BMC Neuroscience

BioMed Central

Poster presentation

Open Access

EEG processing with TESPAR for depth of anesthesia detection

Vasile V Moca*[1,7], Bertram Scheller[2], Raul C Mureşan[1,3], Michael Daunderer[4] and Gordon Pipa[3,5,6]

Address: [1]Center for Cognitive and Neural Studies (Coneural), Cluj-Napoca, Cluj, Romania, [2]Clinic for Anesthesiology, Johann Wolfgang Goethe University, Frankfurt, Germany, [3]Max Planck Institute for Brain Research, Hesse, Frankfurt am Main, Germany, [4]Clinic for Anesthesiology, Ludwig Maximilians University, Bavaria, Munich, Germany, [5]Frankfurt Institute for Advanced Studies, Johann Wolfgang Goethe University, Frankfurt, Germany, [6]Dep. of Anesthesia and Critical Care, Massachusetts General Hospital, MA, USA and [7]Department of Electronics, Telecommunications, and Information Technology, Technical University of Cluj-Napoca, Cluj, Romania

Email: Vasile V Moca* - moca@coneural.org

* Corresponding author

from Eighteenth Annual Computational Neuroscience Meeting: CNS*2009
Berlin, Germany. 18–23 July 2009

Published: 13 July 2009

BMC Neuroscience 2009, **10**(Suppl 1):P68 doi:10.1186/1471-2202-10-S1-P68

This abstract is available from: http://www.biomedcentral.com/1471-2202/10/S1/P68

© 2009 Moca et al; licensee BioMed Central Ltd.

Introduction

Adequate anesthesia is crucial to the success of surgical interventions and subsequent recovery. Neuroscientists, surgeons, and engineers have sought to understand the impact of anesthetics on the information processing in the brain and to properly assess the level of anesthesia in an non-invasive manner. Studies have indicated a more reliable depth of anesthesia (DOA) detection if multiple parameters are employed. Indeed, commercial DOA monitors (BIS, Narcotrend, M-Entropy and A-line ARX) use more than one feature extraction method. Here, we propose TESPAR (Time Encoded Signal Processing And Recognition) a time domain signal processing technique novel to EEG DOA assessment that could enhance existing monitoring devices.

Methods

We developed an artificial system that employs TESPAR descriptors from EEG combined with MLP artificial neural networks to discriminate between five DOA levels. The system was trained and tested on DOA mappings performed by two expert anesthesiologists based on morphologically different features, namely the mid latency auditory evoked potentials (MLAEP) known to be correlated with DOA. A number of 62 patients, underlying surgery, were enrolled in this study after having provided their informed consent. The patients were sedated using a cocktail of substances chosen by the attending anesthesiologist. The cleaned EEG with a bandwidth of 0.5 to 600 Hz was divided in segments of about 100 seconds that were categorized in five DOA classes based on the notes recorded during surgery and the shape of the corresponding MLAEP.

Results

The largest amount of self-consistency achieved by one of the experts that classified the same data on two occasions was 70.77%. This was regarded as the limit of classification performance that the artificial system could achieve. Indeed, the artificial system achieved a 69.05% classification performance. Moreover, we found that the human expert and the artificial system had similar confusion matrices and thus similar mapping patterns.

Discussion

TESPAR processed EEG showed an intimate relation with states of patients undergoing general anesthesia. This intimate relation allowed the artificial system to achieve good DOA classification performance, despite the limits imposed by learning from imperfect human experts. TESPAR offers small, compact, fixed-size and highly informative descriptors that could be used to enhance

already existing DOA monitors. TESPAR shows promising perspective in areas where only light computational resources are available.

Acknowledgements

We gratefully acknowledge the financial support from the Hertie Foundation, three grants of the Romanian government (Human Resources Program RP-5/2007 contract 1/01.10.2007 and Ideas Program ID 48/2007 contract 204/01.10.2007 both financed by MECT/UEFISCSU, and Partnerships Program contract 11039/18.09.2007 financed by MECT/ANCS), a grant for the "Max Planck – Coneural Partner Group," and the EU (EU project GABA-FP6-2005-NEST-Path-043309). We want to thank Prof. Wolf Singer, Diek Wheeler and Ovidiu Jurjut for useful discussions and comments on the manuscript.

Publish with **BioMed Central** and every scientist can read your work free of charge

"BioMed Central will be the most significant development for disseminating the results of biomedical research in our lifetime."

Sir Paul Nurse, Cancer Research UK

Your research papers will be:

- available free of charge to the entire biomedical community
- peer reviewed and published immediately upon acceptance
- cited in PubMed and archived on PubMed Central
- yours — you keep the copyright

Submit your manuscript here:
http://www.biomedcentral.com/info/publishing_adv.asp

BioMedcentral