Guest Editorial Special Section on New and Emerging Technologies in Bioinformatics and Bioengineering

I. Introduction

RECENT technological advances have facilitated the development of complex biomedical systems, including sophisticated biosensor networks, wearable health-monitoring systems (WHMSs) [1], innovative medical imaging equipment [2], and human–computer interaction (HCI) systems [3], promising a significant upgrade in the quality of provided healthcare services. Additionally, the consolidated results of more than ten years of research on information and communication technologies (ICT) supporting hardware advancements have generated evidence of the enabling role of ICT on the whole range of health services from life style and self-health management to improving health-related quality of lives of patients and citizens, and managing chronic disease conditions, such as diabetes, chronic heart disease, and mental health [4]–[6]. Moreover, it is anticipated that properly designed innovative health services supported by ICT may modulate and improve chronic disease prognosis, which is extremely important in view of the rapidly growing population ageing.

The tremendous amount and the diversity of the collected/stored biomedical data, the creation and proliferation of biomedical knowledge sources, and the opportunity to employ large processing power make automated biomedical data analysis increasingly important in healthcare and place biomedical data mining in a unique position to significantly impact patient care [7], [8]. Advanced computational techniques and methods in machine learning, data mining, pattern recognition, knowledge representation, data modeling, and physiological systems modeling and simulation continue to pave the way toward the identification and extraction of useful biomedical knowledge from large data repositories, and provide valuable tools for numerous applications ranging from bioinformatics [9]–[11] to imaging [12], [13] and decision making [7], [14] in the life sciences domain. Incorporating context-aware technology and combining with data-mining techniques in already existing and emerging healthcare provisioning systems and applications is in line with the current trends in patient treatment, which call for protective (proactive self-care), preventive, reachable (i.e., at home, at work, and while travelling), and high-quality health advice and assistance [15], [16].

Computational intelligence embedded in wireless biosensor networks plays a key role toward this direction. Networks of implantable or wearable devices can be used for real-time health monitoring, diagnostics, treatment, or as prosthetic devices [1], [17]. In some situations, a feedback loop can be formed within a biosensor network that integrates wearable and/or implantable devices. For example, the communication network that forms between a continuous glucose monitoring system (implantable or external wearable unit) and a subcutaneous insulin delivery device can be considered as a biosensor network [18]. Glucose measurements are processed by means of adaptive algorithms and provide control signals that are transmitted to the insulin pump. Thus, continuous real-time control of blood glucose is achieved. Furthermore, continuous ambulatory monitoring of vital signs enables proactive personal health management and better treatment of patients suffering from chronic diseases, the elderly population, and emergency situations [1], [19].The development of implantable material, sensing devices, efficient algorithms, and protocols for communication [20], [21] represent challenging issues that should be addressed toward the deployment of body sensor networks in routine healthcare.

HCI lies at the crossroads of several research areas, including computational intelligence, computer vision, psychology, and robotics. In recent years, there has been a growing interest in introducing intuitive interfaces that can recognize the user's body movements and translate them into machine commands [3]. For the neural linkage with computers, various biosignals can be used, which are acquired from a specialized tissue, organ, or cell system, like the nervous system. Examples include EEG, electrooculogram (EOG), and electromyogram (EMG). Many attempts have been made for the purpose of interpreting the EMG signal into computer command, aiming at the development of efficient HCI and in particular of control interfaces for robotic devices. With the introduction of robots in everyday life tasks (e.g., service robots, robots for clinical applications), there is a strong need for simple and natural control interfaces. Effectively interfacing a robot arm with a human entails the necessity for continuous and smooth control [22]. Moreover, successful HCI should be able to follow the basic principles of communication among human beings [23], [24]. Toward this direction, the incorporation of emotional intelligence [25], [26] and multisensory integrative information [27], [28] represent major challenges that should be addressed in order, for the machines, to become more human-like, more effective, and more efficient [9].

Machine learning and computational intelligence play an essential role in the medical imaging field, including medical image analysis, computer-aided diagnosis, organ/lesion segmentation, image/data fusion, image-guided therapy, image annotation, and image retrieval [12], [29], because objects, such as lesions and anatomy in medical images cannot be modeled accurately by simple equations; therefore, tasks in medical

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imaging require learning from examples. In addition, imaging has a pivotal role in the development, evaluation, and validation of physiological models both in humans [30] and animals [31], and in the translation of such models to the clinical setting with both diagnostic and therapeutic applications [32]. The introduction of new imaging modalities and methodologies, such as diffusion-weighted MRI and functional MRI (fMRI) [33], electrical impedance tomography (EIT) [30], and microwave radiometry [34], provides enhanced insight in various physiological and pathophysiological processes. Computational models serve to engender interpretation of the physiological measurements/imaging data in a way compliant with the underlying biophysical, biochemical, or biological laws of the physiological or pathophysiological processes under investigation. Ultimately, such investigative tools and systems enhance our understanding of disease processes, the natural history of disease evolution, and the influence of therapeutic interventions on the course of a disease.

