Doctoral School of Information and Biomedical Technologies Polish Academy of Sciences

Subject
Testing deep learning technique as a putative early diagnostic strategy in Alzheimer disease.

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Project Description

Deep learning techniques that are recently getting lots of attention provide new possibilities of analyzing neurophysiological data [1]. The aim of this project is to investigate their applicability in early Alzheimer's disease (AD). AD is the most common cause of dementia: a set of symptoms like memory impairments, thinking confusions, language disorders. In the search to find a treatment of AD, beside works done in humans, researchers have developed animal models of AD. Since animals do not express AD, transgenic animals are used. It has been shown that certain genes make human more likely to develop AD. Such human gene has been identified and secondary included in the genome of mice (transgenic mice) which then develop AD-like symptoms.

Using such models researchers are now able to better understand the cellular and molecular mechanisms of AD. Also, a lot of work has been devoted in the research of AD effect on system and neural networks levels using multielectrode recordings in the brains of freely moving animals. For example, high-frequency oscillations generated in the hippocampus during specific phase of sleep, so called sharp-wave ripples (SWRs) express different dynamics in AD than in the control group of mice [2]. Our preliminary results on deep learning performance of so called "interneural computing machine" indicate that using SWRs the machine is able to distinguish SWRs expressed before and after learning in control but not in transgenic animals. This suggests that the machine performance can be use as a biomarker of AD. Importantly moreover such segregation between healthy and sick animals is also possible if the machine performance is based on fragments of signals not containing SWRs, which do not express group-specific characteristics when analyzed using classical methods. In this project both intrabrain activity and EEG signals will be recorded in freely moving mice performing memory task, at different stages of AD development (collaboration with Bordeaux University). The data will be analyzed using deep learning techniques developed in the Research Center for Interneural Computing in Taichung (collaboration with China Medical University) [3].

Bibliography

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