**The University of Burdwan**

A project on

**Studies of Machine Learning Approach Based Sentiment Analysis in Social Media: Public Mood Based on Their Posts."**

By

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Under the guidance of

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**Certificates**

This certifies that Soumi Samanta(Roll no. BUR/MCS/2022/019) and Moupriya Manna (BUR/MCS/2022/009) completed the project work named **"Studies of Machine Learning Approach Based Sentiment Analysis in Social Media: Public Mood Based on Their Posts."** in partial satisfaction of the requirements for the Master of Science in Computer Science degree that The University of Burdwan, Burdwan, will be awarding in the academic year 2022-2024. The project report has been accepted as it fulfills the prerequisite academic criteria for the project work required for the specified degree.

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**Declaration**

As genuine students of the Department of Computer Science at Golapbag, The University of Burdwan, Soumi Samanta(Roll no. BUR/MCS/2022/019) and Moupriya Manna (BUR/MCS/2022/009) we thus certify that the dissertation named, Under the direction of Prof. Dr. Abhoy Chand Mondal, Head of the Department of Computer Science, Golapbag, The University of Burdwan, we completed the study **"Studies of Machine Learning Approach Based Sentiment Analysis in Social Media: Public Mood Based on Their Posts."** in partial fulfillment of the requirements for the award of the Master of Science in Computer Science degree at The University of Burdwan, Burdwan, during the academic year 2022–2024. This dissertation report contains only original work that has never been turned in for credit toward another degree from a university.

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**Abstract**

Nowadays, social media is such an important platform where we can know the situation of the world through thousands of posts. Sentiment analysis is a valuable tool to measure public opinion. It successfully devoted itself to health issues, brand marketing, crime prediction, financial market prediction, customer analytics, and emergency management. In which situation, public posts on those topics are vital for research on the basis of sentiment analysis. Many researchers publish sentiment analysis papers on social media because a large number of people use it and they are posting lots of topics in their daily lives, like text, photos, video, and audio. This data can be converted into vital information with the help of sentiment analysis. The public shares their current condition and situation on social media. For what reason does a person post that content on social media? Is it because that person wants suggestions on how to handle the situation or how to survive the condition, wants to know the solution to the problem, or generally shares happiness or sadness? We read about the accuracy and limits of several literature review publications, employed their models and datasets, and conducted surveys of them.

**Introduction**

Today, social media plays a big part in people's daily lives. The number of people who are not connected to social media is very small. They are linked to some platforms like Facebook, WhatsApp, Twitter, YouTube, and Instagram. People benefit from using social media. Not only is social media a medium of communication between people, but it is also an earning path for mankind. On social media, many people build up their businesses by communicating with others and want to get feedback to improve their service. As a result, the number of social media users is high, and I guess it will increase in the future. People express their emotions through the sharing of various texts, videos, and audio photos. For the development of business organizations, advanced technologies like machine learning and AI are used for data processing. This paper explains the applications of sentiment analysis using an experiment with published literature. Sentiment analysis is a way in which we classify a post as having a good, bad, or normal sentiment. There are two types of sentiment analysis: the machine learning approach and the lexicon-based approach. Machine learning is used to find sentiment from data, and a lexicon-based approach is used to regard good or bad words in the language. Most of the previous research on sentiment analysis was held under product or movie reviews, but now the challenge is to understand the public's mental situation at that moment when they are posting something and how the user reacts to seeing this post.

**Literature review**

**Overview of Sentiment Analysis**

Sentiment analysis of public posts on social media and the opinions that go along with them is the process of examining text data from social media platforms to identify the opinions people are expressing and to ascertain the sentiment that they are expressing. This entails gathering text data that is accessible to the public from sites like Facebook, Instagram, and Twitter, then preparing it to handle emoticons and emojis, sanitize it, and tokenize it.

Sentiment analysis can be done in a number of ways: lexicon-based using sentiment dictionaries; machine learning-based using models to classify text into sentiment categories; and hybrid approaches combining machine learning and lexicon-based methods. From the text data, features are taken out, and representations for sentiment categorization are made.

