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Synopsis

Project (21AIP75)

EMOTIONIX

Submitted in partial fulfillment for the award of degree of

Bachelor of Engineering in Artificial Intelligence and Machine Learning

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“EMOTIONIX”

INTRODUCTION

Emotion is a dynamic cognitive and physiological condition that develops in reaction to inputs, like experiences, thoughts, or interactions with people. It includes subjective experience, cognitive processes, behavioral influences, physiological responses, and communication. Therefore, emotion recognition is crucial in the application areas such as marketing, human–robot interaction, healthcare, mental health monitoring, and security.

The study of emotions for healthcare includes vast neurological disorders like sleep disorders, schizophrenia, evaluation of sleep quality, and Parkinson’s disease. Human emotions can play a key role in detecting physiological conditions like fatigue, drowsiness, depression, and pain. The experts also suggested that variation in emotions are of great importance in the study of autism spectral disorder , attention deficit hyperactivity disorder, and panic disorder.

This project proposes a novel solution to tackle the problem of reconstructing incomplete facial images using the algorithms. The algorithm uses a combination of geometric and image processing techniques to recover occluded or damaged regions of the face. It works by generating a convex hull around the visible portions of the face and then applying nonlinear elliptical approximations to estimate the missing boundaries and reconstruct facial features. These approximations are particularly effective in recreating natural contours of the face, ensuring a more accurate recovery of facial structure.

The study of human emotion is also crucial for human–robot interaction and brain-computer evaluation, where machines are designed to behave like humans for various applications. Therefore, a detailed study of human emotions and automated human emotion recognition is crucial.

OBJECTIVES

- Emotion Detection through Speech and Text: Develop a system that accurately identifies human emotions based on speech input and text prompts using advanced natural language processing (NLP) and speech recognition techniques.
- Personalized Emotional Feedback: Provide users with personalized feedback on their emotional state, offering insights and explanations based on the detected emotions.
- Therapy and Well-being Recommendations: Suggest relevant therapy-related tips, relaxation techniques, or well-being activities based on the user's emotional state, enhancing mental health support.
- User-Friendly Interaction: Design a user-friendly interface for seamless interaction, where users can easily input speech or text and receive clear, understandable emotional analysis and recommendations.
- Integration of Machine Learning: Employ machine learning models to continuously improve the accuracy of emotion detection and recommendation, adapting to different emotional expressions and user inputs.
- Support for Multimodal Inputs: Enable the system to process and analyse multiple forms of input (e.g., speech, written text) to provide a comprehensive emotional understanding.
- Real-Time Emotional Analysis: Ensure real-time processing of speech and text data for immediate emotional feedback, allowing users to get insights on-the-go.
- Promote Emotional Awareness and Mental Health: Empower users by raising awareness of their emotional states, ultimately encouraging emotional intelligence and mindfulness for better mental well-being.

PROBLEM STATEMENT

With rising mental health challenges, there is a need for an accessible tool that accurately identifies emotions from both speech and text. Current systems often lack the ability to offer real-time emotional insights and personalized support. This project aims to develop a solution that analyzes emotions from user inputs and provides tailored therapy tips or suggestions to enhance emotional well-being.

SYSTEM REQUIREMENTS

- **System Hardware Requirements:**

1. Processor: Intel i5 or higher (or equivalent AMD)
2. RAM: Minimum 8 GB (16 GB recommended for smoother performance)
3. Storage: At least 256 GB SSD (preferably 512 GB or more for faster data access)
4. Microphone: High-quality microphone for clear speech input
5. GPU (Optional): Dedicated GPU (NVIDIA/AMD) for faster model training if using deep learning
6. Speakers or Headphones: For audio output and feedback.

- **System Software Requirements**:

1. Operating System: Windows 10/11, macOS, or Linux (Ubuntu preferred for development)
2. Programming Languages: Python (for emotion detection algorithms)
3. Frameworks and Libraries: Transformers and Pipeline for text based emotion classification, NLTK or SpaCy (for natural language processing), librosa (for speech emotion analysis), OpenCV (if video or facial emotion detection is integrated)
4. IDE: PyCharm or VS Code for development
5. Version Control: Git (GitHub for repository management).
6. API’s such as Gemini API for recommendation and Spotify API for music recommendation.

