Novel Simplified Convolutional Neural Network Classification Algorithm of Motor Imagery EEG Signals Based on Deep Learning

Brain-computer interface (BCI) is a direct communication and control system that is established between the human brain and an electronic device.

P300 potentials (cited in many articles).  
  
CWT-SCNN algorithm proposed to classify motor imagery EEG signals.  
  
Steps:

* Raw MI-EEG filtered
* Signal mapped into a time-frequency image by CWT (Continuous Wavelet Transform)
* Time-frequency images in the range of mu and beta are extracted for training the SCNN (Simplified Convolutional Neural Network).
* MI-EEG data are divided into two categories after the SCNN to provide classification results.

SCNN with 6 layers:

* 1 input
* 2 convolutional
* 1 flatten
* 1 fully connected
* 1 output

Classification methods compared:

* CNN-SAE (Convolutional neural network and stacked autoencoder)
* CSP (Common spatial pattern)
* ACSP (Adaptive common spatial pattern)
* DBN (Deep belief net)
* CWT-SCNN

Evaluate the classification performance: Kappa value.

Other classification methods: (combination)

* CWT-SCNN
* CSP-SCNN (Common spatial patten & Simplified Convolutional Neural Network)
* FFT-SCNN (Fast Fourier transform)
* STFT-SCNN (short time Fourier transform)

On average SCNN is better and has better kappa value.

Shortens training time and reduces the parameters needed.

“CNN upgrade”