Opinion mining, often referred to as aspect-based sentiment analysis, is the process of locating certain elements or entities (such as goods or services) that are referenced in the text and evaluating the sentiment that is conveyed about each one. Metrics including accuracy, precision, recall, and F1-score are used to assess the performance of sentiment analysis algorithms.

Sentiment analysis on social media data is used in market research, public opinion tracking, political sentiment analysis, brand monitoring, customer feedback analysis, and sentiment-driven recommendation systems. Nonetheless, this sector has difficulties processing irony, slang, sarcasm, misspellings, and comprehending sentiment expressions that vary depending on the context.  
  
  
In order to solve these issues, future research in sentiment analysis on social media data may concentrate on creating multilingual sentiment analysis models, investigating novel approaches for context-aware sentiment analysis, and integrating visual content (pictures and videos).

**Social media platforms and data collection**

Social media platforms serve as virtual environments where people connect, share material, and voice opinions on numerous issues. Large volumes of user-generated data, including text, photos, videos, and interactions, are gathered by these platforms. Sentiment analysis is a technique that uses data from social media posts to identify and classify user attitudes as neutral, negative, or positive.  
  
Accessing publicly accessible postings on social media networks via their APIs (application programming interfaces) or web scraping methods is commonly used in data collection for sentiment analysis. Text, timestamps, user IDs, and other metadata related to each post may be included in the data collection. Furthermore, several systems provide sentiment analysis-specific APIs that provide users access to measurements and insights pertaining to sentiment.

Techniques for analyzing sentiment vary; they include machine learning algorithms and rule-based systems. While machine learning algorithms automatically classify sentiment in new postings by learning patterns from labeled data, rule-based techniques rely on predefined rules and lexicons.

It is also possible to gather opinions regarding social media posts using a variety of techniques, such as surveys, interviews, or the examination of engagement indicators like likes, shares, and comments. These viewpoints offer insightful information on how users see and engage with material on social networking sites.

**Data processing**

Data preprocessing is an action that is used to transfer raw data into a knowledgeable format. Through some steps, data processing is completed. The steps are data clearing, data transformation, and data reduction. The steps are used to classify incorrect data if it is not preprocessed. Data that is collected from social media sites like Twitter, Facebook, and WhatsApp is always inappropriate for the user. They exist mainly in slang, acronyms, abbreviations, and misspellings in posts, which may reduce the quality of the post. For the development of the machine learning structure, it is first necessary to find raw data from multiple sources and then synchronize those in a proper data set. Different datasets are used for different perspectives. Health care-related data sets and business data sets are completely different from each other. In the data clearing step, the data consists of many irrelevant parts. It works for handling missing and noisy data. Then the data is transformed into an appropriate form. Then data reduction happened, increasing storage efficiency and reducing the size of the data.

**Sentiment analysis methods**

There are two methods of sentimental analysis. One is a machine learning approach, and the other is a lexicon-based approach.

Machine learning: Machine learning is used to analyze the text of the human language. Sentiment analysis is a machine learning technique that explains the positive and negative words in a text. When a person posts the text, the machine automatically captures the emotions behind it.

Machine learning tells the computer to memorize the latest job unless explicitly programmed to redact the tasks. Machines can read unused words, irony, and human mentality. Suppose a person comments about a post: "Change your wonderful mentality." In this text, "wonderful" is a positive word, but it is a negative comment. There is a double meaning in the texts. In this way, a device calculates lots of users minds at a time.

Lexicon-based approach: Lexicon-based analysis is a famous approach that uses the substance of the emotion as positive, negative, or neutral. It depends on words and phrases that have an attached sentiment class. But there are some challenges that can be harmful to its validity. So we should find the common problems of lexicon-based analysis and find the solution to the problem.

Language diversity: One of the main challenges of lexicon-based analysis is domain variation. Sentiment analysis finds the internal emotion that is hidden in the words and phrases of a text. The word 'weak' is a negative designation. Depending on the language's diversity, lexicon-based sentiment is used. It could be a word that can hold. The word 'confident' has a positive and negative meaning together. Lexicon-based analysis can be hard because the sentiment of the words and faces can change depending on the domain.

