EE-514 Brain computer interaction

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Summary
How to provide a direct interaction between the human neural system and machines aiming to augment human capabilities, especially of disabled people. Description of the brain signals and the algorithms (signal processing & machine learning) for recognizing subjects’ intents and cognitive states.

Content
1. Introduction
2. Basic Neurology + ML
3. Multiunit Recording
4. Electroencephalogram (EEG) & Inverse Methods
5. EEG-based BCI and Paradigms
6. Electrocorticogram (ECoG)
7. Beyond Motor-related Signals for BCI
8. Cognitive Signals for Brain Interaction
9. BCI Applications

Keywords
brain-computer interfaces, brain-machine interfaces, neuroprosthetics, pattern recognition, brain signal processing, human physiological signals, neuroscience, human-computer interaction

Learning Prerequisites
Required courses
Pattern recognition (for instance, Data Analysis and Model Classification)
Signal Processing

Recommended courses
Neuroscience and Cognitive Neuroscience

Important concepts to start the course
Pattern recognition: feature selection, linear models for classification and regression (quick introduction at the beginning of the course)
Signal processing: Frequency domain analysis, filtering (basic introduction at the beginning of the course)
Matlab programming (tutorial provided at the beginning of the course)
Lectures and project based on students' own experiments.

**Expected student activities**
Students will have to run their own experiments on a protocol of their choice. Then, they will analyze the recorded brain signals (EEG) and provide a written report.

**Assessment methods**
Written exam. Final grade: 60% Exam, 40% Exercises.

**Resources**

**Bibliography**

**Ressources en bibliothèque**
- Brain-computer interfaces : principles and practice / Wolpaw
- Towards Brain-Computing Interfacing / Millan

**Moodle Link**