Towards high performance and efficient brain computer interface character speller : convolutional neural network based methods

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Propositions belonging to the Ph.D. dissertation:

Towards High Performance and Efficient Brain Computer Interface Character Speller: Convolutional Neural Network based Methods

by Hongchang Shan

1. Convolutional Neural Networks (CNNs) should be designed to learn P300-related features from raw brain signals because the nature of P300 signals is the positive voltage potential in raw brain signals. (This dissertation, Chapter 3)
2. For P300-based Brain Computer Interface (BCI) character spellers, it is unnecessary to design a deep CNN to accurately detect P300 signals and infer characters. (This dissertation, Chapter 3, Chapter 4)
3. The weights of a CNN, which is trained to detect P300 signals, can be used to determine the importance of the sensors in the sensor selection process for a P300 speller. (This dissertation, Chapter 5)
4. A small number of sensors is enough to keep a good performance of a P300 speller. (This dissertation, Chapter 5, Chapter 6)
5. P300-related separate temporal and spatial features, and joint spatial-temporal features have different impact on the accuracy and speed of character inference when different number of sensors are utilized to record EEG signals in a P300 speller. (This dissertation, Chapter 6)
6. BCI-related research should address real-world problems related to humans in order to be significant.
7. More publicly available brain signal data bases will inspire more ideas in the BCI community.
8. When designing a good neural network for solving real-world problems, performing experiments is more important than theoretical thinking.
9. It will not be easy to understand how neural networks work until we really understand how our brain works.
10. More effort does not mean more gain. But no effort definitely equals to no gain.