

## CLASSIFICATION OF MOVEMENT-RELATED ERD/ERS PATTERNS IN ECOG

Graimann<sup>1</sup>, B., Huggins<sup>2</sup>, J., Levine<sup>2</sup>, S., Neuper<sup>1</sup>, C., Pfurtscheller<sup>1</sup>, G.

<sup>1</sup>Dept. of Medical Informatics, Institute for Biomedical Engng.

University of Technology Graz, Austria

<sup>2</sup>Dept. of Physical Medicine and Rehabilitation, University of Michigan Medical Center,  
Ann Arbor, MI

Event-related potentials (ERP) and event-related desynchronization (ERD) are responses of the brain to externally- or internally-paced events. It is important to note that ERP and ERD/ERS are different responses. The former can be read as a reactivity pattern of a stationary system to a stimulus, and the latter as a change in the ongoing ECoG resulting from alterations in the functional connectivity within a neural network (Pfurtscheller and Lopes da Silva, 1999).

It has already been demonstrated that the detection of movement-related potentials (MRP) in single ECoG channels is possible with high accuracy (Levine et al., 2000). The goal of this work is to demonstrate that the detection of ERD/ERS patterns is also possible with very good accuracy. In fact, classification results of more than 90% hit percentages and less than 10% false positive percentages were found.

Feature extraction was done by calculating adaptive autoregressive parameters (AAR). Linear discriminant analysis (LDA) together with a simple threshold detector was used as classifier. The training process of the classifier was extended by a genetic algorithm which divided the training data into action and resting periods.

The classification results obtained by the proposed ERD/ERS detection method were compared with the results of the ERP detection method suggested in Levine et al. (2000). It is of special interest that depending on the location of the ECoG electrodes, good classification results have been obtained either with both reactivity patterns (MRP and ERD/ERS) or with only one of the reactivity patterns (MRP or ERD/ERS).

### References:

Pfurtscheller G, Lopes da Silva FH. Event-related EEG/MEG synchronization and desynchronization: basic principles. *Clinical Neurophysiol* 1999b; 110:1842-1857

Levine SP, Huggins JE, BeMent SL, Kushwaha RK, Schuh LA, Rohde MM, Passaro EA, Ross DA, Elisevich KN, Smith BJ. A direct brain interface based on event-related potentials. *IEEE Trans Rehabil Eng* 2000; 8(2):180-185