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Machine Learning Approaches for the Analysis of Functional Brain Connectivity Patterns in Depression

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According to recent statistics, in Lithuania, in 2022, there were 23,97 per 1,000 residents who suffered any kind of depression. Depression is one of the suicide risk factors, and Lithuania is known for its high suicide rate (first place in the European Union, seventh worldwide). Improvement of prevention and treatment of depression using artificial neural networks could help to lessen illness severity and improve treatment efficacy, which is crucial for improving life quality, mental health, and well-being.

During mental disorders, there are changes in behaviour, but also in brain bioelectric activity, which could be monitored using neuroimaging methods such as electroencephalography, magnetoencephalography, and functional magnetic resonance imaging. Data acquired using those methods can be analyzed as functional brain connectivity. To understand this concept better and to find out if connectivity can be a sustainable biomarker of depression or other mental disorders, several machine learning methods were applied to classify patients and healthy subjects, to distinguish depressed patients from patients with other mental disorders, to predict the symptom change and of treatment efficacy.

The purpose of this research was to evaluate machine learning methods used in this field, what results were achieved, and what are strengths and limitations by analysis of related articles found using the PubMed database from 2000 to 2023. This analysis is important for potential enhancements to these methods, leading to improved diagnostic and therapeutic approaches for depression.