

## **Hybrid Brain Computer Interface: Review**

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### **Problem description:**

Brain–computer interfaces (BCIs) allow disabled people to establish a new communication channel between the human brain and a machine. Hybrid brain–computer interfaces (BCIs) are representing a recent approach to develop practical BCIs by analyzing simultaneously electroencephalogram (EEG – electrical activity of the brain) and more other signals such as electromyogram (EMG – electrical activity of muscles) activities. It has been shown that there is a correlation between the two signals. For example, in the preparation of a motor action, a desynchronization of cortical rhythms in the beta and mu frequency band can be detected on the EEG signals recorded over motor areas. This desynchronization precedes the appearance of bursts of action potentials in EMG signals and the realization of movement.

Consequently, the student shall give an overview of Hybrid BCI **that coupling EEG and EMG signals**. Moreover, he must provide a comparison between the two types of BCIs and present the advantages of using Hybrid BCIs.

### **Tasks:**

This seminar requires the student to:

- Familiarize with scientific literature and research papers
- Present the state of the art of the use of hybrid BCI
- Compare between classical and hybrid BCI
- Write down the results in a scientific report
- Present the results of the scientific seminar in oral form

### **Bibliography:**

[1] José Rouillard, Alban Duprès, François Cabestaing, Stéphanie Leclercq, Marie-Hélène Bekaert, Charlotte Piau a , Jean-Marc Vannobel a, Claudine Lecocq, "Hybrid BCI coupling EEG and EMG for severe motor disabilities", 6th International Conference on Applied Human Factors and Ergonomics (AHFE), 2015

[2] Robert Leeb, Hesam Sagha, Ricardo Chavarriaga and Jose Del Milan, "A hybrid brain–computer interface based on the fusion of electroencephalographic and electromyographic activities", JOURNAL OF NEURAL ENGINEERING, 2010

[3] Mueller-Putz Gernot, Breitwieser Christian, Cincotti Febo, Leeb Robert, Schreuder Martijn, Leotta Francesco, Tavella Michele, Bianchi Luigi, Kreilinger Alex, Ramsay Andrew, Rohm Martin, Sagebaum Max, Tonin Luca, Neuper Christa, Millán José del R, "Tools for Brain-Computer Interaction: A General Concept for a Hybrid BCI ", Frontiers in Neuroinformatics, 2011

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