Abstract2

Cognitive Signals for Robot Interaction: Human-in-the-Loop

The idea of moving robots or prosthetic devices not by manual control, but by mere "thinking" (i.e., the brain activity of human subjects) has fascinated researchers for the last 30 years, but it is only now that first experiments have shown the possibility to do so. Such a kind of brain-machine interface (BMI) is a natural way to augment human capabilities by providing a new interaction link with the outside world and is particularly relevant as an aid for physically disabled people. Normally, people use a BMI to control and interact with devices by constantly delivering mental commands. But a BMI can also provide an effective way to monitor some cognitive states of the subject that, if recognized in real time, can improve and facilitate tremendously interaction. In this talk I will describe this general framework and how to recognize cognitive states from electroencephalogram (EEG) signals such as awareness to erroneous responses of the BMI or anticipation. I will also discuss a new framework for semi-autonomous robots. In this "human-in-the-loop" approach, an intelligent artificial cognitive agent (e.g., an autonomous robot) makes decisions in order to solve a task, while a human user monitors the agent's performance and provides asynchronous, corrective signals ---derived from his/her EEG in real time--- that can be used to correct erroneous actions, or to improve the autonomous controller following a process alike to reinforcement learning.