SYNOPSIS

Report on

Take Your Care

by

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ABSTRACT

In modern society, rapid technological advancements and increased digital connectivity have reshaped human interactions, work dynamics, and lifestyle patterns. While these advancements offer numerous benefits, they have also contributed to the rise of mental health issues such as anxiety, depression, and stress-related disorders. The growing prevalence of mental health conditions, coupled with social stigma and limited access to professional care, has created a need for innovative, technology-driven solutions.

In recent years, individuals have increasingly turned to digital platforms such as social media, blogs, and online forums to express their thoughts and emotions. This presents an opportunity to leverage advances in Natural Language Processing (NLP) to detect signs of mental health conditions through text analysis.

This research explores the development of an AI-powered text-based emotion analysis model designed to identify potential mental health disorders. By leveraging Natural Language Processing (NLP) and machine learning techniques, the model analyses user-generated text to detect conditions associated with mental issues like depression, anxiety. The system integrates transformer-based architectures such as BERT, RoBERTa, trained on publicly available mental health datasets, to achieve high accuracy in classification.

The proposed solution aims to bridge the gap between individuals experiencing mental health concerns and professional intervention by providing preliminary insights and recommendations. While the model does not replace clinical diagnosis, it serves as a supportive tool for early detection and awareness. This research contributes to the intersection of AI and mental health, emphasizing the importance of ethical AI applications in addressing modern psychological challenges.

Keywords: NLP, RoBERTa, BERT, Mental Health, Multi-labels Classification, ML.

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INTRODUCTION

Mental health disorders are becoming an increasingly pressing issue around the globe, impacting millions of people from all walks of life and age groups. As stress, anxiety, and depression rise—particularly among students and working professionals—it's more important than ever to catch these issues early and intervene. Traditionally, mental health assessments have depended on self-reported surveys and clinical interviews, which can take a lot of time and may not always be reliable.

However, recent breakthroughs in Natural Language Processing (NLP) and machine learning are paving the way for automated mental health detection. By analyzing social media posts, online forums, and other digital interactions, we can tap into a wealth of textual data that reveals signs of mental health challenges.

Transformer models such as the BERT, RoBERTa (Robustly Optimized BERT Approach) model with their context-aware capability have demonstrated outstanding capabilities in grasping contextual language, making it an excellent tool for identifying mental health conditions through text analysis. These models are cutting-edge NLP transformer models with the following advantages:

- Performance
- Reliability
- Scalability

This project is driven by a desire to harness the power of artificial intelligence to bridge that gap. By analysing the way individuals express their emotions through text, we aim to develop a system that can understand and identify mental health issues early and accurately. Transformer-based language models, especially those fine-tuned for emotional or mental health content, offer a powerful opportunity to interpret subtle cues in language that traditional methods might miss.

But the goal doesn't stop at detection. We envision a system that not only recognizes when someone is struggling but also guides them toward appropriate help—connecting users with mental health professionals in a timely, personalized manner. By combining the strength of cutting-edge NLP with compassionate application design, this project aspires to be more than just a technical achievement—it aims to make a real-world impact, one message at a time.

Ultimately, this research is motivated by empathy, innovation, and the belief that technology can—and should—play a role in building a healthier, more supportive society.

LITERATURE REVIEW

There have been numerous studies in the field of mental health awareness and detection by utilizing the advanced technology and reading human brain patterns to help detect the causes of these disorders. The evolution of the study is discussed below:

- **Traditional Approaches to Mental Health Detection**

  Earlier efforts in mental health detection primarily utilized rule-based or classical machine learning techniques such as Naive Bayes, Support Vector Machines (SVM), and Random Forests. These models often relied on handcrafted features such as term frequency-inverse document frequency (TF-IDF), sentiment scores, or psychological lexicons like LIWC (Pennebaker et al., 2001). While they demonstrated moderate success, their performance was limited by their inability to fully capture contextual and semantic nuances in language.

- **Deep Learning and NLP Evolution**

  The introduction of deep learning models, especially Recurrent Neural Networks (RNNs), LSTMs, and CNNs, brought significant improvements in understanding temporal patterns and syntactic structures. Studies like Shen et al. (2017) used deep LSTM architectures for depression detection, showing that emotional expression can be learned directly from sequences of words. However, these models still struggled with long-range dependencies and context representation.

