional manual methods, using AI Business Intelligence makes the process automatic for you which is also uncomplicated. The easiest way to achieve this is through AI Business Intelligence where creative thinking helps businesses to organize and search their data in a meaningful way. By hearing customers’ voices you could make the best business decisions possible.

**How does semantic business search help find business information?**

Browse people, companies, genres, products, and locations with the click of a button. Semantic Enterprise Search (SES) was developed to overcome the greatest challenge in today's Big Data. To help businesses and governments to discover important business information which is buried deep can be quickly and accurately handled by SES. Semantic Search APIs for Business uses machine learning models to find all organizations and topics in corporate text data. This allows its information providers to search the documents mathematically or based on the context in which the data resides. By using our business intelligence search engine, businesses will be able to search for people, companies, genres, products, locations, and anything else they can think of at the click of a button. Using the native language search interface, you can search for your content mathematically instead of the usual keyword and boolean method which is more time-consuming and can waste valuable resources. Like our multilingual emotional analysis, our smart search understands more than 20 languages ​​including English, Spanish, French, and Arabic. By using Semantic Enterprise Search, you have all the important business details of your organization effortlessly accessible to your hands.

**How can emotional analysis help you understand your business details?**

We live in a customer-focused business world so drive the business into a multi-channel economy. To be truly successful in today's marketplace, companies need to know the feelings, thoughts, and behaviors of their customers. Using a business intelligence semantics model will help you run a business in a multi-channel economy, a business needs to know the business feelings of its customers so that it provides them with as much personal and advanced product information as possible. To begin to better understand customers, the company needs to have an emotional analysis as part of the context strategy and appropriate technology to begin discovering and analyzing the information found in the text, texts where customers express their feelings and opinions on topics such as the type, price, quality, service and support, customer, information, etc. Whether customers are neutral, hesitant, or confident about the various aspects of your business, knowing how your customers feel can help you make the right decisions and the necessary changes to make it a real business growth.

* **Sentiment analysis in healthcare as the patient voice**

A health care survey by the Health University of Utah predicted that the first and foremost barrier to providing an outstanding patient experience is not granting enough time to patients. According to the survey, Patients seek to be heard than spending time with their providers. As clinicians provide a surplus of time to patients related to medical care, they find it difficult to allot time for patients’ mental needs. How can we remove barriers and create an environment for clinicians to know better and understand their patients? We could try a completely electronic health record in the hospitals instead of clinicians spending their time and energy, feasibly they would simply feel less rushed.

**Patient voice**

To improve safety and quality of care, and patient experience, the healthcare industry analysis patient feedback, this phenomenon is known as patient voice. Patients’ feedback opinions and feelings are captured using sources such as post-appointment service in clinic questionnaires, feedback web forms, and phone calls. Health care providers are exploring the best methods to understand the patient voice and evaluate their service quality to offer a more positive patient experience. The practice of the healthcare industry that analyzes patients’ feedback, and experience, and how those connect to the medical treatment patients receive and take efforts to improve at all costs is known as Patient voice. Many organizations such as clinics, hospitals, and doctor's offices take this data and analyses it to improve safety, quality of care, and patient experience. Patient feedback, opinions, and feelings are represented using sources such as in-clinic questionnaires, post-appointment surveys, phone calls, and feedback web forms. To offer a more positive patient experience healthcare providers are looking for the foremost methods to recognize the patient voice.

Health care providers understand the importance of analyzing a patient's response, and how it can improve their knowledge of care efforts. Yet many organizations rely on slow and ambiguous methods to extract the data they need to better understand what their patients are trying to say.

By measuring information on new Patient Voice systems, communities such as hospitals, and even health insurance companies, can get valuable information on where they are doing good work in their organization, and where they may need a particular job. In addition, they can use math tools to unlock the “why” they do well or not. This visual patient does not have to be annoying. Automated text analysis tools can be used to extract relevant content, perform emotional analysis in response, and combine results according to topic categories.

