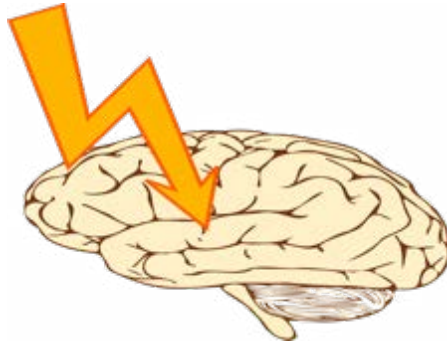


Workshop In Epilepsy Engineering

29-30 June 2015

University of Surrey, UK

Programme



SPONSORS

EPSRC

The Engineering and Physical Sciences Research Council (EPSRC) is the main UK government agency for funding research and training in engineering and the physical sciences, investing more than £800 million a year in a broad range of subjects - from mathematics to materials science, and from information technology to structural engineering.

epsrc.ac.uk

IAS Institute of Advanced Studies

The Institute of Advanced Studies (IAS) at the University of Surrey hosts small-scale, scientific and scholarly meetings of leading academics from all over the world to discuss specialist topics away from the pressure of everyday work. The events are multidisciplinary, bringing together scholars from different disciplines to share alternative perspectives on common problems.

ias.surrey.ac.uk

WELCOME

Welcome

We are delighted to welcome you at the Workshop in Epilepsy Engineering. This meeting arises as a collaboration between epilepsy researchers from the University of Surrey and King's College London.

This workshop brings together clinical and engineering researchers in epilepsy and aims to encourage cross-fertilisation. Its scope is to disseminate current methodology in epilepsy research, encouraging the inter-disciplinary communication of algorithms, drawbacks, and clinical issues. Your perspective, experience and input are crucial to the success of this workshop and our effort to develop useful and practical recommendations on this topic.

We would like to thank our sponsors the Engineering and Physical Sciences Research Council (EPSRC) and the Institute of Advanced Studies (IAS), as well as all participants and members of the Organising and Programme Committee for their support. In addition, special thanks to our keynote speakers and everyone who helped bring this workshop to life. Last but not least, the event would not have happened in its current form without the support of the Surrey's Conference Office and Events Team, including the colleagues and researchers at the University of Surrey.

With best wishes for a successful, stimulating and enjoyable event.

Dr Saeid Sanei, Department of Computing, University of Surrey

Dr Loukianos Spyrou, Department of Computing, University of Surrey

Organising Committee

Dr Loukianos Spyrou, Department of Computing, University of Surrey

Dr Saeid Sanei, Department of Computing, University of Surrey

Ms Becki Leach, Marketing, Faculty of Engineering, University of Surrey

Dr Daniel Abasolo, Biomedical Engineering, Department of Mechanical Engineering Sciences, University of Surrey

Dr Ying Chen, Department of Biochemistry and Physiology, University of Surrey

Dr Gonzalo Alarcon, Department of Basic and Clinical Neurosciences, King's College London

Programme Committee

Dr Loukianos Spyrou, Department of Computing, University of Surrey

Dr Saeid Sanei, Department of Computing, University of Surrey

Dr Clive Cheong Took, Department of Computing, University of Surrey

Dr Daniel Abasolo, Department of Mechanical Engineering Sciences, University of Surrey

Dr Gonzalo Alarcon, Department of Basic and Clinical Neurosciences, King's College London

Dr Antonio Valentin, Department of Basic and Clinical Neurosciences, King's College London

Mr David Martin Lopez, Department of Basic and Clinical Neurosciences, King's College London



