Research

Comparative Analysis of Models for Emotion and Mental Health Condition Detection

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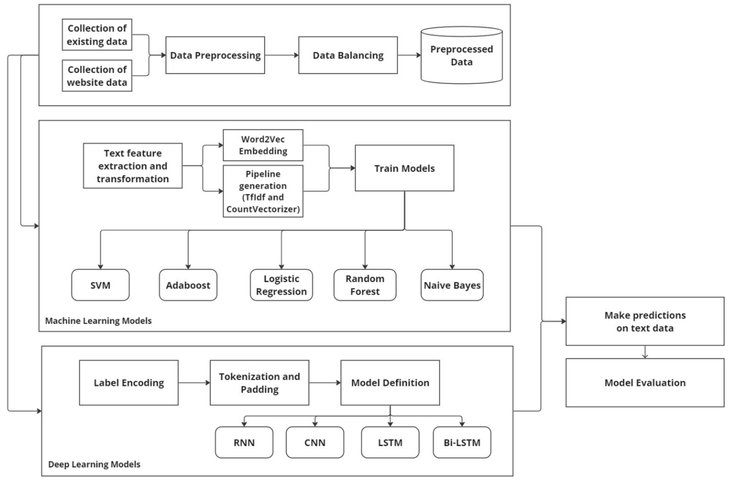
Abstract

In a digital era, where social media serves as a primary mode of communication, understanding the emotional and mental well-being of individuals through textual data has emerged as a critical concern. This study presents a comprehensive comparative analysis focusing on detecting emotions and mental health conditions. The study consists of two primary components: emotion detection and mental health condition detection, both leveraging datasets extracted from our data collection survey website and social media platforms such as Twitter, Reddit and other sources. Various machine learning and deep learning models, including Logistic Regression, SVM, Naive Bayes, Random Forest, Adaboost, RNN, LSTM, Bi-LSTM, and CNN, are evaluated to discern their efficacy in recognizing emotions and symptoms of mental health conditions from the textual data. The objective is to identify optimal models that can accurately detect emotions and signs of depression and suicidal ideation in the text. Through rigorous evaluation, this study aims to contribute to the advancement of technology-enabled mental health care, leveraging the vast pool of textual data available on social media platforms to enhance our understanding and detection of emotional and mental health states.

System Architecture



Results

Performance of Emotion Detection Models:

Model	Accuracy	Precision	Recall	F1 Score
CNN	0.63	0.64	0.63	0.61
Logistic Regression (Count Vectorizer)	0.61	0.62	0.61	0.61
Conv1D-BiLSTM	0.60	0.55	0.60	0.57

Performance of Mental Health Condition Detection Models:

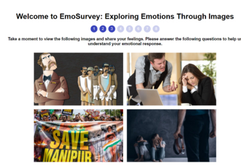
Model	Accuracy	Precision	Recall	F1 Score
CNN-LSTM	0.94	0.95	0.94	0.94
Bi-LSTM	0.77	0.73	0.74	0.72
Logistic Regression (Count Vectorizer)	0.72	0.71	0.79	0.70

Background Information

The pervasive influence of social media can trigger feelings of isolation, worry, and inadequacy, contributing to negative mental health effects like depression and thoughts of self-harm among users. Machine Learning technologies have emerged as promising tools for analyzing the sentiments expressed in textual data shared on social media platforms. [1] These technologies excel in pinpointing emotions conveyed through text. The authors advocate for further refinement of emotion detection models, urging the integration of multimodal data and the exploration of real-world applications such as mental health monitoring and customer feedback analysis. However, they highlight the persistent challenge of acquiring large-scale, accurately labeled emotion datasets. [2] The process of identifying expressions of emotion in text involves analyzing linguistic cues, context, and sentiment to determine the underlying emotional content. However, textual expressions of sarcasm and irony can be misinterpreted by emotion detection algorithms, leading to inaccurate results. [3] A new hybrid approach has been suggested for identifying depression through the analysis of users' written posts on Reddit. The effectiveness of various word embedding techniques was assessed using the Bi-LSTM model to distinguish between depressive and non-depressive posts. By manually reviewing and categorizing posts into depressive or non-depressive classes, observations were made to support the evaluation process. [4]

Data

The data collection process for our research was conducted through two distinct approaches, each tailored to specific methodologies. Our first approach focused on detecting emotions, for which we developed an interactive website called 'Emosurvey" to collect emotional responses from users. This platform was meticulously designed to evoke a spectrum of emotions, ranging from anger and stress to anxiety, sadness, fear, and joy. Users were prompted with carefully curated questions, accompanied by thoughtfully selected images to elicit nuanced emotional responses. The acquired data was then merged with other sources of emotion data available online to build a comprehensive dataset.



Our second approach focused on detecting signs of depression and suicidal ideation in text. For this, we sourced our data from GitHub, incorporating random tweets from the Sentiment 140 dataset and extracting tweets indicative of depression using the Twitter API. Preprocessing techniques were implemented to balance entries across different mental health indicator states, ensuring a more equal representation within the dataset. The culmination of these efforts resulted in a comprehensive dataset serving as the foundation for our analysis.

References

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