SYLLABUS DEL CORSO

Ai Applied To Neurological Sciences and Brain-Computer Interfaces

2425-2-F551MI036

Learning area

Learning objectives

The aim of this course is to provide an introduction to the basics of Brain Computer Interfaces (BCI) principally based on oscillatory EEG activity, but also on transient EP and ERP signals. The course will introduce the main methods for acquiring and processing electrophysiological data allowing the decoding of brain activity in real time for converting it into BCI control signals.

Contents

• The Electro-ionic origins of brain electrical potentials
• Electrophysiological recording and analysis. EEG rhythms, Evoked Potentials (steady state and pattern onset), Event-related Potentials. Wavelet analysis.
• Biofeedback and Neurofeedback. Eye-movement BCI systems.
• Brain Computer Interface systems.
• Electrical markers for BCI: (P300 and N400, SSVEP, slow cortical potentials, motor and sensorimotor rhythms). Motor imagery. OpenVibe for BCI
• Classification and machine learning algorithms for mind reading
• Examples of EEG/EP based BCI applications

Detailed program

AI applied to Neurological Sciences and Brain-computer Interfaces [M-PSI/02, MED/26]

Aim of this course is to provide the theoretical basis aimed at fostering an interdisciplinary and integrative interaction between clinicians, AI algorithm designers, medical-application-specific "chip scientists". The interaction between AI and cognitive neuroscience/neuropsychology will be discussed, with a focus on how information derived from neurophysiological data can guide AI to manage different final effectors through brain computer interfaces (BCI). Furthermore, the use of AI to advance the knowledge on brain functioning with the application of machine learning on brain signals will be discussed.

The changing landscape of medical education, with specific focus on Neurology

AI-assisted Detection & Diagnosis- Neuroimaging

AI-assisted Neurorehabilitation

Disease Management - Health Analytics

Neurology and Aging

AI-assisted neurotherapeutics- drug discovery in neurological disorders

Brain computer interfaces (non invasive, semi-invasive, invasive, closed loop, open loop);

Adaptive Interfaces

Using Neural Measures to Predict Real-World Outcomes;

Social/Affective neuroscience for human-machine interaction;

Usability of BCIs in cognitive neuroscience;

BCI in cognitive and neurological rehabilitation

Prerequisites

Teaching methods

Assessment methods

Oral colloquim

Textbooks and Reading Materials

Sustainable Development Goals