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AI-Driven Discovery of Psychobiotics: Predicting Mental Health Therapeutics via Multi-Omics Gut Microbiome Data and Deep Reinforcement Learning

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Abstract: *The gut microbiome has been increasingly recognized for its impact on mental health, with psychobiotics emerging as a promising avenue for non-pharmaceutical treatments. However, identifying the optimal bacterial strains for mental health benefits remains a challenge due to the complexity of microbial interactions. This study introduces an AI-driven framework integrating multi-omics data and deep reinforcement learning (DRL) to predict and optimize psychobiotic formulations. By analyzing metagenomic, metabolomic, and host genomic data, the proposed model identifies microbial strains that influence neurotransmitter production and mental health outcomes. The DRL framework simulates microbial interactions and optimizes strain selection based on neurotransmitter synthesis, reducing trial-and-error in psychobiotic discovery. Initial results show improved accuracy in predicting beneficial microbial strains, suggesting a novel and efficient method for microbiome-based mental health therapies.*

Keywords: Psychobiotics, Gut-Brain Axis, Multi-Omics, Deep Reinforcement Learning, AI in Microbiome Research, Mental Health Therapeutics, Probiotic Optimization

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