ISSN: 2582 - 6379
IJISEA Publications
International Journal for Interdisciplinary Sciences and Engineering Applications
IJISEA - An International Peer- Reviewed Journal
2025, Volume 6 Issue 2
www.ijisea.org

Sentimental Analysis Using Transformers Tensor flow and Bert Model

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ABSTRACT

This project presents an innovative approach to mental health detection and personalized recommendations using advanced natural language processing techniques. Leveraging BERT-based sentiment analysis and Generative Pre-trained Transformers (GPT), our methodology integrates deep learning models with TensorFlow and the Hugging Face Transformers library. We employ a diverse dataset encompassing a range of emotional expressions—neutral, negative, and positive—to train and validate our models. Once trained, the sentiment analysis model is deployed via TensorFlow Serving within a Streamlit web application, enabling real-time user input analysis. Predicted sentiment labels are displayed alongside personalized mental health recommendations generated by a configured GPT model. This integration enhances user interaction by providing contextually relevant responses tailored to individual emotional states. Additionally, a command-line interface (CLI) version ensures usability across various contexts, offering seamless text-based interaction for mental health assessment and support. Experimental results demonstrate the framework's high accuracy in sentiment classification and its ability to generate coherent, relevant recommendations, thereby advancing mental health applications through cutting-edge NLP technologies.

I. INTRODUCTION

Mental health is a critical aspect of overall well-being, yet it is often underdiagnosed and inadequately addressed due to stigma, limited access to professional help, and the complexity of emotional states. With the global rise in mental health concerns, there is a growing need for innovative, accessible solutions that provide timely and personalized support. Recent advances in natural language processing (NLP) and machine learning offer promising avenues by enabling emotion analysis and the generation of contextually relevant recommendations.

This project introduces a novel framework for mental health detection and personalized support using state-of-the-art NLP techniques. By combining BERT-based sentiment analysis with GPT-driven text generation, the framework aims to accurately classify emotional states and offer tailored mental health guidance. Built with TensorFlow and Hugging Face's Transformers library, the system ensures robust performance and scalability.

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The framework processes diverse emotional expressions—neutral, negative, and positive—using a comprehensively labeled dataset. After training, the sentiment analysis model is deployed via TensorFlow Serving within a Streamlit web interface that supports real-time input and response. Users receive sentiment labels and personalized mental health recommendations generated by the integrated GPT model. To ensure accessibility across different platforms, the system also includes a CLI version for streamlined, text-based interaction.

Experimental evaluations show the system achieves high accuracy in sentiment classification and delivers coherent, personalized responses. This work demonstrates the potential of deep learning-driven NLP solutions for enhancing mental health support in real-time applications.

II. RELATED WORK

To understand the current landscape and identify areas for improvement, this section reviews existing systems for mental health detection and personalized recommendations, highlighting their key functionalities, limitations, and potential enhancements.

1. **Sentiment Analysis and Emotion Detection Systems**
   - *Functionality:*
     These systems classify text into emotional categories (e.g., positive, negative, neutral) using NLP models like Support Vector Machines (SVM), Recurrent Neural Networks (RNN), and more recently, transformer-based models like BERT.
   - *Limitations:*
     - Difficulty understanding nuanced or context-rich expressions.
     - Limited multilingual and cross-cultural handling.
     - High computational demands for training and deployment.
   - *Opportunities:*
     - Enhanced contextual analysis using models like BERT and GPT.
     - Development of lightweight, real-time models for edge deployment.
2. **Mental Health Detection Systems**
   - *Functionality:*
     These systems analyze user-generated text (e.g., social media, chat logs) to detect indicators of mental health issues such as anxiety, depression, or stress. Some systems rely on structured data collection (e.g., surveys).
   - *Limitations:*
     - Dependence on self-reported data, which may lack accuracy.
     - Limited real-time capabilities.
     - Concerns around data privacy and ethical use.
   - *Opportunities:*
     - Real-time feedback integration.
     - Enhanced privacy and security features.
3. **Personalized Recommendation Systems**
   - *Functionality:*
     These systems offer advice and resources based on user input and emotional state, using collaborative or content-based filtering.
   - *Limitations:*
     - Generic or non-contextualized recommendations.
     - Minimal real-time data integration.
     - Lack of empathy in generated responses.
   - *Opportunities:*
     - Use of GPT to create coherent, empathetic, and contextually aware responses.
     - Dynamic adaptation to real-time sentiment analysis for personalized feedback.