II. Organization of This Section

This Special Section is aimed at providing a snapshot of the latest and emerging developments and applications of ICT in the fields of biology and medicine, based on the best papers presented in the Eighth IEEE International Conference on Bioinformatics and Bioengineering—BIBE 2008. The papers published in this Special Section present research results and address open issues in highly timely topics related to chronic disease management, early diagnosis and treatment of cardiovascular and lung disease, functional imaging, development of advanced HCI, with an ultimate aim of enhancing the healthcare services provided to the citizen and the patient, and facilitating their deployment in everyday medical care. The fifteen papers of this Section have been grouped into the following categories.

1) Computational intelligence and data mining in support of decision making in biomedicine.
2) New applications and wireless communication issues in body sensor networks.
3) Human–computer interaction.
4) Medical imaging and physiological systems modeling.

A. Computational Intelligence and Data Mining in Support of Decision Making in Biomedicine

Machine learning and data mining facilitates biomedical data exploration using data analysis methods with sophisticated algorithms in order to discover unknown patterns. Thus, reliable and effective results are obtained that provide high classification accuracy with a simple representation of gathered knowledge, and are especially appropriate to support decision-making processes in biomedicine [7], [8].

With the development of proteomics, tandem mass spectrometry has been used for the rapid identification and characterization of protein components in complex biological mixtures. Several search engines have been developed to interpret tandem mass spectra for peptide identification [35]. All search engines need to determine the masses of peptide ions from their mass/charge ratios, given that the ions charges are not detected by mass spectrometers. The current strategy is to search candidate peptides multiple times, once for each possible charge state, a procedure that is time consuming and involves the risk of false-positive peptide identification. The paper by Zou *et al.* [11] proposes a support vector machine technique aiming at discriminating doubly charged spectra from triply charged ones, based on the use of 28 features, reaching a discrimination accuracy of 93%–95%.

Coronary heart disease (CHD) is one of the major causes of disability in adults as well as one of the main causes of death in the developed countries. The paper by Karaolis *et al.* [14] presents the development of a data mining system based on decision trees for the assessment of heart-event-related risk factors targeting the reduction of CHD events. According to the presented results, it is anticipated that data mining based on decision trees can help in the identification of risk subgroups of subjects for developing future events, and it might provide a valuable tool for the selection of therapy, i.e., angioplasty or surgery.

Anxiety disorders are considered the most prevalent of mental disorders and the exact reasons that provoke them to patients remain yet not clearly specified. In their paper, Panagiotakopoulos *et al.* [16] present a context-aware approach combined with data mining techniques, aiming to provide medical supervisors with a series of applications and personalized services, which enable exploitation of the multiparameter contextual data collected through a long-term monitoring procedure. In particular, an application that assists the archiving and retrieving of the patients' health records is presented along with four treatment-supportive services. The three services focus on the discovery of possible associations between the patient's contextual data, while the fourth service aims at predicting the stress level a patient might suffer from, in a given context. The paper presents a quite useful approach to the treatment of anxiety disorders.

B. Human–Computer Interaction

The increasing heterogeneity of computer users and the stricter demands for reduced user frustration while interacting with computers pose an imperative need for a shift of the adaptation requirements from the human user to the computer [9], [17], [23].

Complex mechanisms or systems of sensors have been used to develop human–robot interfaces, while in most cases, the user has to be trained to map his/her action (i.e., 3-D motion of a joystick or a haptic device) to the desired motion for the robot. The interface presented in the paper by Artemiadis and Kyriakopoulos [22] allows the user to control in real time an anthropomorphic robot arm in 3-D space, using upper limb motion estimates based only on EMG recordings. The proposed interface is robust to EMG changes with respect to time, mainly caused by muscle fatigue or adjustments of contraction level. The efficiency of the method is assessed through real-time experiments, including random arm motions in the 3-D space with variable hand-speed profiles.

The significance of embedding emotion recognition and/or multisensory integrative information to HCI systems has become clear [24], [25]. The paper by Frantzidis *et al.* [26] attempts to classify the emotional state of a user by using advanced classifiers and data mining techniques applied to neurophysiological (EEG) recordings. The proposed classification model is formed according to current neuroscience trends, adopting the independency of two emotional dimensions (arousal and valence), as dictated by the bidirectional emotion theory, whereas it is gender-specific. Robust classification of objective emotional measures is the first step toward numerous applications within the sphere of HCI.

