Datenkontrollblatt zur Veranstaltung Mathematische Methoden zur EEG/MEG Rekonstruktion und TES/TMS Manipulation neuronaler Netzwerke im menschlichen Gehirn - Teil I

Veranstaltungsgrunddaten

Veranstaltungsnr.	104384	**Veranst. SWS**	2
Veranstaltung	Mathematische Methoden zur EEG/MEG Rekonstruktion und TES/TMS Manipulation neuronaler Netzwerke im menschlichen Gehirn - Teil I	**Semester**	WS 2018/19
		Erwart. Teil.	
		Max. Teil.	
		Hyperlink	
Kurztext			
Veranst.-Art	Vorlesung		
Belegpflicht	J		
Studienjahr			

Veranstaltungstermine, Räume und Personal

Di	16:00 - 17:30	woch	16.10.2018 - 05.02.2019	Seminarraum, Institut für Biomagnetismus

Personen

Christoph Kellinghaus
Harald Kugel
Gabriel Möddel
Paul Muhle
Carsten Wolters

Studiengänge

Master/Mathematik; -
Master/Mathematik; -
Staatsexamen - Medizin; -
Medizin. Wissenschaften; -
Dr rer med/Medizin. Wiss.; -

Einordnung Vorlesungsverzeichnis

Spezialisierungen
6. Biomagnetismus und Biosignalanalyse
Vorlesungen und Übungen in Angewandter Mathematik

Zuordnung zu Prüfungen

Zuordnung zu Prüfungen

Zuordnung zu Prüfungsorganisationssätzen

Einrichtungen

Fachbereich 05 - Medizinische Fakultät
Fachbereich 10 - Mathematik und Informatik

Hyperlinks

Kommentar

Nowadays devices and tools are available for analyzing and monitoring the human brain at a high level of detail. These details are necessary, e.g., for successful surgery or, more generally, for basic brain research. Rapid advances were achieved in the fields of structural and functional imaging modalities such as Magnetic Resonance Imaging (MRI), ElectroEncephaloGraphy (EEG) and MagnetoEncephaloGraphy (MEG). Since the functional modalities EEG and MEG each have their strengths and weaknesses, they complement each other and synergetic effects are expected from their integration. Non-invasive computational methods are often used in the field of neurosciences. The field of EEG/MEG source analysis is a representative of such methods. Non-invasive tools are of course preferable to invasive methods which may be of high risk to patients. In fundamental brain research, most often there is no other choice besides computational methods.
Furthermore, in recent years, new methodologies were developed for manipulating the human brain using brain stimulation methods such as Transcranial Electric Stimulation (TES) and Transcranial Magnetic Stimulation (TMS).
This lecture will focus on mathematical methods for the analysis of EEG, MEG, MRI, TES and TMS. We will study registration and segmentation methods for the structural modalities T1-weighted MRI, T2-weighted MRI and Diffusion Tensor MRI (DT-MRI) and signal analysis, Maxwell equations, Helmholtz' reciprocity law, boundary and finite element forward methods, inverse approaches such as current density reconstruction and Bayesian inversion as well as optimization approaches for multi-sensor brain stimulation modalities such as TES and TMS.
Finally, we will apply the new methodologies for reconstructing and manipulating neuronal networks in the human brain in neuroscientific applications and in clinical fields of neurology and psychiatry and especially in the field of presurgical epilepsy diagnosis.

Literatur

http://www.sci.utah.edu/~wolters/LiteraturZurVorlesung

Bemerkung

A following bachelor or master thesis in the topics of the lecture/tutorial might be possible and also welcome. If there is the need, the lectures will be given in english, otherwise in german. The first lecture will be on Oct.16, because the main lecturer, Prof. Wolters, will be in China on a conference on Oct.9.

Voraussetzung

The students should have basic knowledge of analysis, linear algebra and numerical mathematics. Some knowledge on functional analysis, numerical mathematics of partial differential equations, inverse problems and optimization is helpful, but we will also derive the most important concepts in the lectures.