International Journal of application or Innovation in engineering and management

Ijaiem.com/Mar 2025/ Volume 14/Issue 1/Article No-1/223-225
ISSN: 2319-4847

TEXT BASED EMOTION DETECTION USING MACHINE LEARNING AND DEEP LEARNING

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Article Info

Received: 28-03-2025 Revised: 05 -04-2025 Accepted: 16-04-2025 Published:27/04/2025

Abstract:

Due to social media platforms there are lots of comments every day. Generally the comments are friendly and have good intentions. But sometimes comments convey the feelings of anger, sadness, fear, etc. Negative comments provide evidence that you cannot succeed at your goals, which can also be demotivating. So our task is to predict the various emotions of the comments. For this work, machine learning like Decision Tree, Random Forest, SVM, Logistic Regression using tf-idf and count vectors based model and deep learning model have been used. Among all deep leaning model have performed better than any other machine learning models with an accuracy of 92%. Emotion detection from text has gained significant attention in recent years due to its applications in sentiment analysis, customer feedback evaluation, social media monitoring, and mental health analysis. Traditional methods rely on lexicon-based approaches, but with advancements in machine learning (ML) and deep learning (DL), more accurate and efficient models have been developed.

Keywords Comparative Analysis, Emotion Detection, Machine Learning, Deep Learning

1. INTRODUCTION

Emotional intelligence is the ability to recognize your emotions, understand what they're telling you, and realize how your emotions affect people around you. Emotion Detection in text documents is essentially a content - based classification problem involving concepts from the domains of Natural Language Processing as well as Machine Learning Emotional Intelligence is comprised of four components: self-awareness, self-management, social awareness, and relationship management. Self-awareness refers to the ability to recognize and understand one's own emotions and their impact on behavior, thoughts, and performance Self- management is the capacity to regulate one's emotions and behavior in a positive manner, even in challenging situations. Social awareness is the ability to recognize and understand the emotions of others, and relationship management is the ability to effectively communicate and build relationships with others.Machine learning is a subfield of artificial intelligence that involves the use of algorithms and statistical models to enable computer systems to learn from data and make predictions or computer systems to learn from data and make predictions or decisions without being explicitly programmed .

Emotion detection using machine learning is an area of research that aims to develop algorithms and models that can automatically detect emotions from various sources such as facial expressions, speech, and text. This paper aims to explore the concept of emotion detection using machine learning and its applications in various fields.
Emotion detection using machine learning has numerous applications in various fields such as healthcare, marketing, education, and entertainment. In healthcare, emotion detection can be used to detect mental health disorders such as depression, anxiety, and stress by

analyzing speech and facial expressions. In marketing, emotion detection can be used to analyze consumer behavior and preferences by analyzing social media data and customer feedback. In education, emotion detection can be used to improve student engagement and

learning outcomes by analyzing facial expressions and speech patterns. In entertainment, emotion detection can be used to enhance user experiences in virtual reality and gaming applications by analyzing user emotions in real-time.

2. LITERATURE SURVEY

Shiv Naresh Shivhare and Prof. Saritha Khethawat, "EMOTION DETECTION FROM TEXT", in the Proceedings of Data Mining and Knowledge Management Process (DKMP 2012) Conference at New Delhi, DOI: 10.5121/csit.2012.2237. Emotion can be expressed in many

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ways that can be seen such as facial expression and gestures, speech and by written text. Emotion Detection in text documents is essentially a content - based classification problem involving concepts from the domains of Natural Language Processing as well as Machine Learning In this paper emotion recognition based on textual data and the techniques used in emotion detection are discussed.