**Is the patient voice in health care important?**

During the various stages in the patient healthcare journey, the organizations look to engage with their patients in dialogue. The stories which the patients say about their care are gathered using outreach. This outreach may include text messages, emails, marketing campaigns, text messages, patient portals, and even mobile applications. Creating a dialogue, and listening to patient voices, has proven to drive engagement, improve the experience of care, and deliver greater health care satisfaction. Now there are several social media gatherings created by vendors which serve as an opinion mining platform. Social networks such as Twitter, Google, and FB gauge the patients’ progress more positively and provides a holistic experience for them. Establishing a patient voice, while measuring and tracking patients’ progress assuredly assists healthcare organizations that satisfy the needs of the patient. These communications may include marketing campaigns, text messages, emails, patient sites, and mobile applications. Creating a dialogue, and listening to the patient's voice, has proven to drive engagement, improve the care experience, and bring greater health care satisfaction.

**In what ways does sentiment analysis help with patient voice?**

The implementation of Sentiment analysis is done by using Natural Language Processing or NLP techniques to identify a patient's feelings and opinions. While Patient Voice surveys collect answers to their responses to survey questions, the sentiment analysis goes on. By collecting feedback from patient voice notes, surveys, reviews, and social media, you can take what your patients have to say in their research and understand where improvement is needed by checking whether their information is positive, neutral, or negative. When you combine emotions with the patient's voice, you gather the emotional response of your patients. The power of a large response solution is well known in innumerable fields. By linking the benefits of the Patient Voice tool with sentiment analysis, the information which would make your healthcare organization more data-driven and confident in its strategic decision-making to improve patient mood will be available in hands.

* **Sentiment analysis in social media as social media listening**

Social media is one of the most popular channels where a common man could express his thoughts, feelings, and emotions about his favorite products in this digital age. No matter how many surveys your customers complete, there is no other channel that would give you in-depth details of what your customers want in a product rather than a social network.

People express everything about their lives online. From tutorials to product reviews, and recommendations, your customers express their thoughts about you through the most accessible social channels. Whether via Facebook, Twitter, YouTube, or Instagram, millions of product discussions take place every day.

Listening to social media helps companies keep an eye on social media by flagging keywords like competitors and titles. The data is then collected for analysis to measure customer response. Whether the response to a new product, an existing product, customer service, shipping, etc. You can get to the core of your customer response in an effective way.

For these public comments, discussions, and updates to be helpful to companies, they must have available technologies and also strategies available to collect data based on what their customers tell about their products. Being able to identify and extract relevant points, to analyze them to get the feel of a social media platform will give brands a higher power, not only when it comes to providing a better customer experience, but also when it comes to getting that leg up the competition.

With emotional analysis enabled by public listening tools, brands can better help their customers by responding to negative or direct words at the right time. This important tool will also help companies to make changes in their offering to satisfy current customers and attract new ones.

**Is there any difference in social media listening and monitoring social media?**

Public monitoring is about the response to public discussion and engagement, while public listening is about identifying and responding to each product on social media. Public Listening, on the other hand, collects data on what has been said in public and broad customer interviews and draws information from them to make your customers better decisions. The human factor of written communication and interpersonal communication is what separates social media listening and public monitoring Social media monitoring involves customer interaction and the principles of doing what people say about your company. Public Listening is driven by metrics and is effective. Although both are important parts of a customer’s voice strategy.

**Open Challenges in Sentiment analysis**

1. Audio input

Challenge

Translating the voice message into wordings could be complex, and it may be even more complex to acknowledge the written word. Things get not up to par when one tries to analyze a large amount of data that can contain both direct and indirect answers. Brands could face difficulties in finding specific emotions and analyzing them well with the intended tone.

Remedy

The premise of any good sentiment analysis software includes the ability to interpret straightforward statements from the right ones and find the right tone for them. For example: “A commodity is expensive but good” is a self-centered concept that has the effect that price makes the product unwelcomed. With the smart sentiment API, companies can specify such nuances in tone, and level.