Mocary: The second challenge of lexicon-based analysis is to detect mockery because it cannot detect the irony of a word. As an example, "I like to eat rice." In the sentence, there may be sarcasm if the person actually hates to eat rice. But lexicon-based analysis can catch another sense of the sentence. It can express the word 'like' as a positive vibe. Not only the machine, but it is also difficult for humans to understand the irony.

**Future Extraction and Representations**

Future Extraction and Representations in sentiment analysis on social media involve discerning sentiments expressed in posts discussing future events. "Future extraction" entails identifying references to events that have not yet occurred but are anticipated or discussed. This involves recognizing keywords or phrases hinting at future occurrences, which can be challenging due to the informal nature of social media communication.

"Representations" refer to accurately portraying sentiments associated with these future events. Given the speculative nature of such discussions, accurately capturing sentiment requires understanding the context and nuances of language. This involves discerning between speculation, concrete plans, and hypothetical scenarios.

Addressing these challenges involves leveraging advanced natural language processing and machine learning techniques. Algorithms sift through vast social media data, recognizing patterns and extracting relevant information. Techniques such as sentiment lexicons tailored to future-oriented content and contextual embeddings help capture semantic meaning. Additionally, domain-specific knowledge fine-tunes models for specific applications, such as finance or marketing.

By effectively identifying and interpreting future-oriented content, Future Extraction and Representations facilitate insights into emerging trends and shifting sentiments within online communities.

**Sentiment lexicon and datasets**

Lists of words or phrases with their sentiment polarity—positive, negative, or neutral—annotated are called sentiment lexicons. These lexicons function as dictionaries, offering sentiment labels for specific words or phrases. Sentiment analysis algorithms utilize these labels to categorize the sentiment of textual data.  
  
Datasets are collections of annotated text that are used to train and assess sentiment analysis models in the context of social media sentiment analysis on public postings. These datasets usually include human-assigned sentiment labels (positive, negative, and neutral) combined with user-generated material (tweets, comments, reviews, forum posts, etc.).

For the purpose of creating and assessing sentiment analysis algorithms for public postings on social media and the views that accompany them, sentiment lexicons and datasets are essential components. They support practitioners and researchers in developing supervised machine learning models and assessing how well they predict sentiment labels on unobserved data. However, when employing sentiment lexicons and datasets in sentiment analysis on public posts on social media, consideration must be given to issues like domain specificity, cultural variances, biases, and shifting language trends.

**Opinion Mining and Aspect – Based Sentiment Analysis**

Opinion Mining, also known as sentiment analysis, involves extracting and analyzing opinions, emotions, and attitudes expressed in text data. In the context of social media posts, opinion mining focuses on understanding the sentiments conveyed by users regarding various topics, products, events, or individuals.

Aspect-Based Sentiment Analysis (ABSA) is a more refined approach within opinion mining that goes beyond overall sentiment to analyze specific aspects or attributes of a subject. In social media posts, ABSA breaks down opinions into different aspects or features, such as the performance of a product, the customer service of a company, or the ambiance of a restaurant. It then assesses the sentiment expressed towards each aspect individually.

For instance, in a restaurant review, ABSA might identify aspects like food quality, service speed, and ambiance. It would then analyze the sentiment associated with each aspect separately, determining whether users express positive, negative, or neutral opinions about them.

This nuanced approach provides deeper insights into user opinions, enabling businesses and analysts to understand not just the overall sentiment but also the specific aspects driving those sentiments. By pinpointing areas of strength or weakness, ABSA helps businesses make targeted improvements, refine marketing strategies, and enhance overall customer satisfaction.

In summary, Opinion Mining focuses on extracting sentiments from text data, while Aspect-Based Sentiment Analysis delves deeper by analyzing specific aspects or features within the text to gain a more comprehensive understanding of user opinions. In the realm of social media, these techniques enable businesses and analysts to glean valuable insights into customer perceptions, preferences, and sentiments.