The paper by Magosso [28] presents a neural network model to investigate the mechanisms underlying visual–tactile interactions, which are increasingly being combined in many human–computer interfaces (mouse, keyboard, and touchpad), communication technologies (e.g., mobile phones), warning systems and multisensory information displays, endoscopic chirurgical devices, and virtual reality systems. Some of the principles delineated in the presented model that are biologically inspired (feedforward and feedback connections, topological organization, inhibition to implement competitive mechanisms, and solve conflicting and ambiguous situations) may have a general validity and may be exploited in a large family of information processing systems for multisensory integration.

C. Emerging Applications and Wireless Communication Issues in Body Sensor Networks

WHMS represent the new generation of health care by providing real-time unobtrusive monitoring of patients' physiological parameters through the deployment of several wearable and implanted biosensors [1].

In the paper by Pantelopoulos and Bourbakis [19], a physiological data-fusion model is presented for a multisensor WHMS, called PROGNOSIS.The proposed methodology is based on a fuzzy regular language for the generation of the prognoses of the health conditions of the patient, whereby the current state of the corresponding fuzzy finite-state machine signifies the current estimated health state and context of the patient. The operation of the proposed scheme is explained via detailed examples in hypothetical scenarios. Moreover, a stochastic petri net model of the human–device interaction is presented, which illustrates how additional health status feedback can be obtained from the WHMS' user.

The paper by Mougiakakou *et al.* [18] presents a platform, called SMARTDIAB, which aims to support the monitoring, management, and treatment of patients with type 1 diabetes mellitus (T1DM). The platform integrates mobile infrastructure, Internet technology, wearable continuous glucose measurement devices and implanted insulin pumps, advanced modeling techniques, control methods, and tools for the intelligent processing of diabetes patients information. The SMARTDIAB platform allows 1) intensive monitoring of glucose levels; 2) diabetes treatment optimization; 3) continuous medical care; and 4) improvement of quality of life of individuals with T1DM.

Efficient algorithms and protocols for communication are of utmost importance in body sensor networks. In the paper by Oh *et al.* [20], a new [phase silence shift keying (PSSK)] modulation scheme for high data rate implantable medical devices is proposed. Simulation results are presented in terms of performance, modulation options, spectrum regrowth by nonlinearity, and roll-off values of a pulse-shaping filter. Link budget planning justifies the applicability of the proposed scheme for high data rate applications in the body channel environment, such as capsule endoscopy.

Today's offered solutions in body sensor networks involve the usage of radio frequency communication systems, which have shown to provide adequate performance to ensure proper network functionality, but there are concerns about their potential harmful effects to the exposed human tissues. In the paper by Davilis *et al.* [21], the use of ultrasonic waves as an alternative means for wireless communication in body sensor networks is proposed. A simple propagation model is used to evaluate ultrasonic waves as a communication medium, study the feasibility of the approach, the effective bit rates that may be achieved, the power efficiency of the scheme, and other system issues.

D. Medical Imaging and Physiological Systems Modeling

Advances in functional imaging techniques, computer-aided image interpretation, and computational modeling is coming to have a major role in a comprehensive interdisciplinary effort to elucidate functions of living systems and structure-to-function interrelations [32]. The intensive use of imaging techniques like segmentation, rendering, and shape modeling is leading to detailed descriptions of organs, while quantitative measures not only of dimensions but also of composition and material properties can be provided. Modeling can be seen as a major tool in order to integrate knowledge, to drive experiments, and to optimize measurements in biological and clinical research.

Thoracic EIT aims to reconstruct a cross-sectional image of the internal spatial distribution of conductivity from electrical measurements made by injecting weak alternating currents via an electrode array placed on the surface of the thorax. The paper by Denaï *et al.* [30] attempts to demonstrate the principles of mechanical ventilation, lung recruitment, and EIT imaging on a comprehensive physiological model that combines a data-driven physiological model of respiratory mechanics, a model of the human lung absolute resistivity as a function of air content and a 2-D finite-element mesh of the thorax to simulate EIT image reconstruction during mechanical ventilation. The overall model provides a good understanding of respiratory physiology and EIT monitoring techniques in mechanically ventilated patients and can be combined with appropriate information/data-fusion techniques to serve toward ventilator therapy management of critical care patients.