2. Polarity

Challenge

Words such as “good” and “evil” are high in point and which has a polarity of (+1) and negative (-1). This is unchallenging to understand. But there is a connection between words such as “not so good” which could mean “average” and then between polarity (-75). Sometimes phrases like these are left out, which lowers the score.

Remedy

Those midst-word phrases which give an absolute view of the comments could be predicted by sentiment analytics tools assuredly. In this context, article-based sentiment analysis may provide a comprehensive analysis, but with thought-based sentiment analysis, one can gain an in-depth view of many facets of comments.

3. Contempt

Challenge

People use ridicule and mockery in casual conversations and memes on social media. The act of expressing negative emotions using personal compliments can make it difficult for emotional analysis tools to determine the true context of a response. Without exception, this challenge leads to a high level of misunderstanding and provides “positive” reviews as negative and vice versa.

Remedy

A high-quality emotional analysis API would be able to discover the context of the language used and everything else involved in creating a real feeling when someone posts something. In this case, the language database in which the emotional analysis model is trained not only needs to be accurate but also large.

4. Emojis

Challenge

The problem with text-based social media content, such as Twitter, and Linkedln is that it is full of emojis. NLP activities are trained to define language. Although able to extract text from parallel images, emojis are not the language itself. Many emotional analysis solutions treat emoji as special characters that are extracted from data during text excavation. But doing so means that companies will not receive all the details from the data.

Remedy

To meet such analytical challenges, the company needs to use an emotional analysis tool that can determine the language of emojis and not associate them with special characters such as commas, spaces, or stops. Data scientists first analyze whether people use emojis often for good or bad events, and then train models to learn the relationship between different words and emojis.

5. Idioms

Challenge

Machine learning programs do not understand the metaphor. For example, the saying “dog with two tails” will confuse the algorithm because we understand things in a real sense. Therefore, if a phrase is used in a comment or review, the sentence may be misunderstood by an algorithm or ignored. To overcome this problem the emotional analysis platform needs training in understanding idioms. When multilingualism is spoken, the problem is uncountable and the model might become confused.

Remedy

The only way this challenge can be met with the accuracy of the sentimental analysis is that the neural networks in the emotional mining API are trained to understand and interpret expressions. Sayings are mapped out with nouns that express emotions such as anger, joy, determination, success, etc. then the models are properly trained. Suffice it to say, only then can an emotional analysis tool be able to provide accurate information from such a text.

6. Denial

The problem

Denial, given by words like no, never, never, never, etc. can confuse the ML model. For example, a machine algorithm needs to understand that the phrase, "I can not go to my gym class today", means that one intends to go to the class.

Solution

The emotional analysis field should be trained to understand that two negatives are superior to others and to convert a sentence into a positive. This can only be done if there is an adequate corporate training algorithm and has the highest number of opposing words possible to make the total number of permits and combinations.

7. Comparison sentences

Challenge

Comparison sentences can be difficult because they may not always give an idea. Much of it should be considered. For example, when someone writes, "Jupiter is bigger than earth", the sentence does not refer to any negative or positive emotions but refers to a relative order in terms of the size of the two phones.

Solution

The accuracy of the sentimental analysis can be achieved in a situation where a machine learning model can compare the level of a business with one location to a greater or lesser degree than another. Then tie that to a negative or positive feeling. This is not a matter of simply having a code of words for negative or constructive emotions, but of training an artificial intelligence machine to integrate information from its knowledge graph and analyze the relationships between organizations, words, and emotions.

8. Employee bias

Challenge

Employee feedback is crucial when it comes to developing a corporate culture, developing marketing strategies, and reducing employee profits. Many companies, however, find themselves struggling to transfer information due to bias. This may be from an employee, or from the perspective of an inspector who may not respond.

**Summary**

The preceding chapter in this series delivered you a brief overview of sentiment analysis. The purpose of this chapter is to apply this information to the development of Sentiment analysis in every possible room. The discussion in this chapter begins with a summary of sentiment analysis and continues with its methods, tools, and open challenges of this process today.