

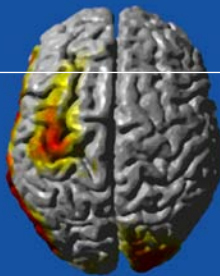
DGBMT

DEUTSCHE GESELLSCHAFT FÜR
BIOMEDIZINISCHE TECHNIK IM VDE



3rd Summer School

Reconstruction of sources of electro-physiological signals



International
Summer School
in Biomedical
Engineering

Weimar and
Ilmenau, Germany
Sept. 4–17, 2008



Biomagnetic Center Jena
Friedrich-Schiller-University Jena



**MAX
PLANCK
INSTITUTE** FOR
HUMAN
COGNITIVE AND BRAIN SCIENCES
LEIPZIG

VDE



Introduction

Background

Many physiological processes, like e.g. neuronal activity in the brain, contraction of muscles, or the beating of the heart, are accompanied by electrical current flow. These currents cause electric and magnetic fields, which can be measured outside the body. In order to gain information on and achieve understanding of the underlying physiological processes, the sources of these fields need to be reconstructed. In particular, source reconstruction based on electroencephalographic or magnetoencephalographic measurements is a key technique for understanding how the brain works and is used in brain research as well as in various neurological applications.

Aims

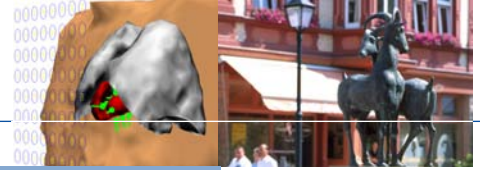
The objective of the International Summer School is to provide in depth education and practical exercises on source reconstruction techniques, covering both theoretical foundations and practical applications. It aims at a thorough understanding of the underlying mechanisms and thus will develop a critical view on current applications and possible future developments. The International Summer School provides contact with leading experts in the fields and is expected to facilitate the exchange of ideas on latest developments.

Target group (up to 40 participants)

- PhD students
- advanced Master students
- researchers entering the field source reconstruction

Support

- ANT b.v.
- Compumedics Neuroscan
- DAAD
- MEGIS Software GmbH
- Technically co-sponsored by ISBEM and ISFSI
- VDE



Faculty

Organizers

Jens Haueisen, *Institute of Biomedical Engineering and Informatics, Ilmenau University of Technology*
Thomas Knösche, *Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig*

Scientific Programme Committee

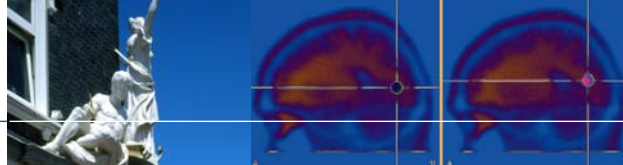
Luca Di Rienzo (*Politecnico di Milano*)
Burkhard Maess (*MPI Leipzig*)
Jürgen Reichenbach (*University Jena*)
Otto W. Witte (*University Jena*)
Herbert Witte (*University Jena*)

Organisation of Symposia

Daniel Baumgarten (*TU Ilmenau / University Jena*)
Sebastian Biller (*TU Ilmenau*)
Moritz Dannhauer (*MPI Leipzig*)
Roland Eichardt (*TU Ilmenau*)
Stephan Lau (*TU Ilmenau / University Jena*)
Mario Liehr (*University Jena*)
Andreas Spiegelger (*TU Ilmenau / MPI Leipzig*)

Invited speakers

Gabriel Curio (*Berlin, Germany*)
Luca Di Rienzo (*Milano, Italy*)
Stefan Kiebel (*London, GB*)
Burkhard Maess (*Leipzig, Germany*)
John Mosher (*Los Alamos, USA*)
Ernesto Palmero Soler (*Enschede, The Netherlands*)
Michael Scherg (*Munich, Germany*)
Paul Schimpf (*Spokane, USA*)
Kensuke Sekihara (*Tokio, Japan*)
Michael Wagner (*Hamburg, Germany*)
Carsten Wolters (*Münster, Germany*)



Symposia

1. Inverse Problems in BME

This symposium addresses the fundamentals, including the measurement of electrophysiological signals, the formulation of forward problem and source models, as well as different types of solutions to the inverse problem.

2. Low parametric sources

The estimation of the parameters of parsimonious source models, like e.g. the spatio-temporal dipole models, is the topic of this symposium. In part I, deterministic non-linear search methods are treated, while part II will deal with stochastic non-linear search methods, such as evolution strategies, genetic algorithms, simulated annealing.

3. Advanced source models

A special class of models for electrophysiological sources in the brain is discussed that does not only reflect the physical properties of the current sources, but also the neurobiological generation of these currents by networks of neuronal populations. In particular, we will treat the so-called neural mass models and the estimation of their parameter from EEG and MEG by dynamic causal modelling (DCM).

4. Reconstruction of distributed sources

Distributed source models normally feature many more parameters than there are measured values for their determination. This makes them very flexible to accommodate any intracranial current distribution, but at the same time the solution is underdetermined and leads to the minimum norm approach. Different linear and non-linear solutions, like the minimum norm least squares (MNLS), L1-norm based approaches, LORETA, and sLORETA will be treated, with particular emphasis on the issues of regularization and incorporation of additional information.