- **Transformer Models in Mental Health Applications**

  The advent of transformer-based architectures revolutionized NLP, with BERT (Devlin et al., 2019) setting a new benchmark for various text classification tasks. BERT introduced bidirectional context understanding, which was shown to be particularly effective in emotion and mental state detection. Studies such as Losada and Crestani (2016) and Yates et al. (2017) applied BERT to suicide risk assessment and depressive language detection with promising results.

  RoBERTa (Liu et al., 2019), an optimized version of BERT, further improved model robustness by training on more data and removing certain training constraints. Several studies (e.g., Ji et al., 2022) demonstrated that RoBERTa outperformed BERT in mental health classification tasks due to better generalization and fine-tuned pre-training techniques.

- **Domain Specific Models: MentalBERT, MentalRoBERTa**

  Recent research has emphasized the importance of domain-specific language models. **MentalBERT** and **MentalRoBERTa** are transformer models pre-trained on large-scale

mental health-related text corpora, such as Reddit threads from mental health subreddits. Ji et al. (2021) introduced MentalBERT and showed that it significantly outperformed general-purpose models on depression, anxiety, and suicidal ideation detection. Similarly, MentalRoBERTa demonstrated superior performance in extracting mental health signals from short and informal text due to its pre-training on context-specific language.

LIMITATIONS IN CURRENT STUDIES

Despite significant progress, current studies often focus on binary classification (e.g., depressed vs. non-depressed) and rarely explore multi-class mental health classification. Additionally, few works implement a complete end-to-end system that not only detects mental health conditions but also recommends relevant interventions or therapists. Moreover, model comparisons in most studies are limited to one or two models, lacking a broader performance benchmark.

CONTRIBUTIONS AND IMPROVEMENTS OF THIS STUDY

This study addresses the limitations by:

- Comparing the transformer models (BERT, RoBERTa) on a multi-class mental health classification task (e.g. Depression, Anxiety, Stress, Bipolar Disorder, Normal, etc.)
- Evaluating models using comprehensive metrics including Accuracy, Precision, Recall, etc.
- Deploying the best performing model in a real-world application that detects mental health status and suggests suitable therapists, offering a practical implementation of AI in mental health care.

PROJECT OBJECTIVE

1. **Develop an Emotion Detection Model**
    - Combine multiple text-based emotion recognition approaches to improve accuracy.
    - Explore NLP techniques such as transformer models, sentiment analysis, and deep learning.

2. **Identify Mental Health Disorders from Text Inputs**
    - Analyze textual symptoms to match potential mental health conditions.
    - Develop a classification model that correlates symptoms with possible disorders.

3. **Improve Early Detection and Intervention**
    - Provide insights into emotional and psychological states based on user text input.
    - Generate recommendations for consulting a professional if risk indicators are identified.

4. **Ensure Model Accuracy and Fairness**
    - Minimize bias in text-based emotion detection across different demographics.
    - Validate the model using diverse datasets to improve generalization.

5. **Develop an Explainable and Interpretable AI Model**
    - Implement interpretable techniques for understanding model predictions.
    - Provide users with reasons for detected emotions and suggested mental health concerns.

RESEARCH METHODOLOGY

Some common features of the app *Take Your Care*:

- Mental Health Status Detection
- Therapist Recommendation

Key Features and Functionality with Step-wise Flow —

- **Step 1: Get Mental State Text —** To get the input text for the emotional state or about *how he feels?* from the user who wants to get his mental health predicted.
- **Step 2: Analyze Mental Health —** Analyzing mental health triggers the process of the deployed model, **RoBERTa**, to detect the mental health condition of the user who wishes to detect mental health status.
- **Step 3: Detected Mental Health Status —** Detected mental health status is displayed on the diagnosis results page after completing the analysis process.
- **Step 4: Therapist Recommendation —** The detected status is responsible for the therapist recommendation shown to the user. If a user is detected with normal mental status, there will be no therapist recommendation, otherwise the detected status is matched in the therapists list for respective status and then shown or displayed to the results page below the detected status.

