Computational and Mathematical Methods in Medicine

Special Issue on

Computational Intelligence Methods for Brain-Machine Interfacing or Brain-Computer Interfacing

CALL FOR PAPERS

Brain-machine interfacing or brain-computer interfacing (BMI/BCI) is an emerging and challenging technology used in engineering and neuroscience, with the end goal of providing a pathway from the brain to the external world via mapping, assisting, augmenting, or repairing human cognitive or sensory-motor functions. Recently, many computational intelligence methods have appeared, such as deep learning and transfer learning. Deep learning methods have achieved great success in areas such as image and video analysis, natural language processing, and speech recognition and have also started to find applications in BMI/BCI. Transfer learning makes use of data or knowledge gained in solving one problem to help solve a different, albeit related, problem and can be particularly useful in BMI/BCI to cope with variability across individuals or tasks, accelerating learning and improving performance. Deep learning and transfer learning can also be integrated to take advantage of both domains.

Although the study of brain-machine interfaces using computational intelligence methods has become more popular, there are many unsolved fundamental problems, such as deep learning representation of some EEG-based BMI/BCI data from multiple modalities, mapping data from one modality to another to achieve cross-source BMI/BCI data analysis, identifying and utilizing relations between elements from two or more different signal sources for comprehensive BMI/BCI data analysis, fusing information from two or more signal sources to perform a more accurate prediction, transferring knowledge between modalities and their representations, and recovering missing modality data given the observed ones.

In the past decade, several EEG-based BMI/BCI methods and technologies have been developed and have shown promising results in real-world applications such as neuroscience, medicine, and rehabilitation. This has led to a proliferation of papers showing and comparing the accuracy and performance of these technologies; however, many of these have not advanced to real-time translation or application. For all the reasons mentioned above, it is important to exploit and develop effective computational intelligence algorithms for addressing fundamental issues in the field of BMI/BCI.

This Special Issue aims to provide a forum for researchers from BMI/BCI and computational intelligence to present recent progress in computational intelligence research with applications to BMI/BCI data. We welcome original research articles that contain detailed experimental analysis and related clinical translations, as well as related review articles discussing the current state of the art.

Potential topics include but are not limited to the following:

- Computational intelligence methods for BMI/BCI signal processing, for example, Independent Component Analysis (ICA), Common Spatial Pattern (CSP), Canonical Correlation Analysis (CCA), and so forth
- Computational intelligence methods for BMI/BCI feature extraction, for example, time-domain, frequency domain, time-frequency domain, spatiotemporal features, and so forth
- Computational intelligence methods for BMI/BCI pattern recognition, for example, deep learning, transfer learning, ensemble learning, reinforcement learning, multitask learning, multiview learning, and so forth
- Invasive and noninvasive BCIs
- Online and offline BCI applications
- Different modalities of BCIs, for example, Electroencephalogram (EEG), Magnetoencephalography (MEG), Functional Magnetic Resonance Imaging (fMRI), Functional Near-infrared Spectroscopy (fNIRS), Electrocorticography (ECoG), Spikes, Local Field Potentials (LFPs), and so forth

Authors can submit their manuscripts through the Manuscript Tracking System at https://mts.hindawi.com/submit/journals/cmmm/amlmb/.

Papers are published upon acceptance, regardless of the Special Issue publication date.

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