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III. METHODOLOGY

The proposed system follows a structured methodology covering data acquisition, model training, system development, and deployment.

1. **Data Collection and Preprocessing**
   - *Dataset Selection:*
     - Collect diverse emotional data (neutral, negative, positive) from sources such as social media, chat logs, and public repositories.
     - Ensure accurate sentiment labeling for supervised training.
   - *Preprocessing:*
     - Tokenize text for model compatibility.
     - Normalize text (e.g., lowercase, remove special characters, expand contractions).
     - Apply data augmentation techniques to enhance dataset variability and model robustness.
2. **Model Development**
   - *Sentiment Analysis Model:*
     - Fine-tune a pre-trained BERT model for sentiment classification.
     - Optimize performance through transfer learning, hyperparameter tuning, and cross-validation.
   - *Recommendation Generation Model:*
     - Fine-tune a GPT model to generate relevant, empathetic mental health recommendations.
     - Train on curated advice datasets and validate through feedback-driven evaluation.
3. **System Integration**
   - *Web Application (Streamlit):*
     - Build an interactive Streamlit app for real-time sentiment analysis and recommendation display.
     - Integrate BERT and GPT models for seamless user experience.
     - Ensure a clean, intuitive user interface.
   - *Command-line Interface (CLI):*
     - Create Python scripts for CLI-based interaction.
     - Enable full model functionality through text prompts in terminal environments.
4. **Evaluation and Testing**
   - *Performance Metrics:*
     - For sentiment analysis: accuracy, precision, recall, and F1-score.
     - For recommendation quality: coherence, relevance, and user satisfaction.
   - *User Testing:*
     - Conduct user studies to assess usability and gather actionable feedback.
     - Iteratively refine system components based on test results.
5. **Deployment**
   - *Cloud Deployment:*
     - Use cloud services (e.g., AWS, Google Cloud) for hosting the web application.
     - Containerize the application using Docker for consistent deployment.
   - *CLI Deployment:*
     - Provide OS-compatible executable scripts.
     - Include detailed setup and usage documentation.
6. **Maintenance and Updates**
   - *Monitoring:*
     - Continuously track model and system performance.
     - Implement robust error handling and logging mechanisms.
   - *Model Updates:*

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- Periodically update datasets and retrain models to ensure accuracy and relevance.
- Address new use cases and improve recommendation diversity.

