Docket #: S25-189

Device and method for effective multi-modal sensory neuromodulation

Over 1 in 3 people are affected by neurological conditions worldwide. Pharmacological and surgical treatment options may be limited due to access, side effects, and reduced therapeutic efficacy. Non-invasive stimulation techniques have been developed for the treatment of a subset of these disorders characterized by abnormally strong neuronal synchronization in the nervous system. Some of these treatment approaches employ sensory stimuli, e.g., vibrotactile or acoustic stimuli. These techniques are able to overcome the limitations of pharmacological and surgical treatments

The Tass Lab at Stanford has invented a combined acoustic and tactile device for neuromodulation therapy. The invention is called the Vibrotactile Coordinated Reset (vCR) stimulation and it's designed as an alternative treatment for Parkinson's and other brain disorders characterized by abnormally synchronized neuronal activity. Synchronized pulses in the same frequency and phase are delivered through wireless gloves that serve as wearable devices for the vCR stimulation. vCR stimulation facilitates the unlearning of abnormal synaptic connectivity patterns in neuronal populations, which induces long-lasting desynchronization of disease-related neuronal synchrony and, in turn, results in long-lasting and sustained relief. Along with the vibrotactile stimuli, users can also incorporate auditory stimuli, which provides a multi-modal approach to increase the connectivity between the vibrotactile and auditory cortical areas of the brain during treatment.

Applications

- Treatment of brain disorders such as Parkinson's disease, epilepsy, dysfunction after stroke, and movement disorders (e.g. essential tremor, dystonia)

- Neuropsychiatric diseases
- Auditory diseases, such as tinnitus

Advantages

- Conditioning stimulation by combining desynchronizing stimuli with unspecific stimuli
- Device easy-to-develop, easy-to-test, and easy-to-implement
- Non-invasive
- No medication administered
- Low cost device

Publications

- Ehrens, D., Aeed, F., Otor, Y., Charu, V., Razavi, B., Sarma, S. V., ... & Tass, P. A. (2025). " Electrical Coordinated Reset stimulation induces network desynchronization in an in vivo model of status epilepticus". Epilepsy & Behavior, 165, 110300.

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