

Testi del Syllabus

Resp. Did.	LONGO RENATA	Matricola: 003135
Docenti	BATTAGLINI PIERO PAOLO, 3 CFU BELGRANO MANUEL GIANVALERIO, 2 CFU LEANZA GIAMPIERO, 2 CFU LONGO RENATA, 3 CFU	
Anno offerta:	2017/2018	
Insegnamento:	895SM - TECNICHE NEUROFUNZIONALI	
Corso di studio:	SM54 - NEUROSCIENZE	
Anno regolamento:	2016	
CFU:	10	
Settore:	FIS/07	
Tipo Attività:	C - Affine/Integrativa	
Anno corso:	2	
Periodo:	Primo Semestre	
Sede:	TRIESTE	



Testi in italiano

Lingua insegnamento English

Contenuti (Dipl.Sup.)

Part 1: (prof. Renata Longo) neuroimaging techniques Computed Tomography: basic principles, recent techniques and application in brain imaging. Magnetic resonance imaging (MRI): basic principles. Functional MRI: physical and physiological basis. fMRI experimental design: blocks and event related paradigms data analysis in fMRI: images processing and statistical analysis Exercise in small groups at the MRI unit of the Cattinara hospital: Block design experiments, image acquisition and data analysis. Diffusion weighted images (DWI) and diffusion tensor imaging (DTI): physical basics. DTI in brain imaging: a technique for neurons bundles study Fiber tracking based on DTI data set. Exercise in small groups at the MRI unit of the Cattinara hospital: DTI experiments, image acquisition and data analysis. Radioisotopes imaging: single photon emission tomography (SPECT) and positron emission tomography (PET). Physical and physiological basics. Introduction to biological effects of ionizing radiation and radiobiology. The challenge of integration: EEG and MRI or PET, PET and CT or MRI.

Part 2 (dott. Manuel Belgrano) Neuroradiology Anatomy of the central nervous system and correlation to imaging in CT and MRI. Basic clinical principles of stroke and the related imaging. Cerebral perfusion applied to ischemic stroke and to other SNC pathologies. Advanced neuroimaging in MRI. Part 3: (prof. Pier Paolo Battaglini) Electrophysiology. The basic aspects of recording and analyses the electrical brain signals will be presented, with particular emphasis on the basic approaches to build a brain computer interface.

Part 4: (prof. Giampiero. Leanza) The course will outline and discuss the making of a scientific publication from the moment an experiment is designed to the time the publication reaches an audience, which must of

course be as wide as possible.

Testi di riferimento

The essential of functional MRI. P. W. Stroman CRC press 2011
Relevant slides and pdf files will be provided during classes.

Obiettivi formativi

Understanding the physical and physiological basis of the modern techniques used in human brain mapping. To be able of designing and performing an MRI study for brain mapping.

To be able to understand the basic principles for recording and analyzing the electrical activity of the brain. Students will understand the main algorithms of on-line analysis and the basis for building brain-computer interfaces.

The aim of the course is to provide introductory information that should help the participants to improve their skills in manuscript preparation, so as to increase the chance of their papers being accepted by a peer-reviewed international journal.

Metodi didattici

Lectures and small group tutorials at the MRI unit

Modalità di verifica dell'apprendimento

Students are required to take a final oral examination, to prepare a report of the MRI experiment and to prepare of a short (≈ 300 words) scientific abstract based on topics of interest. The oral examination consists in a discussion of 30 min, during which the student is invited to describe and comment on a few topics covered in the course.

Programma esteso

Computed Tomography: basic principles, recent techniques and application in brain imaging. Magnetic resonance imaging (MRI): basic principles. Functional MRI: physical and physiological basis. fMRI experimental design: blocks and event related paradigms data analysis in fMRI: images processing and statistical analysis Exercise in small groups at the MRI unit of the Cattinara hospital: Block design experiments, image acquisition and data analysis. Diffusion weighted images (DWI) and diffusion tensor imaging (DTI): physical basics. DTI in brain imaging: a technique for neurons bundles study Fiber tracking based on DTI data set. Exercise in small groups at the MRI unit of the Cattinara hospital: DTI experiments, image acquisition and data analysis. Radioisotopes imaging: single photon emission tomography (SPECT) and positron emission tomography (PET). Physical and physiological basics. Introduction to biological effects of ionizing radiation and radiobiology. The challenge of integration: EEG and MRI or PET, PET and CT or MRI. Introduction to the technical problems and the expected results.

Principles for the direct interaction with the brain will be presented. Knowledge will be provided on how to record signals from the brain, particularly about techniques that serve as source of input signals for brain computer interfaces (BCIs). Knowledge on how to stimulate the brain will also be provided, with particular emphasis on the techniques allowing BCIs to provide direct feedback to the brain.

Basic approaches for signal processing will be given, particularly concerning the frequency domain, Fourier transform, Spectral and spatial filters. Principles of machine learning and artificial neuronal networks will also be provided. Finally, the major types of BCIs will be discussed as well as the brain responses useful for BCI.

The course will outline and discuss the making of a scientific publication from the moment an experiment is designed to the time the publication reaches an audience, which must of course be as wide as possible.



Testi in inglese

English

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