IV.RESULTS

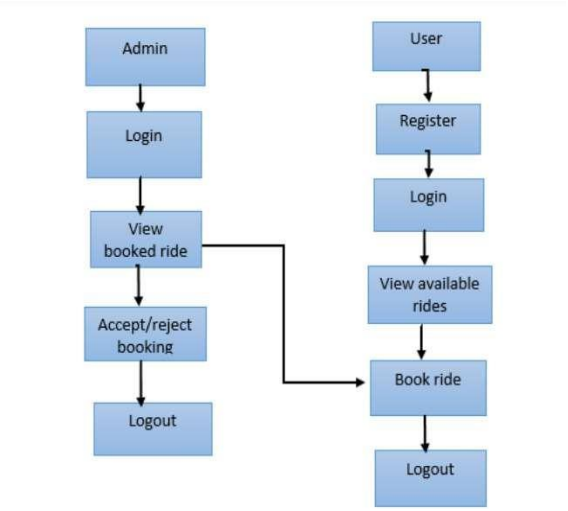

Figure 1:Shows Block Diagram

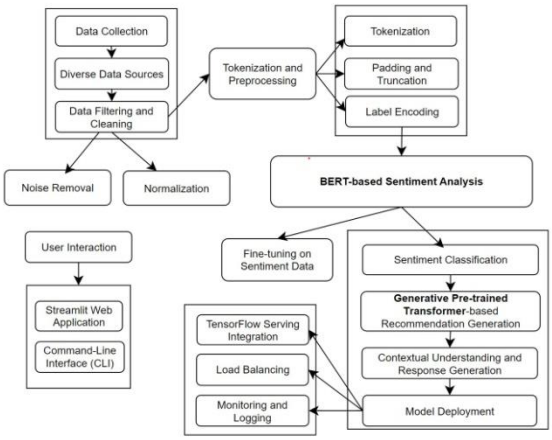

Figure 2 : Shows Architecture Diagram

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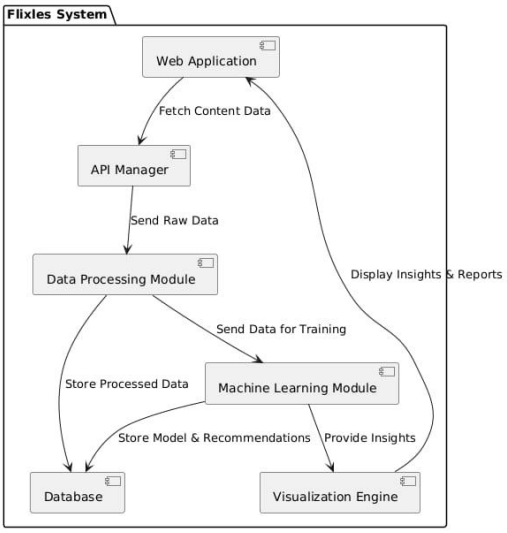

Figure 3 : Shows Component Diagram

V.CONCLUSIONS

In conclusion, the ride-sharing project aims to promote a more sustainable and environmentally friendly method of transportation. By encouraging people to share cars, the project can reduce the number of cars on the road, decrease traffic congestion, lower carbon emissions, and minimize the need for parking spaces. The project proposes several motor pooling strategies and provides an abstract representation of a system that can facilitate safe car-sharing. The success of this project relies on the active participation of individuals and organizations, as well as the support of government policies and regulations. Ultimately, the adoption of ride-sharing as a viable alternative to traditional modes of transportation can lead to a more efficient, cost- effective, and eco-friendly way of getting around.

The success of ride-sharing projects depends on a number of factors, including the availability of reliable technology platforms, incentives for participation, and effective communication strategies. The implementation of such projects requires collaboration between the government, private sector, and individuals.

The benefits of ride-sharing extend beyond reducing traffic congestion and lowering emissions. It can also lead to increased social interaction, reduced transportation costs, and improved accessibility for people who may not have access to personal vehicles.

As the world becomes more urbanized and the number of cars on the road continues to increase, it is important to explore alternative transportation options like ride-sharing. By leveraging technology and promoting a culture of sharing, we can create a more sustainable and equitable transportation system for all.

ACKNOWLEDGEMENT(S):

It gives me immense pleasure to thank my guide Mr. M BHUCHI BABU Professor, CSE for having been a source of constant inspiration, precious guidance and generous assistance during the project work. I deem it as a privilege to have worked under her able guidance. Without her close monitoring and valuable

suggestions, this work would not have taken this shape. I feel that his help is substitutable and unforgettable.

I take the privilege to record my thanks to H.O. D of CSE Dr. P CHIRANJEEVI for his encouragement, cooperation and valuable suggestions to complete project in time.

I take the privilege to record my thanks to Directories od academics of college Dr. P CHIRANJEEVI for his encouragement, cooperation and valuable suggestions to complete project in time.

I am very thankful to honorable Principal Dr M.SASIDHAR and I express my sincere gratitude and deep sense of respect for making me available with all the required assistance and for his support and inspiration to carry out this project in the Institute.

Absolutely! Here's your reference list converted to numerical citation format using square brackets:

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