**Applications**

Applications for sentiment analysis of public social media posts and opinion analysis of such posts are numerous and span numerous industries. The literature on this issue analyzes these applications in depth, including variables such as data collection methods, sentiment analysis methodologies, and the consequences of sentiment analysis in varied situations. Typical uses for them include:   
  
Marketing: Campaigns and plans can be informed by knowledge of how consumers feel about certain brands or items. Companies may use sentiment analysis to determine how the public feels about them and where their goods and services need to be improved.  
  
Consumer service: Real-time monitoring of consumer comments on social media platforms may be achieved using sentiment analysis. This enables businesses to quickly resolve client concerns and raise client satisfaction levels overall.

Politics and population opinion: Social media post sentiment analysis can shed light on what the general population thinks about political issues, politicians, and policy. Political campaigns, decision-makers, and analysts may use this data to better understand public opinion and make wise choices.

Brand Reputation Management: Companies may better control their online image by keeping an eye on social media sentiment about their brand. Early detection of unfavourable sentiment enables businesses to take action before problems worsen and damage their reputation.

Product Development: Product development efforts can be guided by analyzing consumer opinion around particular features or elements of products. In order to better satisfy the demands and preferences of their customers, businesses might rank features according to client emotion.

**Evolution Metrics**

These metrics provide valuable insights into how sentiments towards a particular topic, product, event, or individual evolve and fluctuate across different time periods.

Understanding sentiment evolution is crucial for businesses, marketers, and analysts to gauge the effectiveness of their strategies, assess public perception, and make informed decisions. By monitoring sentiment trends, organizations can identify emerging issues, detect shifts in consumer attitudes, and capitalize on opportunities.

Evolution metrics typically include measures such as sentiment polarity distribution over time, sentiment intensity changes, and sentiment trends across different user segments or demographics. These metrics help analysts visualize how sentiment towards a specific entity has evolved, whether it's becoming more positive, negative, or neutral, and what factors might be driving these changes.

For example, a company launching a new product might track sentiment evolution to assess how the public responds to its marketing campaigns, product features, and customer service efforts over time. By analyzing sentiment trends, they can identify which aspects are resonating with customers and which need improvement, allowing them to refine their strategies accordingly.

Similarly, sentiment evolution metrics can be invaluable in crisis management situations, where organizations need to monitor how public sentiment shifts in response to a crisis or controversy. By closely monitoring sentiment trends, companies can gauge the effectiveness of their crisis response efforts and adapt their strategies in real-time to mitigate negative sentiment.

In summary, evolution metrics in sentiment analysis on social media provide a dynamic view of how sentiments change and evolve over time. By tracking sentiment trends, businesses and analysts can gain valuable insights into public perception, identify emerging issues, and make data-driven decisions to drive success.  
  
**Challenges**

Data Quality: Information found on social networking platforms may be loud, unstructured, and riddled with grammatical errors, slang, acronyms, and spelling mistakes. It is difficult to reliably assess sentiment and get significant insights from the data because of this heterogeneity.  
  
Contextual Understanding: Text's complex meaning, which includes sarcasm, irony, comedy, and cultural allusions, is frequently missed by sentiment analysis algorithms. Accurate analysis requires an understanding of the context in which sentiment is conveyed, which can be difficult to accomplish automatically.  
  
  
Ambiguity: Textual information on social networking sites may be confusing, with the same words or phrases suggesting several meanings based on the situation. Sophisticated algorithms that can analyze surrounding material and recognize minor indications are needed to resolve this discrepancy.

Language and Cultural Differences: people from a variety of linguistic and cultural backgrounds utilize social media platforms, which causes differences in the way they express themselves verbally and emotionally. Models of sentiment analysis trained in a particular language or cultural setting could not generalize well to others, necessitating customization or adaptation for various demographic groups.  
  
Subjectivity: People interpret and express sentiment in different ways depending on their own experiences, preconceptions, and prejudices, making sentiment analysis intrinsically subjective. Though difficult, subjectivity must be captured and taken into consideration in sentiment analysis algorithms in order for the analysis to be correct.

**Future Directions**

Future directions encompass several promising avenues poised to advance the field. One such direction involves the integration of multimodal data, incorporating not only textual content but also images, videos, and audio. By analyzing a diverse range of media formats, sentiment analysis can capture richer contextual information, enhancing the accuracy and depth of insights derived from social media content.

