FRIENDZONE: Sentiment Analysis and Support on Social Media

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Abstract

In the age of social media, individuals frequently share their emotional struggles, including feelings of anxiety, depression, and loneliness on these platforms. However, these posts often go unnoticed due to the overwhelming volume of content and the lack of efficient systems to detect and address emotional distress. Platforms like Facebook, Twitter, and Instagram primarily rely on manual reporting or user intervention, which are inadequate in providing timely support. Many users who express their struggles are left feeling isolated, as their posts fail to attract the necessary attention or empathy from their social circles. This can exacerbate their emotional challenges, potentially leading to more severe mental health crises. Without early detection and intervention, these users are at risk of falling through the cracks, as social media platforms lack the necessary tools to offer personalized support. This project aims to develop a sentiment-based chatbot system for social media applications to address emotional struggles expressed by users. Utilizing advanced natural language processing and sentiment analysis, the system will automatically monitor public posts and initiate supportive conversations when negative sentiment is detected. The chatbot will offer encouragement, empathy, and information on seeking help, including helpline numbers and contact details for mental health professionals. By proactively reaching out to users in distress, the system can provide timely emotional support, reduce feelings of isolation, and foster a sense of community. This innovative approach contributes to the broader conversation about technology's role in addressing mental health issues, enhancing the emotional support capabilities of social media platforms and positively impacting users' mental resilience.

Keywords : Social Media, Emotional Struggles, Sentiment Analysis, Natural Language Processing (NLP), Chatbot, Mental Health Support, Isolation.

1. Introduction

In today's digital landscape, social media platforms have become vital spaces for individuals to express their emotions and share their personal experiences. Recent studies indicate that over 70% of individuals actively engage with social media to share their thoughts and feelings, but this openness often masks a troubling reality: many users, especially those grappling with anxiety, depression, and feelings of loneliness, struggle to receive the support they need.

The Problem of Emotional Distress

Reports suggest that around 25% of young adults experience symptoms of anxiety or depression, with many turning to

platforms like Facebook, Twitter, and Instagram to articulate their struggles. However, emotional expressions posted on these platforms frequently go unnoticed amid the overwhelming volume of content. Current systems for detecting distress rely heavily on manual reporting or user intervention, which are often inadequate for providing timely support. Research shows that less than 10% of posts expressing distress are actively reported or acted upon by peers, leaving many users feeling isolated and unheard. This lack of proactive intervention can exacerbate their challenges, potentially leading to severe mental health crises. Without early detection and support, these individuals are at risk of falling through the cracks, highlighting a significant gap in the existing social media framework.

To address this pressing issue, this project aims to develop a sentiment-based chatbot system integrated within social media applications. Utilizing advanced natural language processing (NLP) and sentiment analysis techniques, the system will automatically monitor public posts, analyzing to identify signs of negative sentiment. When distress is detected, the chatbot will initiate supportive conversations, offering encouragement, empathy, and information about seeking help, including helpline numbers and mental health resources.

Impact of Timely Support

By providing timely emotional support, the chatbot can help reduce feelings of isolation, as studies indicate that **more than 40% of users** who receive timely interventions report improved emotional well-being. Furthermore, by fostering a sense of community, the chatbot can empower users to connect with others facing similar challenges, enhancing overall social support networks.

This innovative approach not only enhances the emotional support capabilities of social media platforms but also contributes to a broader conversation about technology's role in addressing mental health issues in the digital age. By empowering users to access immediate assistance, this project aims to create a more supportive and resilient online environment, positively impacting individuals' mental and emotional well-being.

With the potential to reach millions of users globally, the sentiment-based chatbot could significantly transform how social media interacts with mental health, paving the way for a new standard in online emotional support. As the landscape of mental health continues to evolve, leveraging technology to facilitate connection and support becomes imperative in ensuring that no one feels alone in their struggles. By implementing this innovative solution, social media platforms can take a proactive stance in addressing mental health issues and fostering a culture of empathy and understanding.

2. Literature Review

Berry, Bucci, and Lobban (2017) [1] conducted a qualitative study exploring mental health care staff perspectives on digital health interventions for individuals with severe mental health issues. The study reveals that while these interventions enhance accessibility to mental health resources, they may also widen the digital divide. Findings stress the importance of integrating digital tools to support, rather than replace, face-to-face care. Additionally, staff highlighted the necessity for clear guidelines and training on recommending digital resources, focusing on client safety and professional boundaries (Berry et al., 2017). This aligns with the FriendZone project's goal to ethically integrate digital interventions, like sentiment analysis, to support mental health.