Pietikäinen, Matti, and Olli Silven. "Challenges of Artificial Intelligence--From Machine Learning and Computer Vision to Emotional Intelligence." arXiv preprint arXiv:2201.01466 (2022). We consider the problem of real-time video-based facial emotion analytics, namely, facial expression recognition, prediction of valence and arousal and detection of action unit points. We propose the novel frame-level emotion recognition algorithm by extracting facial features with the single EfficientNet model pre-trained on AffectNet. As a result, our approach may be implemented even for video analytics on mobile devices Experimental results for the large scale Aff-Wild2 database from the third Affective Behavior Analysis in-the-wild (ABAW) Competition demonstrate that our simple model is significantly better when compared to the VggFace baseline. In particular, our method is characterized by 0.15-0.2 higher performance measures for validation sets in uni-task Expression Classification, Valence-Arousal Estimation and Expression Classification. Due to simplicity, our approach may be considered as a new baseline for all four sub-challenges.

Mayer, J. D., Roberts, R. D., & Barsade, S. G. (2008). Human abilities: Emotional intelligence. Annual Review of Psychology Emotional intelligence (EI) involves the ability to carry out accurate reasoning about emotions and the ability to use emotions and emotional knowledge to enhance thought. We discuss the origins of the EI concept, define EI, and describe the scope of the field today. We review three approaches taken to date from both a theoretical and methodological perspective We find that Specific-Ability and Integrative-Model approaches adequately conceptualize and measure EI. Pivotal in this review are those studies that address the relation between EI measures and meaningful criteria including social outcomes, performance, and psychological and physical well-being. The Discussion section is followed by a list of summary points and recommended issues for future research.

Hochschild, A. R. (1983). The managed heart :Commercialization of human feeling. University of California Press. "In private life, we try to induce or suppress love, envy, and anger through deep acting or "emotion work just as we manage our outer expressions of feeling through surface acting. In trying to bridge a gap between what we feel and what we "ought" to feel, we take guidance from "feeling rules" about what is owing to others in a given situation Based on our private mutual understandings of feeling rules, we make a "gift exchange" of acts of emotion management. We bow to each other not simply from the waist, but from the heart. But what occurs when emotion work, feeling rules, and the gift of exchange are introduced into the public world of work? In search of the answer, Arlie Russell Hochschild closely examines two groups of public-contact workers: flight attendants and bill collectors. The bill collector's job is to collect on the service, and if necessary, to deflate the status of the customer by being "nastier than natural." Between these extremes, roughly one-third of American men and one-half of American women hold jobs that call for substantial emotional labor. In many of these jobs, they are trained to accept feeling rules and techniques of emotion management that serve the company's commercial purpose.

Diefendorff, J. M., Richard, E. M., & Yang, J. (2008) Linking emotion regulation strategies to affective events and negactive emotions at work. Journal of Vocational Behavior, 73(3),498-508. This study examined the use of specific forms of emotion regulation at work, utilizing Gross's [Gross, J. J. (1998).. The emerging field of emotion regulation: An integrative review. Review of General Psychology 2, 271–299] process-based framework of emotion regulation as a guiding structure. In addition to examining employee self-reported usage of these emotion regulation strategies, we assessed the types of discrete negative emotions and negative affective events

associated with their use. Results demonstrated that employees reported using a wide variety of emotion regulation strategies, and that each strategy tended to align with a distinct set of discrete negative emotions and affective events

3.PROPOSED METHODOLOGY

The proposed system The methods The proposed methodology for text-based emotion detection integrates both machine learning (ML) and deep learning (DL) techniques to achieve accurate and robust emotion classification. The process begins with data preprocessing, where raw text is cleaned and tokenized, removing irrelevant elements like punctuation and stopwords Next, feature extraction is performed using techniques like TF-IDF (Term Frequency-Inverse Document Frequency) and word embeddings (e.g., Word2Vec or GloVe) to convert the text into a numerical format.

For the model development stage, both traditional machine learning models and deep learning architectures are employed. Machine learning models like Support Vector Machine (SVM), Random Forest, and Logistic Regression are used for initial classification tasks, leveraging the extracted features. These models are trained to recognize patterns and dependencies in text that correlate with specific emotions, offering better generalization for complex datasets.

