

PROJ-CS881: Mid-term Review

Project Title: Multimodal AI Framework for Social Media Based Mental Disorder Detection and Personalized Wellbeing Insights	Group#: 29
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1. Questions on the Target System and Functional Implementations

a. What are the core functionalities of the system?

The system is a multimodal AI framework that detects early signs of mental health issues from social media data. It processes inputs across multiple modalities including text, images, videos and audio. It generates personalized wellbeing insights by mapping predictions to specific parameters from Ryff's Well Being Scale using Association Matrix which is dynamically updated with each user filling a wellbeing survey in the application.

b. How are different input types processed?

Text Analysis: Uses NLP techniques (TF-IDF, Bag-of-Words, and advanced vectorizations) and various classifiers (Logistic Regression, SVM, LSTM, Transformer, etc.) to analyze language patterns and classify mental health conditions.

Image Processing & Analysis: Incorporates deep learning modules (e.g., DeepFace and image captioning using ViT-GPT2) to extract text and detect facial expressions. Also, user responses to displayed images are captured and analyzed for emotional cues.

PDF Analysis: Implements PDF analysis by converting PDF pages to images (using tools like pdf2image) followed by OCR (using Tesseract) to extract and process text for mental health cues.

Video & Audio: Extracts frames and audio from videos for separate processing—audio is analyzed via MFCC features, while video frames undergo emotion detection.

Wellbeing Survey & Association Matrix: Captures user survey responses and employs an association matrix that correlates mental health predictions with specific dimensions (e.g., autonomy, personal growth) from Ryff's Scale.

All the above features are combined which collectively helps in analyzing Reddit/Twitter profiles input by the user.

c. How is social media data collected?

Data for the dataset is gathered primarily from Reddit (using PRAW), where posts are preprocessed, cleaned, and balanced across mental health categories before being used to train the various machine learning models.

2. Demo of the System Developed Till Date

A live demonstration of the system would cover the following flow:

- **User Interface (UI):**

A web application (built using Streamlit) provides several modules:

- ***Input Module:*** Users can input text, upload images/PDFs, or even provide video/audio files.
- ***Processing Dashboard:*** Displays real-time predictions and visualizations for each input modality.
- ***Wellbeing Insights:*** After analysis, the system shows targeted recommendations based on the association matrix linked to Ryff's Well Being Scale.

- **Backend Processing:**

Each module (text, image, PDF, audio, and video) routes the input through its dedicated preprocessing pipeline, applies the appropriate machine learning or deep learning model, and then aggregates results for a comprehensive mental health assessment.

- **Interactive Survey:**

Users can fill out a wellbeing survey, and their responses are mapped to specific parameters, generating personalized insights.

This demo showcases the system's capability to handle multimodal data and deliver accurate, actionable insights.

3. % Development and Completion of the System with Calculation Logic

Overall Completion: Based on our requirement matrix (covering FR-001 through FR-012) and the detailed project plan, the system is 100% complete in terms of the originally defined functionalities.

Calculation Logic: The project was segmented into 12 key functional requirements. With each requirement fully implemented and validated (as evidenced by our test cases and evaluation metrics), the calculation is:

$(\text{Number of Implemented Requirements} / \text{Total Requirements}) \times 100$

$$= (12 / 12) \times 100 = 100\%$$

The Gantt chart and scheduling indicate that every milestone—from data collection and preprocessing to model training, testing, and deployment—has been met. Additionally, the enhancements added this semester (PDF analysis, image response analysis, wellbeing survey, and association matrix) have been seamlessly integrated. These enhancements, rather than extending the timeline, have been incorporated within the existing framework, maintaining alignment with the original project objectives. Thus, both the RM figures and project planning milestones confirm that the system is fully developed as per the target for the 8th semester.

4. Design Changes in Semester 8

Several key design enhancements were made:

- **Integration of New Modalities:**
 - **PDF Analysis:** Added a module to extract and process text from PDFs using OCR.
 - **User Response Analysis for Images:** Implemented functionality to capture and analyze emotional responses to images.
 - **Wellbeing Survey Module:** Developed an interactive survey interface to capture user responses.
 - **Association Matrix:** Designed and integrated a new association matrix that maps predicted mental health outcomes to specific parameters from Ryff's Well Being Scale.
- **Architectural Adjustments:**

To accommodate these additional features, modifications were made to the data processing pipelines and the user interface. The modular design of the system allowed these enhancements to be integrated without disrupting the existing functionalities, ensuring that the overall architecture remained robust and scalable.

5. Additional Understanding of the Target System

- **System Modularity:** The project is designed in a modular fashion, enabling independent development and testing of each component (data collection, preprocessing, model training, multi-modal analysis, and wellbeing mapping).
- **Scalability and Extensibility:** The architecture supports future enhancements, such as additional data sources or refined algorithms, which is crucial for a system targeting real-world mental health applications.
- **Real-World Impact:** By integrating multi-modal data analysis and personalized wellbeing insights, the system not only detects mental health issues with high accuracy but also provides actionable recommendations that can aid early intervention.