



AI-Based Real-Time Multi-Agent Depression Detection and Therapy System

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Depression is a prevalent mental health disorder in the world, but diagnosis is constrained by stigma, cost and lack of clinical services. This study describes an AI-Based Real-Time Multi-Agent Depression Detection and Therapy System which aims at early detection and provides therapy suggestions. NLP and speech emotion analysis are incorporated to assess the user input and calculate the level of depression using the Patient Health Questionnaire-9 (PHQ-9). Five specialized agents work collaboratively to process text and voice data, retrieve linguistic and emotional features, and categorize mental states from minimal to severe. A fusion model of PHQ-9 scores, classifier confidence, and speech-based emotion indicators produces a factor-calibrated depression index for precise severity differentiation. Depending on the identified level, the system can offer AI-assisted therapeutic care for minimal or moderate cases, while severe cases are referred to professional care. For voice-based emotion detection, wav2vec 2.0 was trained and reached 81% testing accuracy when classifying emotions into happy, sad, fearful, angry, and neutral categories. Among the 10 participants diagnosed with depression, the system correctly matched the actual severity level for 9 individuals, resulting in an accuracy of 90%. Among these matched cases, a comparison based only on PHQ-9 severity revealed one mismatch: PHQ-9 indicated minimal severity, while both the actual diagnosis and the system identified a moderate level. This demonstrates that the proposed system provides a more accurate severity classification than reliance on PHQ-9 scores alone. A comparison of Large Language Models showed that GPT-3.5 and Mistral produced the most fluent outputs, with BERTScores of 71% and 69.2% respectively, outperforming Gemini at 61% and Claude at 59.8%. Among them, GPT-3.5 was identified as the most suitable model to integrate into the system due to its overall performance.

Keywords: Artificial Intelligence, Depression Detection, Mental Health, Multi-Agent System, Natural Language Processing