Proposed Flow of the Application:

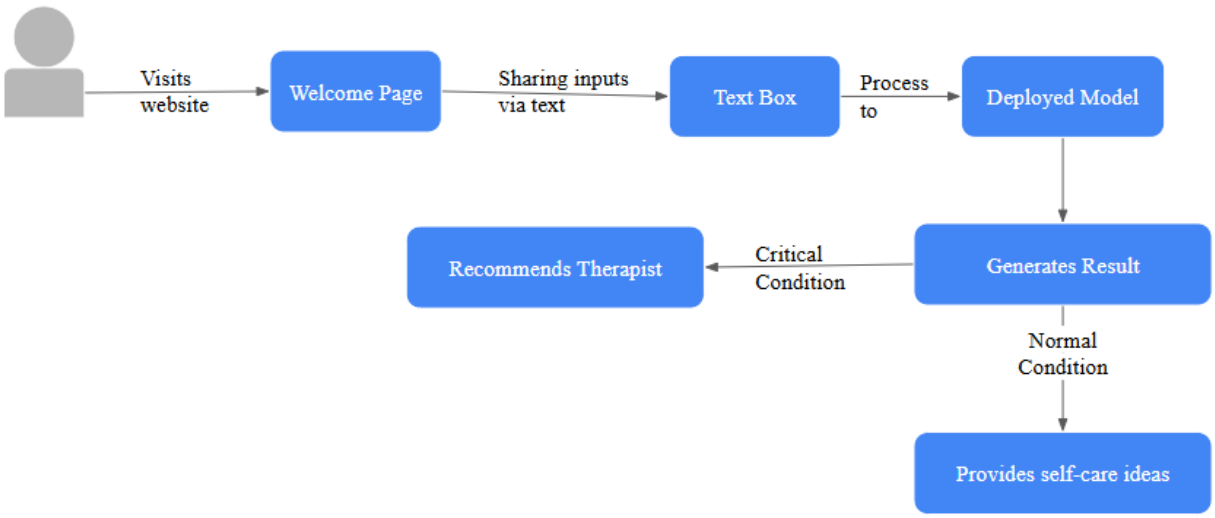

Fig. 1. Proposed Flow of the Application

PROJECT OUTCOME

This project intends to help users by predicting their mental health status early and to contribute to a mentally healthy society by using current technological progress for improved health and well-being.

Expected benefits include:

1. **For Users:**
    - Convenience and Accessibility
    - Cost-Effective
    - Flexibility
    - **Anonymity**: User can easily share his emotional state without the fear of judgment and gets timely treatment as per the predictions and recommendations.

2. **For Society:**
    - Healthy Society, Happy Society, and Fosters growth.
    - Early detection of mental health issues improves the economy by ensuring talented individuals receive timely treatment, contributing to national economic growth. This includes benefiting valuable assets like highly capable students.

APPLICATION OUTCOMES –

- **Detection of Mental Health Condition**

This system provides the result on the mental health status of the user with the help of the text-based inputs provided by the user.

- **Provides Recommendation**

After assessing the user's health status, if the condition is determined to be critical, the system provides contact information for a therapist or psychiatrist. For cases identified as normal or mild, it offers self-care tips and suggestions for improvement.

PROPOSED TIME DURATION

The estimated time duration for the training, development, deployment and testing of "**Take Your Care**" is as follows in the given table:

TASK	Duration							
	1st Week	2nd Week	3rd Week	4th Week	5th Week	6th Week	7th Week	8th Week
Project title								
Project Planning								
Resources & Info Collection								
Synopsis and PPT Work								
Presentation 1								
UI Development								
Model Training and Evaluation								
Finalizing Model and Integrating with UI								
Report and Presentation Work								
Project and Presentation 2								
Testing and Deployment								
Final Report Completion								
Research Paper								

Total Duration: **8 - 12 weeks** (2-3 months)

This schedule takes into account the training, development, deployment and testing to guarantee that the model and the application satisfies project expectations for functionality, performance, and overall experience.

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