PROGRAMME

Venue: Room 32 MS 01, University of Surrey
Monday 29 June 2015

- 9.00 Registration and Welcome
- 9.30 **Keynote Talk: Louis Lemieux**
Safety testing, data quality issues, and implementation of combined EEG and fMRI acquisitions
- 10.30 Coffee Break
- 11.00 **Lorena Vega Zelaya**
Disrupted ipsilateral network connectivity in temporal lobe epilepsy
- 11.30 **Daniel Abasolo**
A study of Lempel-Ziv complexity of epileptiform activity under pharmacological intervention
- 12.00 **Yujiang Wang**
Mechanisms underlying different focal seizure onset patterns
- 12.30 Lunch Break
- 14.00 **Keynote Talk: Jonathan Halford**
Standardized Database Development for EEG Spike and Seizure Detection
- 15.00 Coffee Break
- 15.15 **Diego Jimenez-Jimenez**
Can single pulse electrical stimulation (SPES) resemble Preceding Epileptiform Discharges (PED)?
- 15.45 **David Martin Lopez**
Electrical stimulation of the anterior cingulate gyrus induces responses similar to K-complexes in awake humans
- 16.15 **Shima Abtullateef**
Indication of Non-linear Structure in Time Series of Healthy and Epileptic Brain Electrical Activity Using Spectral Entropy
- 16.45 **Vigneshwari Parthasarathy**
Analysis of Electroencephalogram Signals of Healthy and Epileptic Patients using the Central Tendency Measure
- 18.00 Departing for Shere village (dinner transport organised from Senate House)
- 18.30 Dinner - William Bray Restaurant, Shere

PROGRAMME

Venue: Room 32 MS 01, University of Surrey
Tuesday 30 June

- 9.00 Coffee
- 9.30 **Keynote Talk: Jesus Pastor**
Distributed features in partial epilepsy: Clinical Significance of the new paradigm
- 10.30 Coffee Break
- 11.00 **Loukianos Spyrou**
Detection of Intracranial Signatures of Interictal Epileptiform Discharges on Scalp EEG
- 11.30 **Andreas Antoniadis**
Deep Neural Network methods for IED feature selection
- 11.45 **Samaneh Kouchaki**
Multiview classification of intracranial IEDs through tensor factorisation
- 12.00 **Emlyn Clay, OpenVivo**
EEG measurement demonstration
- 12.45 Lunch Break
- 14.00 **Christophe Bernard**
Organic electronics to record and control neuronal activity
- 15.00 Coffee Break
- 15.30 Closing and Discussions

KEYNOTE SPEAKERS



Prof Louis Lemieux, *University College London, UK*

Safety testing, data quality issues, and implementation of combined EEG and fMRI acquisitions

I will discuss our approach to the development of simultaneous EEG-fMRI for the study of epileptic activity in humans. Starting with a description of the main motivation for simultaneous EEG-fMRI, namely the need for improved localisation of the generators of epileptic discharges, I describe the technical challenges posed by combined instrumentation. The physical principles involved will be reviewed. I will then address in greater detail the practical considerations of using the EEG equipment in the MRI environment: patient and staff safety, EEG and MR image data quality.

Both scalp and intracranial EEG recordings will be presented. Finally, we illustrate a few important applications of the technique.



Dr Jonathan Halford, *Medical University South Carolina, US*

Standardized Database Development for EEG Spike and Seizure Detection

There is a clinical need for automated algorithms for seizure and spike detection in electroencephalographic (EEG) recordings. Misinterpretation of EEG recordings is common in clinical practice and so accurate spike detection algorithms could improve clinical care. The review of long inpatient EEG recordings to identify seizures is taxing on clinicians so accurate seizure detection algorithms could improve physician time management. Unfortunately, current algorithms are not commonly used because there is a perception of inadequate performance. If freely-available standardized databases of EEG recordings could be developed,

this could improve detection algorithm performance and increase the trust of clinicians in automated detection systems. The challenges involved in collecting expert opinion from clinicians on EEG recordings will be discussed, including cost, web-based EEG review systems, and inter-rater reliability.

KEYNOTE SPEAKERS



Dr Jesus Pastor, *Hospital Universidad de Madrid, Spain*

Distributed features in partial epilepsy: Clinical significance of the new paradigm

Presurgical assessment and the surgery strategy in the treatment of focal epilepsy has been performed under the paradigm of functional regions. In this conceptual framework, there must exist a well-defined and usually relatively small cortical region, which excision should prevent the appearance of seizures. The goal of presurgical evaluation would be the exact definition of this area and the aim during the surgery should be the removal of it.