METHODOLOGY

1. **Speech Emotion Detection**:
    - Preprocessed audio data using feature extraction techniques like Mel Frequency Cepstral Coefficients (MFCCs).
    - Trained a Support Vector Classifier (SVC) from Support Vector Machines (SVM) to classify emotions based on extracted features.
2. **Text Emotion Detection**:
    - Employed the cardiffnlp/twitter-roberta-base-emotion model for text classification.
    - Preprocessed textual input by removing noise and tokenizing the text.
    - Predicted emotions using the fine-tuned RoBERTa-based transformer model.
3. **Facial Emotion Recognition**:
    - Used a pre-trained convolutional neural network (CNN) model to detect facial expressions.
    - Extracted features from facial images to classify them into predefined emotion categories.
4. **Integration and Emotion Analysis**:
    - Combined outputs from speech, text, and face detection models for comprehensive emotion analysis.
    - Developed algorithms to handle multiple inputs and provide a unified emotional state.
5. **Recommendations**:
    - Provided emotion-based tips and feedback based on the detected emotional state, aimed at enhancing user well-being.
6. **Development**:
    - Implemented the system using Python and appropriate libraries for each module.
    - Created a user-friendly interface for seamless interaction.

IMPLEMENTATION

1. **Speech Emotion Detection**:
    - Used Librosa for identifying the voice and patterns and removing the noise if any.
    - Extracted audio features using MFCCs from recorded speech.
    - Trained a Support Vector Classifier (SVC) model using labeled speech emotion datasets.
    - Integrated the trained model to classify emotions from live or recorded audio inputs.

2. **Text Emotion Detection**:
    - Utilized the pre-trained cardiffnlp/twitter-roberta-base-emotion transformer model.
    - Preprocessed input text by cleaning, tokenizing, and converting it to the format required by the model.
    - Deployed the model for real-time emotion classification of textual inputs.

3. **Facial Emotion Recognition**:
    - Integrated a pre-trained **Open Computer Vision model** (e.g. deep face).
    - Used facial landmarks and expression analysis for emotion classification.
    - Incorporated real-time or uploaded image processing for emotion detection.

4. **Integration of Modules**:
    - Developed a pipeline to combine results from speech, text, and facial analysis.
    - Weighted or prioritized emotion results from different modalities for accurate emotion detection.

5. **Recommendation System**:
    - Mapped detected emotions to predefined tips and suggestions for emotional well-being using Gemini API.
    - Suggesting the songs in through Spotify application playlists using Spotify API.
    - Displayed recommendations through a simple and intuitive user interface.

6. **User Interface**:

- Built a user-friendly interface using frameworks like Dasha and it’s components for user friendly interaction.
- Allowed users to input speech, text, or images seamlessly.

7. **Testing and Optimization**:

    - Validated the system using RAVESDSS datasets for each modality.
    - Optimized each model for better performance and accuracy.

RESULT

- Achieved high accuracy in detecting emotions across three modalities: speech, text, and facial expressions.
- Demonstrated robust performance in recognizing eight predefined emotions.
- Successfully combined outputs from speech, text, and face detection to provide a comprehensive emotional analysis.
- Enhanced reliability of results by considering multiple inputs.
- Enabled real-time emotion detection for speech, text, and images, ensuring practical usability.
- Provided actionable and relevant tips based on detected emotions, aiding user well-being.
- Developed an intuitive interface that allows users to interact seamlessly and receive emotion-based feedback.
- Validated the system on diverse datasets, ensuring robustness and adaptability to various use cases.

