

SPECIAL ISSUE

## Biomedical Signal Processing

Point of View: Fundamental Research and U.S. National Security

Scanning Our Past: The Rise of Light





**SPECIAL ISSUE**

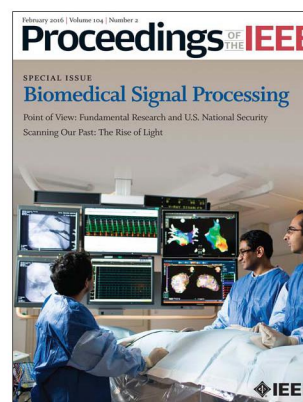
## BIOMEDICAL SIGNAL PROCESSING: FROM A CONCEPTUAL FRAMEWORK TO CLINICAL APPLICATIONS

Edited by M. Baumert, A. Porta, and A. Cichocki

- 223 Reconstructing Time-Dependent Dynamics**  
 By P. Clemson, G. Lancaster, and A. Stefanovska  
*[INVITED PAPER]* This paper provides an in-depth review of the framework of analysis applied to biomedical data in the context of the challenges posed by the time dependence of living systems.
- 242 Multiscale Analysis of Intensive Longitudinal Biomedical Signals and Its Clinical Applications**  
 By T. Nakamura, K. Kiyono, H. Wendt, P. Abry, and Y. Yamamoto  
*[INVITED PAPER]* Recent advances in wearable and/or biomedical sensing technologies have made it possible to record continuous biomedical signals over long periods of time. This paper reviews multiscale approaches for their analysis.
- 262 Time-Variant Modeling of Brain Processes**  
 By L. Leistritz, K. Schiecke, L. Astolfi, and H. Witte  
*[INVITED PAPER]* A brief overview of current modeling strategies in brain research is given; spatial scales ranging from single neuron to large scale activity of and between brain regions are considered.
- 282 Wiener-Granger Causality in Network Physiology With Applications to Cardiovascular Control and Neuroscience**  
 By A. Porta and L. Faes  
*[INVITED PAPER]* The paper reviews predictability improvement, information-based and frequency domain approaches to Wiener-Granger causality assessment in network physiology.
- 310 Linked Component Analysis From Matrices to High-Order Tensors: Applications to Biomedical Data**  
 By G. Zhou, Q. Zhao, Y. Zhang, T. Adali, S. Xie, and A. Cichocki  
*[INVITED PAPER]* This paper gives a brief review of existing matrix-based (two-way) component analysis methods for the joint analysis of biomedical multiblock data and discusses extensions and generalization to tensors (multiarray) data analysis and multiway blind source separation.
- 332 Multimodal BCIs: Target Detection, Multidimensional Control, and Awareness Evaluation in Patients With Disorder of Consciousness**  
 By Y. Li, J. Pan, J. Long, T. Yu, F. Wang, Z. Yu, and W. Wu  
*[INVITED PAPER]* Despite rapid advances in the study of brain-computer interfaces (BCIs), improvement of target detection performance and multidimensional control continue to be major barriers for further development. In this paper, the recent progress in multimodal BCIs is reviewed.

**DEPARTMENTS**

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**On the Cover:** This month's cover illustrates the application of biomedical signal processing in the clinical setting through a photograph of the cardiac electrophysiology laboratory at the Royal Adelaide Hospital. (Photo Credit: Randy Larcombe.)

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**SPECIAL ISSUE: Biomedical Signal Processing: From a Conceptual Framework to Clinical Applications**

- 353 Characterization of Human Motor Units From Surface EMG Decomposition**  
By *D. Farina and A. Holobar*  
|INVITED PAPER| The study of motor units provides a window into the mechanisms of neural control of movement in humans. This paper reviews processing methods of the surface EMG signal to reliably characterize individual motor units *in vivo* in humans.
- 374 Recording and Decoding for Neural Prostheses**  
By *D. J. Warren, S. Kellis, J. G. Nieveen, S. M. Wendelken, H. Dantas, T. S. Davis, D. T. Hutchinson, R. A. Normann, G. A. Clark, and V. J. Mathews*  
|INVITED PAPER| This paper reviews technologies and signal processing algorithms for decoding peripheral nerve and electrocorticogram (ECoG) signals to interpret human intent and control prosthetic arms.
- 392 Techniques for Ventricular Repolarization Instability Assessment From the ECG**  
By *P. Laguna, J. P. Martínez Cortés, and E. Pueyo*  
|INVITED PAPER| Ventricular repolarization instability is a harbinger of malignant arrhythmias. This paper surveys electrocardiogram (ECG) processing techniques approaches for quantifying the ventricular repolarization process.
- 416 Quantitative-Electrogram-Based Methods for Guiding Catheter Ablation in Atrial Fibrillation**  
By *M. Baumert, P. Sanders, and A. Ganesan*  
|INVITED PAPER| How to identify points for catheter ablation to stop atrial fibrillation? This paper summarizes challenges and recent advances in signal processing guided ablation.
- 432 Closed-Loop Neuromodulation Technology for Baroreflex Blood Pressure Control**  
By *K. Hosokawa and K. Sunagawa*  
|INVITED PAPER| The arterial baroreflex is a powerful regulator of blood pressure. This paper presents the closed-loop neuromodulation technology for baroreflex blood pressure control.
- 444 Machine Learning and Decision Support in Critical Care**  
By *A. E. W. Johnson, M. M. Ghassemi, S. Nemati, K. E. Niehaus, D. A. Clifton, and G. D. Clifford*  
|INVITED PAPER| This paper discusses the issues of compartmentalization, corruption, and complexity involved in collection and preprocessing of critical care data.

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