Project Title:

Utilizing AI, EEG and Gut Microbiota to Predict Mental Health Status from Mindfulness Meditations

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Project Abstract/Proposal Summary:

Depression and anxiety are significant public health issues with profound economic impacts. Mindfulness meditation, a non-pharmacological approach, has demonstrated potential in alleviating these conditions by enhancing cognitive and emotional function. Recent research indicates a complex interplay between mindfulness meditation, gut microbiota, brain activity, physiological status, and mental health. However, the specific biomarkers mediating meditation's effects on mental health remain elusive, limiting our understanding of its underlying biological mechanisms. Moreover, there are no comprehensive models capable of continuously monitoring and predicting psychological changes in real time, integrating gut microbiota, brain activity, and physiological data.

This study aims to investigate the effects of an 8-week daily mindfulness meditation intervention on mental health status in a healthy Chinese cohort using a cross-over trial design. We will employ metagenomics, high-density electroencephalography (EEG), oxygen consumption capabilities from bicycle trainers, blood glucose levels from continuous glucose monitors (CGM), and wearable devices to collect comprehensive data on gut microbiota, brain activity patterns, and physiological parameters. Our primary objectives are to: 1) identify potential biomarkers associated with meditation's impact on mental health, and 2) develop an integrated machine learning model to predict mental health status based on these multi-dimensional data.

We will leverage advanced statistical methods and machine learning techniques to examine the intricate relationships among mindfulness meditation, mental health outcomes, and potential biomarkers. By integrating data from gut microbiome, EEG, oxygen consumption from bicycle trainers, blood glucose levels from continuous glucose monitors (CGM), and wearable devices, we aim to create a robust predictive model for mental health status. This model will be rigorously validated to ensure its generalizability and clinical applicability. The long-term goal

of this project is to advance digital medicine by providing AI-driven, personalized mental health monitoring and intervention tools. These tools could enable tailored meditation practices and potentially guide the development of targeted interventions, thereby significantly enhancing mental health care. The findings from this project could revolutionize the approach to mental health management, offering new avenues for both diagnostic and therapeutic applications in personalized medicine.