Some Figures of Result

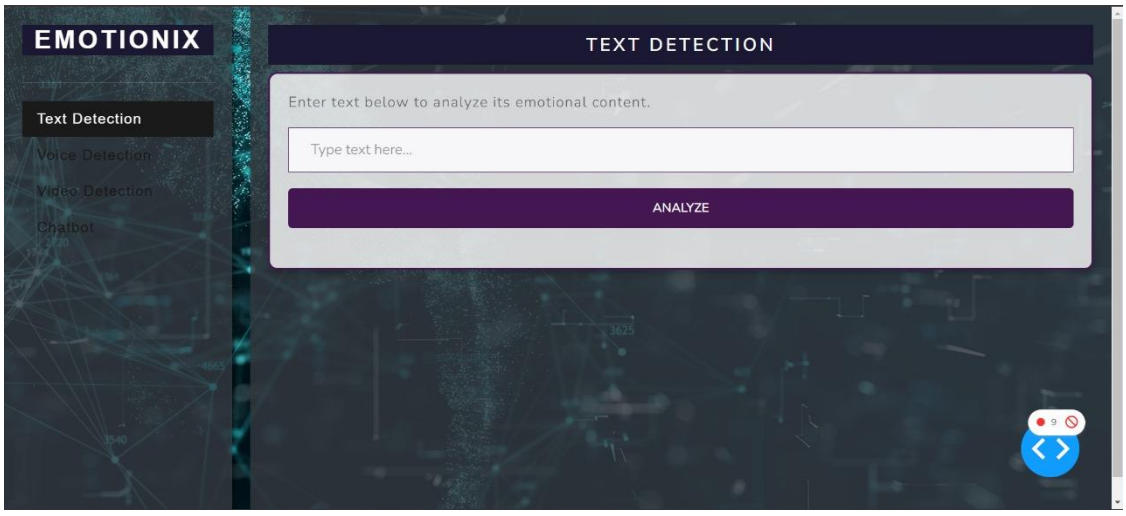

Figure 1 Home page

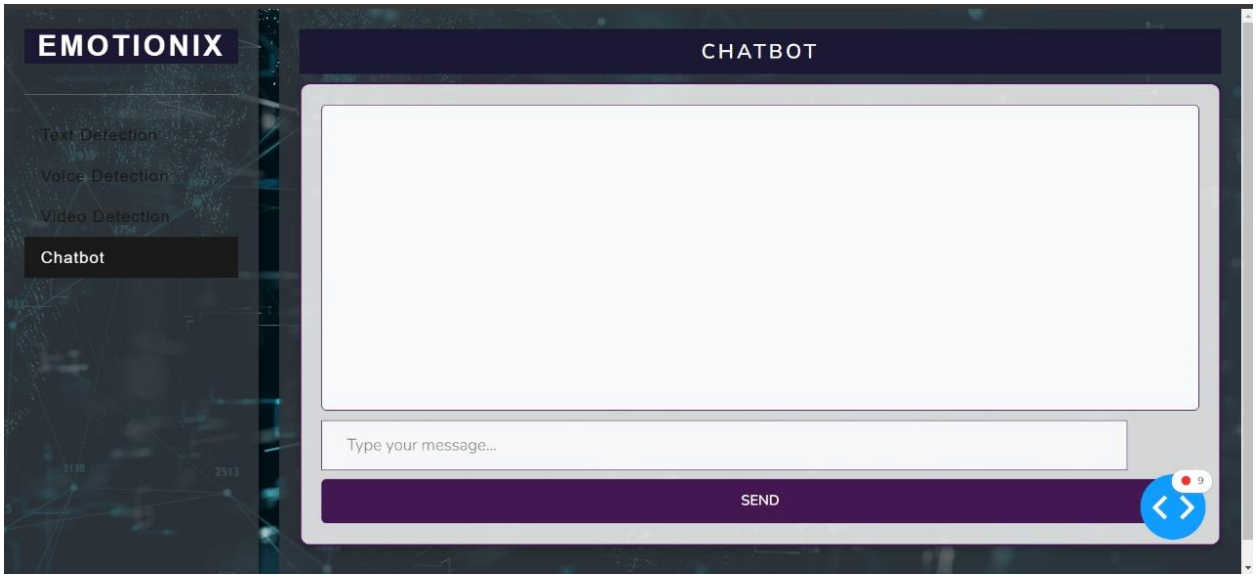

Figure 2 Chatbot implementation

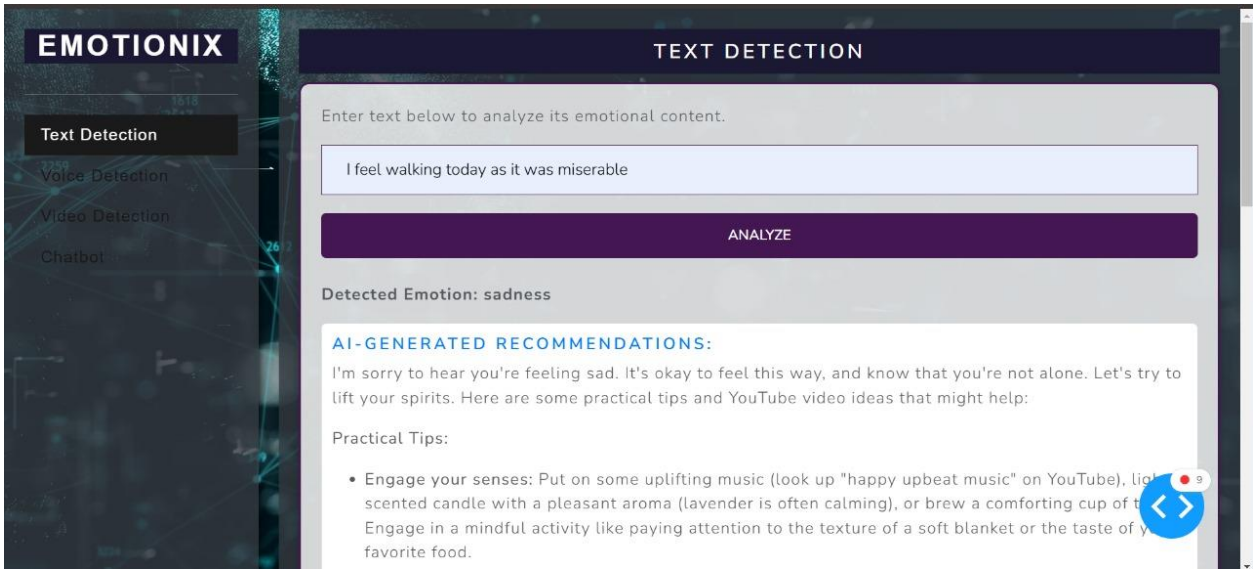