Additionally, there is growing interest in leveraging advanced deep learning techniques, such as transformer models, to improve sentiment analysis performance. These models, with their ability to capture complex semantic relationships and contextual dependencies, hold potential for achieving more nuanced sentiment analysis results, particularly in understanding sarcasm, irony, and other subtle forms of expression prevalent in social media.

Furthermore, there is a push towards developing sentiment analysis models that are more adept at handling multilingual and cross-cultural content. With social media being a global phenomenon, accommodating diverse languages and cultural contexts is essential for ensuring the applicability and effectiveness of sentiment analysis across different regions and demographics.

Another emerging direction involves the incorporation of domain-specific knowledge and expertise into sentiment analysis models. By tailoring models to specific domains, such as healthcare, finance, or politics, sentiment analysis can provide more relevant and actionable insights tailored to the unique needs and challenges of different industries and sectors.

Finally, there is increasing interest in exploring the ethical implications of sentiment analysis, particularly regarding issues of privacy, bias, and fairness. As sentiment analysis technologies become more pervasive, ensuring that they uphold ethical standards and respect user privacy rights is crucial for maintaining trust and accountability in their use.

Overall, future directions in sentiment analysis on public posts in social media hold promise for advancing the field's capabilities, enabling more accurate, insightful, and ethical analysis of sentiments expressed in online discourse.

Literature Survey:

R.A.S.C. Jayasanka, M.D.T.Madhushani , E.R.Marcus , I.A.A.U.Aberathne and S.C.premaratne “Sentimental Analysis For Social Media”

Sentiment analysis is the process of extracting public negative or positive sentiment based on the text received from past published research papers. As technology advances, the number of social media users is growing. They actively use various platforms of social media and express their opinions. They post their attitudes about people, products, and actions. For understanding the sentiment from social media, some techniques can be used, such as natural language processing and machine learning, to produce high-quality text. In this paper, we will try to extract the sentiment and discuss the challenges of this extraction. Here, the approach is to extract sentiment from a Twitter application that produces output on the far side of opposition. This opposition is used in product profiling, trend analysis, and predictivity. A hopeful outcome will present further development. That occurred through sentiment analysis.

“The emergence of social media data and sentiment analysis in election prediction” Priyavrat Chauhan, Nonita Sharma, Geeta Sikka (2020)

This paper presents social media data and sentiment about election prediction. A necessary step is taken to overcome the critical decision based on the opinion of each social media user. Social media is a popular platform where common people express their feelings with the help of audio, video, text, or comments. It is also called opinion mining. It extracts people’s thoughts, attitudes, emotions, topics, and events. Technically, the task is not too easy. The election result was predicted by seeing the public mood at the time of the election through social media. This review makes an attempt to improve the knowledge that the researchers contribute to their survey to predict the election result. In this paper, we tried to study user points of view about ongoing elections using Facebook, Twitter, and other social media platforms. The challenges are to find better ways to understand the opinions of individuals in respective election predictions with the help of social media content.

“Sentiment Analysis on Social Media”, Federico Neri, Carlo Aliprandi, Federico Capeci, Montserral Caudros, Tomas

People can share their personal opinions that they have experienced in their lives, which is importantortant for communication. Social media consumes behavior from text, product action, etc. It also keeps track of the mentality toward brands of products. Today, social media has become a marketing area for online businesses. Facebook has become a master of digital marketing.

This paper highlights over 1000 Facebook posts about a radio or television broadcast of news reports. Italian public broadcasting service in the direction of a private company. This study describes the Italian media analysis that is connected to political communication and produces the result. This study also launched an account where the newscast audience provided data by analyzing social media, mostly Facebook. It will be open to collect measurable public data.