However, in the last years, there has been an increasing evidence that for some patients, this paradigm must be revisited. In this way, data coming from presurgical telemetry and intraoperative recordings have shown that the concepts of functional areas must be reconsidered, because there exists a real epileptogenic network much more extensive than previously thought. This change in the paradigm can extensively modify all the process of treatment. First, we have to define features that allow to identify the type of epilepsy (truly focal or network distributed). Second, during the presurgical evaluation, we should define some network properties relevant for the physiopathology and, even more important, for the treatment. And, finally, maybe for these patients, new kind of surgical treatments will be described. This work will review some of the neurophysiological evidence concerning the definition of distributed epilepsy and how its existence can modify in some way the usual scheme of surgical treatment.



Prof Christophe Bernard, *Institut de Neurosciences des Systèmes, Aix-Marseille Université, France*

Organic electronics to record and control neuronal activity

Monitoring and controlling neural networks is important to understand brain function and dysfunction. We demonstrate ultrathin (4 μm thick) and ultraflexible 100% biocompatible electrodes, whose recording sites are made of organic transistors (PEDOT:PSS), thus providing a 20 dB gain as compared to present current state-of-the-art electrodes, when recording epileptic activity in vivo. The same transistors can be used to stimulate small populations of neurons as shown in the intact hippocampus with 3D 2-photon imaging. They can also be functionalized

to become molecular sensors, as demonstrated with a glucose sensor. Finally, we demonstrate an organic pump that can deliver pure molecules to control neuronal activity. Pumping out GABA stopped epileptiform activity locally without affecting neighboring regions. It is therefore possible to control on-demand neuronal networks where and when it is needed, while monitoring their electro-molecular activity. Such devices may become the future standard for interfacing with the brain.

DELEGATES

Dr Daniel Abasolo

Department of Mechanical Engineering Sciences
University of Surrey
United Kingdom

Dr Gonzalo Alarcon

Basic Systems and Neurosciences
KCL
United Kingdom

Prof Christophe Bernard

Institut de Neurosciences des Systèmes
Inserm
France

Dr Clive Cheong Took

Department of Computing
University of Surrey
United Kingdom

Dr Jonathan Halford

Department of Neurosciences
Medical University of South Carolina
United States

Prof Louis Lemieux

Institute of Cognitive Neuroscience
University College London
United Kingdom

Miss Vigneshwari Parthasarathy

Department of Mechanical Engineering Sciences
University of Surrey
United Kingdom

Dr Hernan Rey

Centre for Systems Neuroscience University of
Leicester
United Kingdom

Dr Loukianos Spyrou

Department of Computing
University of Surrey
United Kingdom

Dr Antonio Valentin

Institute of Psychiatry, Psychology & Neuroscience
(IoPPN)
King's College London
United Kingdom

Mr Diego Jimenez

Basic and Clinical Neurosciences
King's College London
United Kingdom

Ms Shima Abdullateef

Department of Mechanical Engineering Sciences
University of Surrey
United Kingdom

Mr Andreas Antoniadis

Department of Computing
University of Surrey
United Kingdom

Dr Ying Chen

Department of Biochemistry and Physiology
University of Surrey
United Kingdom

Dr Emlyn Clay

OpenVivo Ltd
United Kingdom

Ms Samaneh Kouchaki

Department of Computing
University of Surrey
United Kingdom

DELEGATES

Mr David Martin Lopez

Department of Basic Systems and Neurosciences
King's College London
United Kingdom

Dr Jesús Pastor

Clinical Neurophysiology
Hospital Universitario La Princesa
Spain

Dr Saeid Sanei

Department of Computing
University of Surrey
United Kingdom

Miss Pinar Deniz Tosun

Department of Mechanical Engineering Sciences
University of Surrey
United Kingdom

Mrs Lorena Vega

Clinical Neurophysiology
Hospital Universitario de la Princesa
Madrid
Spain

Dr Yujiang Wang

School of Computing Science
Newcastle University
United Kingdom

Faculty of Engineering and Physical Sciences
University of Surrey
Guildford, Surrey GU2 7XH, UK

Faculty of Health and Medical Sciences
University of Surrey
Guildford, Surrey GU2 7XH UK

surrey.ac.uk



Disclaimer

Every effort has been made to ensure the accuracy of the information contained in this brochure at the time of going to press. The University reserves the right, however, to introduce changes to the information given including the addition, withdrawal or restructuring of degree programmes.