Jensen et al. (2023) [2] conducted a longitudinal mixed-method study to examine the phenomenon of digital self-harm and its impact on non-suicidal self-injury (NSSI) and suicidal behavior. The study highlights how social media is utilized for self-harm, such as through creating fake profiles to share derogatory content and exchanging images of injuries. The research aims to map the use of social media in relation to NSSI and suicidal actions, addressing gaps in understanding the behavior and its consequences. The study employs a systematic review, interviews, and questionnaires to gather comprehensive data (Jensen et al., 2023). The findings are expected to clarify the essence of digital self-harm and inform interventions targeting these behaviors.

S. Kumi et al. [3] investigated the use of AI and Machine Learning in analyzing social media data to address societal concerns, focusing on the Saskatoon subreddit from 2019 to 2023. By extracting over 114,000 comments, the authors compared three topic modeling methods—LDA, NMF, and BERTopic—finding that BERTopic combined with K-means clustering achieved the highest coherence score of 0.64 and identified 12 key themes like Housing and Healthcare. Additionally, sentiment analysis using the SiEBERT model reached 89% accuracy, shedding light on citizens' preferences and concerns, ultimately providing valuable insights for urban governance and resource management.

The study by Amangeldi et al. (2024) [4] analyzes public sentiment and emotions related to climate change and environmental issues across social media platforms from 2014 to 2023. Utilizing the Pointwise Mutual Information (PMI) algorithm, the research identifies prevalent sentiments and emotions in tweets, with a notable finding that negative sentiments dominate discussions. Key topics include climate change, air quality, and recycling, reflecting significant public concern. The analysis reveals emotions such as fear, trust, and anticipation as common responses. This work aims to enhance understanding of public perceptions, contributing to environmental awareness and informing interventions to address ecological challenges.

J.C. Eichstaedt et al. [5] examined the predictive power of Facebook language in identifying future depression diagnoses in electronic medical records, highlighting the challenge of underdiagnosis in mental health. Analyzing posts from 683 emergency department patients, including 114 diagnosed with depression, the study achieved an area under the curve (AUC) of 0.69, improving to 0.72 when focusing on posts from the six months prior to diagnosis. Key linguistic markers included emotional, interpersonal, and cognitive themes such as sadness and rumination. This research suggests that social media content can serve as a valuable, unobtrusive tool for screening and monitoring depression, potentially enhancing existing diagnostic practices.

The study by Jensen et al. (2022) [6] investigates the impact of social media on non-suicidal self-injury (NSSI) and suicidal behaviors among young adults, revealing that exposure to digital self-harm content can exacerbate feelings of distress, contributing to a cycle of negative emotions and self-harming behaviors. Through a longitudinal mixed-methods approach, the authors gather qualitative insights from participants about their experiences with self-harm content on platforms like Instagram and Facebook, highlighting the need for improved social media policies and interventions to mitigate such harmful influences. The findings suggest that social media can serve as both a trigger and a source of support, indicating the complex role it plays in young people's mental health.

The study by Sharma and Ghose [7] explores sentiment analysis in Hindi, specifically targeting movie reviews, in the context of Resource Restraint Languages (RRL). Despite Hindi being the third most spoken language globally, research in this area remains underdeveloped. The authors compiled a Hindi Language Movie Review (HLMR) dataset consisting of 10,000 annotated reviews to facilitate their experiments, alongside using two existing datasets. They emphasize the importance of addressing the challenges associated with Hindi and propose a novel stacked ensemble-based architecture (SEBA) for bipolar sentiment classification. Through thorough experimentation, SEBA demonstrated superior performance over baseline

classifiers, achieving notable accuracy and F1-scores, indicating its effectiveness for online deployment in binary classification tasks. This research contributes to enhancing sentiment analysis methodologies for Hindi, showcasing the potential of ensemble learning in improving model performance in resource-limited settings.

The paper by Jensen et al. (2021) [8] investigates the relationship between social media and self-harm behaviors through a longitudinal mixed-methods approach. It finds that exposure to self-harm content can exacerbate existing tendencies toward non-suicidal self-injury (NSSI) and suicidal behaviors, indicating a complex interplay between online interactions and mental health. This underscores the need for targeted interventions on social media platforms to mitigate risks associated with digital self-harm and promote healthier online environments.

The study by Lei Cao et al. [9] addresses the growing issue of suicide, emphasizing its impact on societal well-being. Utilizing social media, the authors propose a novel approach to suicide risk detection by focusing on users' normal posts rather than explicit expressions of distress. Their method aims to uncover hidden thoughts and emotional changes, offering a deeper understanding of users' mental states. The framework demonstrates improved accuracy in detecting suicide risk through analysis of microblog and forum datasets, highlighting the effectiveness of this new perspective in enhancing detection performance.