Figure 1: Overall design of proposed methodology

The final stages of the methodology involve model training, evaluation, and testing. The models are trained on a labeled dataset and then

International Journal of application or Innovation in engineering and management
Ijaiem.com/Mar 2025/ Volume 14/Issue 1/Article No-1/223-225
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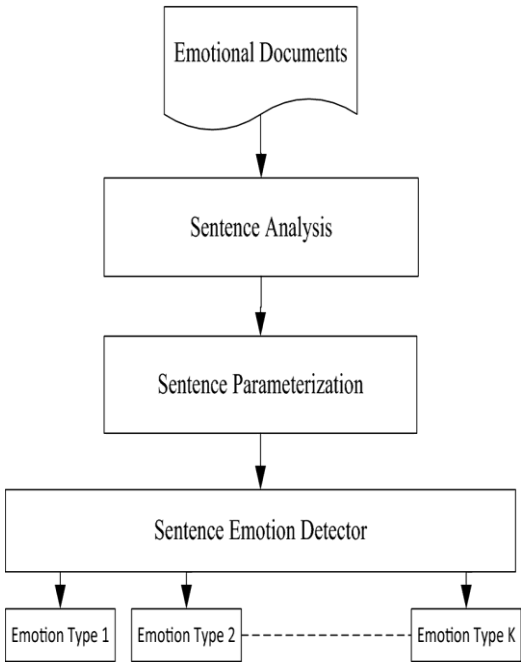
evaluated using metrics such as accuracy, precision, recall, and F1-score to assess their performance. Cross-validation techniques are applied to ensure that the model is not overfitting and generalizes well to unseen data.
Once trained, the emotion detection system is ready for deployment, where it can classify the emotion of new text inputs in real-time, providing valuable insights for applications like chatbots,social media analysis, and customer sentiment analysis.

Architecture:



The proposed system claims to help in privacy protection, reliability and integrity of the messages, traceability The process begins with data preprocessing, where raw text is cleaned and tokenized TF-IDF (Term Frequency-Inverse Document Frequency) and word embeddings (e.g., Word2Vec or GloVe) to convert the text into a numerical format.
Once trained, the emotion detection system is ready for deployment, where it can classify the emotion of new text inputs in real-time, providing valuable insights forThe final stages of the methodology for text-based emotion detection involve model training, evaluation, testing, and deployment. During the training phase, various machine learning and deep learning models are trained on a labeled dataset comprising text samples annotated with corresponding emotion labels. The dataset is preprocessed through techniques like tokenization, stop-word removal, stemming, and lemmatization to enhance the quality of the text data. For deep learning approaches, word embeddings such as Word2Vec, GloVe, FastText, and contextual embeddings like BERT, RoBERTa, or DistilBERT are employed to convert text data into numerical representations that capture semantic and syntactic relationships effectively..

Applications:

- **Sentiment Analysis:** Understanding user sentiments in reviews, tweets, or comments**.**
- **Mental Health Monitoring:** Detecting emotional distress or mood patterns for early intervention.
- **Customer Feedback Analysis:** Improve products, services by analyzing customer emotions.
- **Personalized Content Recommendation**: Tailoring content based on emotional responses.
- **Social Media Monitoring:** Tracking public opinion and emotional trends in real-time.
- **Human-Computer Interaction Enhancement:** Creating empathetic chatbots and virtual assistants.
- **Hate Speech Detection:** Identifying toxic or harmful content to enhance online safety.

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- **Education & E-Learning:** Adapting teaching methods based on student emotional states.
- **Market Research**: Understanding consumer emotions to improve marketing strategies.
- **Political Analysis:** Understanding public sentiment about policies or political figures.

Advantages:

The ETC Advantages of text-based emotion detection using machine learning (ML) and deep learning (DL) are numerous and impactful across various industries. One major advantage is scalability, as these models can process massive amounts of text data quickly and efficiently, making them suitable for analyzing real-time data streams from social media, customer reviews, and other text-based platforms.