“Sentiment Analysis in Social Media and It’s Application”, Zulfadzli Prus, Haliyana Khalid (2019)

This study reviews sentimental analysis in social media and its applications. Social media users uploaded many texts, audio, and videos, and that can be considered raw data on social media. Sentiment analysis converts the raw data into valuable information. This paper reviews the studies published between 2014 and 2019 with the help of some databases, such as IEEE Xplore, Science Direct, etc. This paper chose some articles from the review based on the vision of the study. Here, a lexicon-based approach is used to analyze social media sentiment. We collected the data from Twitter, and the analysis can be based on applications in healthcare, politics, and business.

“Sentiment Analysis of Facebook Users Reacting to Political Campaign post.”,RODRIGO SANDOVAL -ALMAZAN ,DAVID VALLE-CRUZ,Rectoria ,Universidad Autonoma del Estado de Mexico,Toluca,Estado de Mexico,Mexico(2020)

Now a days sentiment analysis in political campaign studies s become trendy to find out public decision. We know how the political campaign Influence publics. This research gives answer to the question: Did the Facebook users reaction in Mexico about produce the result of the election also the public reaction towards state of Mexico in 2017? For this action we collect more than 4000 Facebook part and analysis public emotions. We calculate the public reaction with the help of some emojies: like, haha, love, sad and angry. At last we find the winning party collect more negative sentiment and the unsuccessful party get more positive sentiment in the election.

“An Overview of Social Media and Sentiment Analysis”, Rohan Singh; Pnakaj Sharma

In this paper, we look at a wide area of social media to understand the sentiments of individuals. Here we investigate the best social media platform to search for opinions, emotions, and actions. The findings of sentiment were benefited by some research papers that focused on social media analysis.

“ Social Media Sentiment Analysis Based on COVID-19”, Laszol Nemes, and Attila Kiss

In this paper, we discuss the sentiment, comments, and posts of the users of Twitter based on COVID-19 and the Corona virus with the help of neural language processing and RNN. We tried to show that our model is accurate and errorless in detecting emotions in Twitter posts. The main work is the collection of data from various sources using our recurrent neural network model that can be generated. We can understand the individual sentiments about COVID-19 using this model.

“Sentiment Analysis of Events in Social Media”, Alexandru Petrescu, Ciprian-Octavian Truica, Elena-Simona Apostol (IEEE)

Social media popularity has opened another side of research for content analysis. Event channel proposed by network analysis. Textual content is the central point, and the suggested method is summarization. NPL only explores textual content. It does not fuse graph-based structures. For these boundaries, we propose a method of two-direction. Event direction is used to extract interest from the event. We hope that we get an accurate result with a clear sentiment about the event.

“Sentiment Analysis as a Service: a Social Media Based Sentiment Analysis Framework“ ,Kashif Ali, Hai Dong, Athman Bouguettaya, Abdelkarim Erradi, Rachid Hadjidj

In this paper, we study sentiment analysis using social information services as a framework. Here, the goal is to transform the service into useful information. We want to establish a new model to evaluate the quality of social media information services. As an example, we can see public health observations. To do this, we first understand the sentiment of social media users and point out their location where the disease spreads. This review is directed at a real-world dataset.

“Sentiment Analysis on User Feedback of a Social Media Platform”, Aaryan Singh, Harsh Srivastava, Mohd. Aman, Gaurav Dubey (IEEE)

The challenges of this study are to establish a method for sentiment analysis on user feedback on a social media platform named "DevelopersBay." We collect user feedback from this website by using a deep learning model. We write an algorithm so that we can utilize the sentiment from the user's post as positive, negative, or natural. This information helps us improve the quality of the service. In this paper, we determined accurate sentiment from user feedback on the website. Depending on the result, we tried to improve our website so that we knew the user requirements.

**Conclusion**

In summary, the literature review on the subject of sentiment analysis of public posts on social media based on their emotional content illuminates the changing field of online user sentiment analysis. It is clear from a review of numerous studies that sentiment analysis methods have advanced significantly in identifying the tone of social media content.

Even though the results show encouraging developments in sentiment analysis techniques, there are still significant obstacles and restrictions. It can be difficult to discern user mood from social media posts due to factors like cultural differences, context ambiguity, and linguistic subtleties. Furthermore, because online communication is dynamic, sentiment analysis techniques must be continuously adjusted and improved to keep up with changing user behaviors and language trends.

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