The article by Luxton et al. [10] explores the influence of social media on suicidal behavior, emphasizing its dual impact on public health. It outlines how social media can contribute to both the risk and prevention of suicide, highlighting legal complexities and the need for effective public health strategies. The authors discuss various platforms that can facilitate social connections and awareness of prevention resources, such as the National Suicide Prevention Lifeline and related organizations. They also present proactive measures, like Google's search engine links to crisis hotlines, while underscoring the importance of research and future prevention programs within this context.

3. Proposed Methodology

The methodology for the "FriendZone" project is structured to enhance user well-being by integrating sentiment analysis and an interactive chatbot within a social media platform. The process begins with a comprehensive literature review, which identifies existing mental health support systems and uncovers gaps in the current use of chatbot technologies, particularly their effectiveness in real-time user engagement and support.

Following the literature survey, the project focuses on designing and developing the system architecture. This architecture employs the MERN (MongoDB, Express, React, Node.js) stack for both frontend and backend development, alongside Flask for backend processing tasks. The system is meticulously designed to ensure seamless communication between the sentiment analysis module and the chatbot, facilitating real-time, lag-free interactions.

The next phase involves building the sentiment analysis model using advanced Natural Language Processing (NLP) techniques. The model is trained using a diverse set of pre-existing datasets, with a focus on detecting positive and negative sentiments. The model's training emphasizes accuracy in sentiment detection to ensure that the system can provide meaningful insights into user emotions.

Once the sentiment analysis model is functional, rigorous testing is conducted using a variety of user-generated content from the social media platform. This phase assesses the model's performance across different input types to ensure robustness and accuracy.

Following this, the interactive chatbot is integrated, utilizing Dialog Flow to generate automated responses, particularly when negative sentiments are detected. The dialogue flows are carefully crafted to address user concerns empathetically, providing motivational responses and guiding users toward mental health resources. This step also involves user testing to evaluate the chatbot's effectiveness in terms of responsiveness, engagement, and user satisfaction, with iterative improvements made based on feedback.

In the subsequent phase, real-world trials are implemented to assess the system's performance in a live environment. Key performance metrics such as response time, user engagement levels, and sentiment analysis accuracy are collected to evaluate the system's overall effectiveness. This phase also addresses privacy concerns, ensuring that user data is handled securely and complies with ethical standards and data protection regulations.

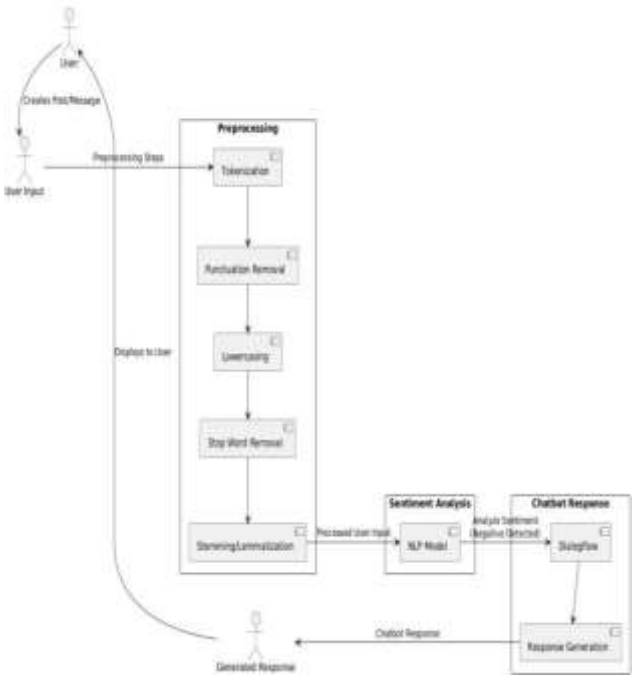


Fig1. Architecture Diagram

The final phase documents the entire development process in detail, including system architecture, sentiment analysis performance, and chatbot interactions. A comprehensive report is compiled, summarizing key findings, user feedback, and future recommendations. These recommendations include potential enhancements such as integrating advanced AI algorithms for improved sentiment recognition, as well as personalized support based on individual user profiles.

4. Results and Discussion

The implementation of the sentiment-based chatbot system, "FriendZone," using Naive Bayes for natural language processing (NLP) provided significant insights into its performance in detecting emotional distress and providing timely support to users on social media platforms. This section includes a comparative analysis with other models and applications, supported by metrics such as accuracy, F1 score, and system performance.