- **Scalability:** Can process massive amounts of text data quickly and efficiently.Improved Security
- **High Accuracy:** Deep learning models can achieve high precision with large datasets.
- **Real-Time Analysis:** Provides instant insights from live text streams (e.g., social media).
- **Language Independence**: Multilingual models can detect emotions across different languages.
- **Contextual Understanding:** Advanced models capture contextual meaning beyond mere keywords..
- **Cost-Effectiveness:** Automated systems reduce the need for manual emotional analysis.
- **Improved Decision-Making:** Supports better business strategies by understanding customer sentiments.
- **Improved Decision-Making:** Supports better business strategies by understanding customer sentiments.

3. EXPERIMENTAL ANALYSIS

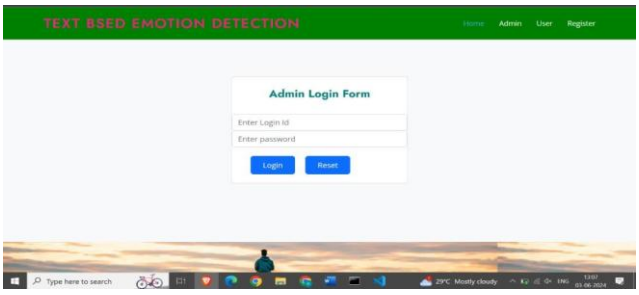

Figure 1: Admin Login Form

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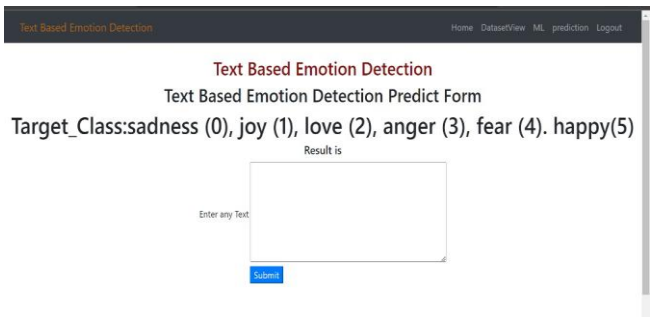

Figure 2: Illustration of uploading image

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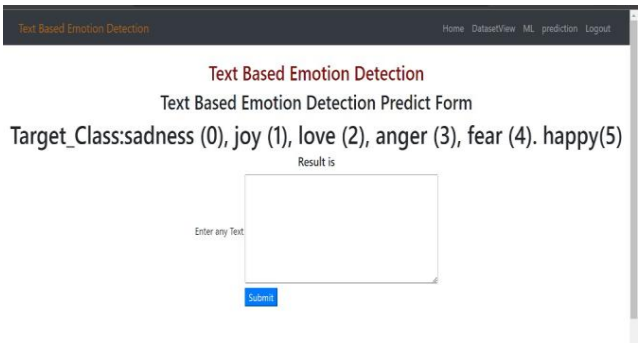

Figure 3: Displaying the Text emotion Detection.

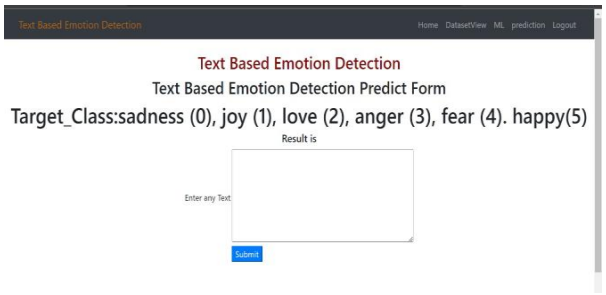

Figure 4 : Text emotion Detection

TF-IDF (Term Frequency-Inverse Document Frequency) and word embeddings (e.g., Word2Vec or GloVe) to convert the text into a numerical format.