Figure 3 Emotion detection using Text prompt from the users and getting personalized AI recommendations.

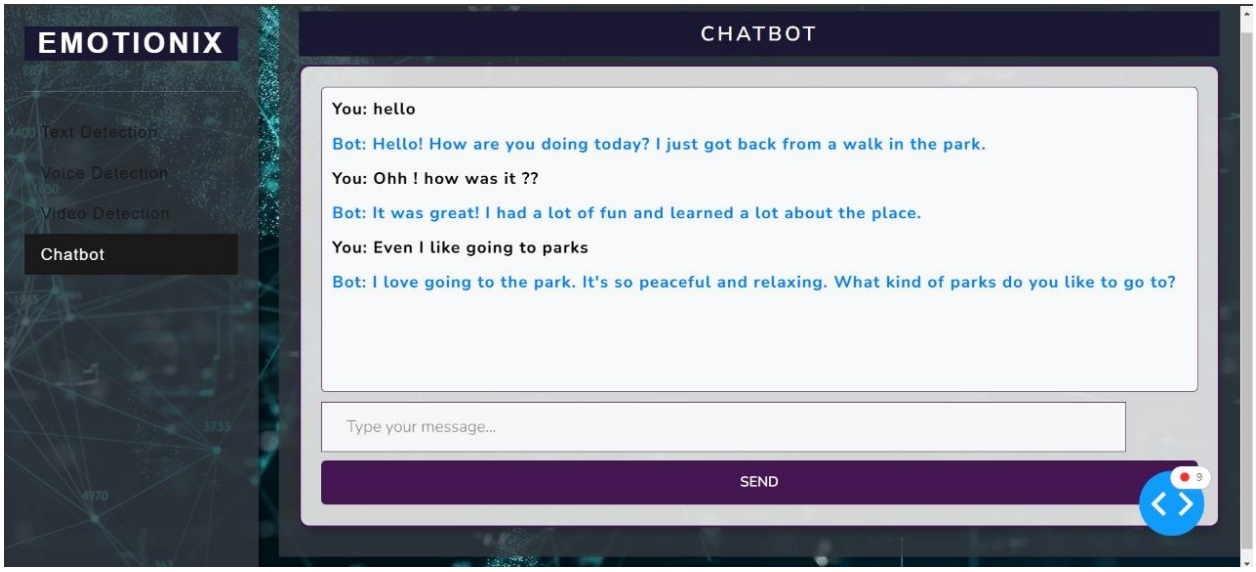

Figure 4 User having the chat with the bot using Chatbot

Project Guide:
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