Neural Co-Processor for Restoration and Augmentation of Brain Function

This technology offers a deep recurrent artificial neural network as a co-processor for the brain. This system utilizes artificial neural networks and deep learning to understand behaviors such as neurorehabilitation and augmentation of brain function.

What is the Problem?

The human brain is one of the world's most powerful autonomous computers, but nevertheless remains a fragile organ that can be difficult to train and repair. The parallel functions of and similarities between the brain and typical silicon computers have prompted considerable interest in the field of brain-computer interfaces. Brain-computer interfaces may be able to address some of the limitations of the human brain as well as bolster the understanding of an organ with many functions and operations that remain to be understood. Specifically, the computational capabilities of biological neural networks and silicon computers are complementary. For example, human brains commonly transfer information with computers through normal sensory and motor channels. However, transferring information through direct recording of neural activity and electrical stimulation of brain sites is much more challenging.

What is the Solution?

The innovation involves the use of a deep recurrent artificial neural network as a co-processor for the brain. This neural co-processor can be used to create new artificial connections between different areas of the human brain or nervous system or create new artificial connections between the brain and muscles or other body organs. This could be done for the purposes of restoring lost function due to neurological disease or injury or augmenting natural capabilities. This is achieved by receiving neural signals from the nervous system of the individual and/or signals from an external sensor or information source. A stimulation pattern is generated based on the neural signals and/or external information sources, and a neural model, and the stimulation pattern is output to the nervous system of the individual. Stimulation of the nervous system based on the stimulation pattern computed by the neural model produces a measurable output by the individual. The neural co-processor can use any hardware for recording neural signals in the brain and stimulating neural regions, nerves, or muscles.

What Differentiates it from Solutions Available Today?

Technology ID

BDP 8694

Category

Device/Other

Selection of Available Technologies

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Recent advances in interface technologies, computing systems, and the understanding of the human brain have sparked new investigations into the potential of brain-computer interfaces that directly record and/or stimulate the brain. These remain investigational and have challenges with multi-channel decoding and encoding. To address the challenge of multi-channel decoding and encoding, this solution uses a unifying framework for developing brain co-processors based on artificial neural networks and deep learning. These 'neural co-processors' can be used to jointly optimize cost functions with the nervous system to achieve desired behaviors ranging from targeted neurorehabilitation to augmentation of brain function.

Patent Information:

WO2018022793A1

References

1. Rajesh P. N. Rao(44166) , https://www.researchgate.net/publication/346701590_Brain_Co-Processors_Using_AI_to_Restore_and_Augment_Brain_Function, Handbook of Neuroengineering