5. Scan methods

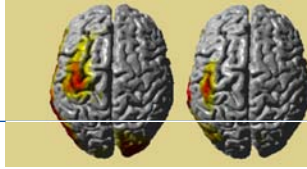
This symposium covers methods that compute for each reconstruction point in a region of interest (e.g. the entire brain or the cortex) a metric reflecting some sort of "appropriateness" of a dipolar source at this point. This includes e.g. spatial filters and beamformers, as well as various types of multiple signal classification (MUSIC).

6. Multimodal Approaches

In this session, the issue of fusion of various types of information, like EEG and MEG, brain imaging (fMRI, PET), anatomy and neurobiological knowledge, in order to draw a detailed picture of physiological processes, is illuminated. In particular, for the solution of the inverse problem from electrophysiological signals like EEG, ECG, MEG or MCG, such additional information is crucial to find a unique solution.

7. Validation techniques

In this last symposium, ways to validate the previously covered inverse problem solution methods will be discussed. For example, source localization accuracy can be assessed with Monte Carlo simulations or physical phantom experiments. Determination of error bounds will be discussed.



Schedule

Thursday, September 4, 2008

9:00	Registration
12:15	
13:15	Introduction
17:45	

Thursday, September 11, 2008

9:00	Symposium 5
12:15	
13:15	
17:45	

Friday, September 5, 2008

9:00	Symposium 1
12:15	
13:15	Tour to CAVE wave front synthesis system
17:45	

Friday, September 12, 2008

9:00	Symposium 6
12:15	
13:15	Symposium 7
17:45	

Saturday, September 6, 2008

9:00	Excursion to Eisenach and castle Wartburg (UNESCO World Heritage site)
12:15	
13:15	
17:45	

Saturday, September 13, 2008

9:00	Summary
12:15	
13:15	Half day hike
17:45	

Sunday, September 7, 2008

9:00	Day hike
12:15	
13:15	
17:45	

Sunday, September 14, 2008

9:00	Weimar (UNESCO World Heritage site)
12:15	
13:15	
17:45	

Monday, September 8, 2008

9:00	Symposium 2
12:15	
13:15	
17:45	

Monday, September 15 to Wednesday, September 17 2008

9:00	10th Workshop on Optimization and Inverse Problems in Electromagnetism (included)
12:15	
13:15	
17:45	

Tuesday, September 9, 2008

9:00	Symposium 3
12:15	
13:15	Tour to Jena (Zeiss Planetarium)
17:45	

Wednesday, September 10, 2008

9:00	Symposium 4
12:15	
13:15	
17:45	

For each of the symposia, an expert in the field will give an overview lecture of about 1.5 hours. Hot topic talks and practical demonstrations will illuminate selected latest developments. Finally, a panel discussion offers the opportunity to discuss open issues in detail.

The summer school is taking place back to back with the 10th Workshop on Optimization and Inverse Problems in Electromagnetism, which is a high ranking scientific event.



General Information

Credits

4 ECTS

Contact

Mrs Gabi Hey

Institute of Biomedical Engineering and Informatics

Ilmenau University of Technology

Gustav-Kirchhoff-Straße 2

98693 Ilmenau, Germany

Tel. +49-3677-692860

Fax +49-3677-691311

Gabi.Hey@tu-ilmenau.de

www.tu-ilmenau.de/bmti

Costs

590 Euro including 13 overnight stays, social program and the conference fee for the OIPE 2008

Support

There are travel grants (Euro 200) and fee reductions (Euro 200) for applicants from outside Germany. For application please send a letter of support from your supervising professor and a one page description of your motivation and current work in the field of source reconstruction.

Registration Deadline May 31, 2008

Registration

For registration please send an e-mail with the following contact data: first name, last name, position (e.g. PhD student), institution with address, telephone, fax, and e-mail to Gabi.Hey@tu-ilmenau.de

Registration becomes valid upon reception of the fee

(590 Euro) on the following bank account:

BIC: MARKDEF1820 (Bank Identifier Code)

IBAN: DE438200 0000 00 8200 1500 (Int. Bank Account Number)

Name of Bank: Deutsche Bundesbank Erfurt

Account holder: Staatskasse Thüringen, TU Ilmenau

Account number: 00 8200 1500

BLZ: 8200 0000

Reason for payment: TUIL-1581-22210194 (don't forget!)

Venue

Sept. 4 – 10, 2008 in Weimar

Bauhaus-University Weimar, Marienstraße 13c

Sept. 14 – 17, 2008 in Ilmenau

Campus of the TU Ilmenau, Humboldtbau,
Gustav-Kirchhoffplatz 1

The International Summer School will take place in Weimar and Ilmenau, Germany. Weimar is situated in the state of Thuringia, in the middle of Germany; Berlin, Frankfurt and Munich are approximately 300 km away. Weimar is one of the most outstanding historical places in Germany and a UNESCO World Heritage site.

www.thueringen-tourismus.de