AI-Based System for Predicting Mental Health Crises Using Speech, Text, and Behavioural Indicators

1. Introduction

Mental health concerns such as depression, anxiety, and suicidal tendencies are increasing globally. Traditional screening often depends on self-reported symptoms, which may be delayed due to stigma or lack of access. Artificial intelligence can analyse subtle variations in speech, written communication, and behavioural patterns to identify early signs of mental health decline. This proposal introduces a multimodal AI system designed for continuous mental health monitoring and crisis prediction.

2. Problem Statement

Existing psychiatric assessment methods lack real-time monitoring capabilities and frequently miss subtle behavioural changes. An automated and privacy-aware AI system capable of examining communication behaviour and smartphone usage patterns is necessary for detecting early mental health risks.

3. Objectives

• Develop an AI model that integrates voice, text, and behavioural data.

• Identify significant emotional, linguistic, and behavioural biomarkers.

• Implement explainable AI methods to enhance trust and transparency.

• Create a mobile-based prototype for real-time monitoring and alerts.

4. Methodology

Data Sources: Emotional speech datasets (DAIC-WOZ, AVEC), mental health text datasets, and smartphone usage records.

Feature Extraction:

• Voice: pitch, pauses, MFCC, tone. • Text: sentiment patterns, emotional markers, topic trends. • Behaviour: screen time, sleep patterns, communication frequency.

Model Development:

• Speech analysis using CNN-LSTM. • Text analysis using transformer models (BERT).

• Behaviour modelling using LSTM.• Multimodal fusion combining outputs from all modules.

Evaluation Metrics: Accuracy, F1-score, ROC-AUC, interpretability scores.

5. Significance

This system enables proactive mental healthcare, supports clinicians with continuous monitoring insights, reduces stigma, and contributes to suicide prevention efforts.