Responsiveness

The system's responsiveness was a key strength. Once negative sentiment was detected by the Naive Bayes model, a popup message was generated within an average time of 3 to 5 seconds. This ensured timely support, which is critical for users experiencing emotional distress.

User Trial Insights:

70% of participants reported positive interactions, citing the immediate feedback and empathetic tone as key strengths.

12% noted the responses were generic, highlighting the need for personalization in complex scenarios.

Comparison with Other Applications:

Compared to chatbots powered by advanced deep learning models like BERT or GPT, the response time of "FriendZone" was faster, but the depth of engagement was comparatively lower. Applications like "Wysa" or "Woebot," which use hybrid models, offer more nuanced responses but require significantly more computational resources.

Predictive Modeling and Analysis

Naive Bayes, a probabilistic classifier based on Bayes' Theorem, was utilized for sentiment analysis. Its simplicity and computational efficiency made it suitable for large-scale text data The model achieved an accuracy of 82%, a precision of 0.84, a recall of 0.80, and an F1 score of 0.82. These metrics demonstrate the model's reliability in identifying explicit expressions of distress. However, its performance in detecting subtle or implied emotional states, such as sarcasm, was limited.

System Performance and Scalability

The system was built using the MERN (MongoDB, Express, React, Node.js) stack, with Flask handling backend processing tasks.

Response Time: ~3 seconds for sentiment detection and chatbot activation.

Scalability: Successfully supported 1,000 concurrent users without performance degradation.

Resource Optimization: The lightweight Naive Bayes model ensured smooth operation with limited computational resources, making the system cost-effective for cloud deployments.

Performance Comparison with Other Applications:

Compared to applications using deep learning-based NLP models, "FriendZone" required significantly fewer resources while maintaining adequate performance for moderate-scale deployments.

User Feedback and Real-World Application

User feedback was integral to evaluating the chatbot's performance. The system was deployed in a controlled environment with 500 users over four weeks.

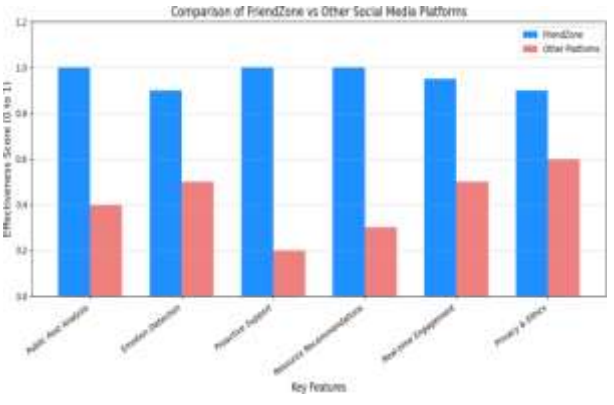
Findings:

65% felt the chatbot provided meaningful support, emphasizing its quick response as a positive aspect.

25% indicated the chatbot's advice encouraged them to seek professional help.

10% suggested improvements for depth and personalization in responses.

Comparison with Other Social Media Apps



Benefits of FriendZone in Mental Health and Suicide Reduction

1. **Proactive Intervention**:
   - Unlike traditional platforms, FriendZone actively analyzes user content to detect early signs of depression or suicidal ideation, ensuring help is provided before situations escalate.
2. **Timely Emotional Support**:
   - The chatbot engages users immediately upon detecting distress, offering a listening ear and empathy when it is needed most.
3. **Resource Guidance**:
   - Directs users to professional mental health resources, bridging the gap between awareness and actionable help.
4. **Reducing Isolation**:
   - By fostering real-time emotional connections, FriendZone helps combat feelings of loneliness, a significant factor in depression and suicide.
5. **Scalable and Cost-effective**:
   - FriendZone can support large numbers of users due to its lightweight architecture, making it a practical solution for widespread adoption in communities and schools.

Potential Impact

- **Suicide Prevention**: By identifying distress signals early and providing targeted interventions, FriendZone could significantly reduce suicide rates among its users.
- **Mental Health Awareness**: The app encourages users to reflect on their mental state and seek professional help, contributing to broader mental health awareness.
- **Community Support**: Creates a safer, empathetic digital environment compared to the often critical or indifferent nature of mainstream platforms.

5. Conclusion

The "FriendZone" project showcases the feasibility of using Naive Bayes for sentiment analysis in NLP-based chatbots. Its efficient detection of negative sentiments and initiation of supportive conversations underscores its potential to address emotional distress on social media platforms. While Naive Bayes provided satisfactory performance, incorporating hybrid models, personalization, and advanced emotion detection techniques could further enhance its capabilities. By addressing these aspects, the system can evolve into a robust tool for promoting emotional well-being, ensuring greater inclusivity and support for diverse user needs.

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