Coordinated finger movements predicted from intracranial brain activity

Acad. Marc Van Hulle
KU Leuven, Belgium

Abstract:
Several studies have successfully employed Brain Computer Interfaces (BCIs) to replace the function of a lost or impaired limb by circumventing defective neural pathways. Electrocorticography (ECoG) offers a unique perspective on long-term brain activity recording while providing high temporal, spatial and spectral resolution. ECoG uses electrodes placed on the exposed cortical surface, thus without entering the cortical tissue as it could lead to scarring and other histological processes that eventually degrade signal quality. Despite advances in individual finger decoding based on ECoG, convincing demonstrations of coordinated finger actions are still lacking. In this contribution, we report on our advances in accurately predicting self-paced individual- and coordinated finger movements from ECoG activity recorded in temporarily implanted epileptic patients capable of performing finger movements. Our long-term ambition is to transfer trained hand-motor BCIs to decode ECoG activity evoked by imagined finger movements as it could serve patients suffering from paralysis due to spinal cord injury, brain stem stroke or a degenerative disorder such as amyotrophic lateral sclerosis, but that are otherwise fully conscious of the intended actions.

Short CV
The Computational Neuroscience group (Prof. Marc Van Hulle http://simone.neuro.kuleuven.be, http://www.mindspeller.com, http://www.flandersbcilab.be) is doing research at the crossroads of neuroscience and neurology, biomedical signal processing and machine learning. The group is renowned for its work on EEG- and ECoG-based Brain Computer Interfacing (BCI) in healthy subjects and patients, EEG studies of language comprehension in healthy subjects and aphasia patients, and early stage cognitive decline in dementia risk patients. Dr. Van Hulle is an Executive Member of the IEEE Signal Processing Society, member of the Program Committee of the Machine Learning in Signal Processing (MLSP) workshops, and associate editor of several journals in Computational Neuroscience, Machine Learning and Signal Processing. He is IEEE

Fellow and member of the Belgian Royal Academy of Medicine and the Spanish Royal National Academy of Pharmacy, Institute of Spain.

Keywords: biomedical signal processing, machine learning, beamforming, tensor decomposition, brain computer interfacing