

Project Overview

Title: AI-Driven Therapy Progress Tracker

Objective: To create a system that can analyze and compare psychological therapy session data to track patient progress using AI and NLP technologies.

Research and Development Approach

Literature Review and Research

Natural Language Processing (NLP):

Sentiment Analysis: We explored different models for sentiment analysis, eventually settling on distilbert-base-uncased-finetuned-sst-2-english from Hugging Face due to its balance of speed and accuracy for our use case. However, a clinical-specific model was considered, which could be integrated if available in the future.

Semantic Similarity: Research into semantic similarity led to the use of Sentence-BERT (all-MiniLM-L6-v2) for computing textual similarity, which provides compact sentence embeddings suitable for our application.

Psychological Assessment:

GAD-7 & PHQ-9: We reviewed established psychological instruments for anxiety (GAD-7) and depression (PHQ-9). These scales were incorporated into the code to score sessions based on symptoms described.

Software Development Methodologies:

Agile Development: Adopted an agile approach for iterative development, allowing for flexibility in adapting the model based on feedback and new research. This method helps in continuous improvement and adaptation to changing requirements.

Design and Architecture

Modular Design:

Assessment Agents: Implemented a factory pattern with AssessmentAgent as a base class, from which GAD7Agent and PHQ9Agent inherit. This allows for easy extension if more assessment tools are needed.

Backend (app.py):

FastAPI: Chosen for its speed and ease of integration with asynchronous tasks, fitting well with our need for handling JSON session data.

Data Flow:

Session data is uploaded via POST requests, processed for sentiment and similarity analysis, then scored using the appropriate assessment agent.

Frontend (ui.py):

Streamlit: Utilized for rapid UI development, providing an interactive interface for users to upload data and view results. Custom CSS was applied for aesthetic enhancement.

Implementation Details

Data Handling:

JSON was chosen for session data due to its ease of use with both Python and web technologies. Error handling was implemented to manage malformed JSON inputs.

NLP Models:

Models were loaded once at startup to save computational resources during multiple requests.

Progress Analysis:

A combination of sentiment scores, semantic similarity, and assessment scores (GAD-7/PHQ-9) provides a nuanced approach to evaluating patient progress.

Error Management and Logging:

Comprehensive error logging and user-friendly error messages in the UI were implemented to ensure maintainability and user experience.

Evaluation and Testing

Unit Testing: Although not shown in the code, unit tests for individual functions like `semantic_similarity`, `is_narrative_improved`, and the agent classes would be crucial.

Integration Testing: Testing the interaction between the FastAPI backend and the Streamlit frontend, including file upload functionalities and API responses.

User Feedback: While not part of the current codebase, planning for user feedback loops to refine the application would be part of the agile process.

Future Work and Improvements

Model Refinement: Explore more specialized NLP models for clinical data, possibly integrating with larger, more diverse datasets.

Scalability: Consider database integration for storing historical data to track long-term progress across multiple sessions.

User Interaction: Enhance user interface with more interactive elements like progress visualization or personalized feedback based on the analysis.

Conclusion

This project combines NLP with psychological assessment tools to offer insights into therapy session progress. The approach was research-driven, focusing on leveraging existing methodologies and tools in a novel way to serve the mental health domain. The iterative nature of our development process allows for continuous enhancement based on new research or feedback.