Admin Page

An Admin Page is a crucial component of most web applications and systems, serving as a powerful back-end interface for administrators to manage, monitor, and control various aspects of the application. This page is typically restricted to authorized users with elevated permissions, providing them with the ability to oversee user activities, configure settings, and maintain the overall health of the system. Furthermore, Admin Pages often support Customization & Theming, In many cases, image compression and optimization techniques are applied before storing or displaying the image. This involves reducing the image size without compromising quality to improve upload speed, reduce storage costs, and enhance user experience. Compression can be performed on the client-side (using libraries like Compressor.js) or server-side (using PIL in Python or Sharp in Node.js). allowing administrators to personalize the interface's appearance and functionality according to their preferences or organizational standards. Notifications and alerts can also be configured to warn admins of critical system events or security breaches, enhancing responsiveness and control.

Illustration of uoloading images

The illustration of uploading images for text-based emotion detection using ML and DL refers to the process flow where users can upload images containing text (e.g., handwritten notes, screenshots, memes, or social media posts) to be analyzed for emotional content. This feature is particularly useful in applications like social media monitoring, mental health assessment, customer feedback analysis, and various sentiment analysis systems.

The process generally begins with the User Interface (UI), where users interact with an upload component designed for easy file selection. This UI could feature a file input button or a drag-and-drop area labeled with instructions like "Upload Image for Emotion Analysis." Once the image is selected, the system often displays a preview to confirm the uploaded file, allowing users to proceed only if the file is in the correct format (e.g., JPEG, PNG) and within the allowed size limit. The user experience can be further enhanced by providing a progress bar to show the upload status, especially when dealing with large files. Once the emotional analysis is completed, the results are displayed to the user. This could include the extracted text, detected emotions, and confidence scores, all presented in a user-friendly dashboard or report format. The results can be stored in a database for future analysis or used to generate insights for applications like mental health monitoring or customer sentiment analysis.

Displaying the Text emotion Detection

Displaying the results of text-based emotion detection is a crucial step in providing users with meaningful insights derived from the uploaded text. Once the text is extracted from an image using Optical Character Recognition (OCR) and analyzed by a Machine Learning (ML) or Deep Learning (DL) model, the results need to be presented in a clear, user-friendly manner. The effectiveness of the presentation significantly impacts user experience, interpretability, and the practical use of the detected emotions. Typically, the results are displayed through a dashboard or results page, where the detected emotions are presented alongside the extracted text.

For each piece of text, the system shows the dominant emotion category, such as happiness, sadness, anger, fear, surprise, or disgust. Additionally, more granular emotions can be displayed depending on the model's training and purpose. Alongside the predicted emotion, the system often provides a confidence score or probability value, indicating the model's certainty about the classification. For instance, it may display something like: *"Emotion Detected: Happiness (Confidence: 92%)"*. Additionally, providing explanatory insights alongside the results can improve the user experience. For instance, if the detected emotion is sadness, the system could highlight which words or phrases contributed most to that prediction. The presentation of results should also include options for users to download the analysis, save results to a database, or share findings with other stakeholders. Such functionalities can enhance the practical application of text-based emotion detection in various domains.

4. CONCLUSION

In this paper, Deep Learning model with Tfidf Vectorizer gives us the best result with an accuracy of 92% Not only the accuracy of ANN is high but also the validation loss is very low. In the future we will tackle the imbalance in the dataset using text augmentation and will build various huge deep learning models. Overall, these findings suggest that intelligence plays an important role in text-based communication and related constructs Further research is needed to fully understand the impact of emotional intelligence on text-based communication in different contexts and settings Text-based emotion detection is a critical and impactful area in Natural Language Processing (NLP), leveraging machine learning (ML) and deep learning (DL techniques to analyze textual data and identify emotional tones such as happiness, sadness, anger, fear, and more. Here are key takeaways from the exploration of ML and DL methods for emotion detection In conclusion, both machine learning and deep learning techniques have made significant contributions to the field of text-based emotion detection. While traditional ML approaches provide a solid foundation, DL methods, especially those using neural networks, have pushed the boundaries of what's possible. As research progresses and more sophisticated models are developed, emotion detection is expected to become more accurate, contextual, and applicable across various domains

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