Naturally generated signals from the body can be exploited to measure temperature and/or conductivity fluctuations at low microwave frequencies, by means of microwave radiometry. In the paper by Karathanasis *et al.* [34], microwave radiometry is implemented using innovative approaches, with the view to achieve 1) completely passive and noninvasive functional imaging of the brain and 2) temperature monitoring during noninvasive intracranial hyperthermia treatment. The main module of the system is an ellipsoidal cavity, which provides the appropriate focusing of the electromagnetic energy on the area of interest. According to phantom experiments, the system is able to detect local concentrated gradual temperature and conductivity variations expressed as an increase of the output radiometric voltage. Moreover, when contactless focused hyperthermia is performed, the results show significant temperature increase at specific phantom areas.

fMRI is a procedure that uses MR imaging to measure the tiny metabolic changes that take place in an active part of the brain. fMRI detects changes of deoxyhemoglobin levels and generates blood-oxygen-level-dependent (BOLD) signals related to the activation of the neurons. Efficient fMRI data statistical analysis schemes are of paramount importance for detecting the weak BOLD signal from the noisy data and determining the activated regions of the brain. In the paper by Oikonomou *et al.* [33], a Bayesian framework is used for the analysis of fMRI data, able to deal with the nonstationarity of the noise. Results using simulated and real data indicate the superiority of the proposed approach by taking into account the complex noise structure of the fMRI time series

Identification and characterization of diffuse parenchyma lung disease patterns challenges computer-aided schemes in computed-tomography lung analysis. In the paper by Korfiatis *et al.* [13], an automated scheme for volumetric quantification of interstitial pneumonia (IP) patterns, a subset of diffuse parenchyma lung disease, is presented. Initially, lung field (LF) segmentation is achieved by 3-D automated gray-level thresholding combined with an edge-highlighting wavelet preprocessing step, followed by a texture-based border refinement step. The vessel tree volume is identified and removed from LF, thus resulting in lung parenchyma (LP) volume. Following, identification and characterization of IP patterns are formulated as a three-class pattern classification of LP into normal, ground glass, and reticular patterns, by means of *k*-NN voxel classification, exploiting 3-D co-occurrence features. Several measures are used to evaluate the performance of the proposed scheme in identifying and characterizing ground glass and reticular patterns.

The last paper of this Special Section by Manos *et al.* [31] illustrates in a clear manner the integration of advanced computational modeling techniques with physiological measurements and imaging data to enhance our understanding of the pathophysiology of hemodialysis access complications. Arteriovenous shunt (AVS) is the surgical connection of an artery to a vein, creating an access site for chronic hemodialysis patients with end-stage renal disease. A subject-specific 3-D shunt geometry in an animal model was built based on biplane angiography data, and boundary conditions were imposed, as obtained from *in vivo* flow and pressure measurements. The flow field in AVS is studied by means of computational fluid dynamics, and local hemodynamics is correlated with wall histology and wall mechanics.

III. Concluding Remarks

The papers of this Special Section addressed some of the challenges and implementation issues in the areas of computer-aided decision making in biomedicine, medical imaging and physiological systems modeling, body sensor networks, and human–computer interfaces. All these topics are interrelated, share advanced methodologies of ICT, and represent the many attempts to provide better care for the citizen and the patient. We trust that the reader will find value in these selected snapshots of research and emerging applications. The Guest Editors would like to thank all the authors for their high-quality work contributed to this Special Section and all the Reviewers for their hard work and expert comments in evaluating the manuscripts.

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References

[1] E. Jovanov, C. C. Y. Poon, and G.-Z. Yang, “Guest editorial on body sensor networks: From theory to emerging applications,” *IEEE Trans. Inf. Technol. Biomed.*, vol. 13, no. 6, pp. 859–863, Nov. 2009.
[2] C. Roux and J. K. Udupa, “Scanning the issue—Special issue on emerging medical imaging technology,” *Proc. IEEE*, vol. 91, no. 10, pp. 1479–1482, Oct. 2003.
[3] J. Flanagan and T. Huan, “Scanning the issue—Special issue on human–computer multimodal interface,” *Proc. IEEE*, vol. 91, no. 9, pp. 1267–1271, Sep. 2003.
[4] Y. T. Zhang, C. C. Y. Poon, and E. MacPherson, “Editorial note on health informatics,” *IEEE Trans. Inf. Technol. Biomed.*, vol. 13, no. 3, pp. 281–283, May 2009.
[5] Z. Kolitsi and J. Roca. (2009, Dec.). e-health and beyond. *Eur. J. ePractice* [Online]. 8. Available: http://www.epractice.eu/journal/volume/8
[6] WHO, *Preventing Chronic Diseases: A Vital Investment: WHO Global Report*. Geneva, Switzerland: World Health Organization, 2005.
[7] M. Sordo, S. Vaidya, and L. Jain Eds., *Advanced Computational Intelligence Paradigms in Healthcare*. New York: Springer-Verlag, 2008.
[8] R. Begg, D. T. H. Lai, and M. Palaniswami, *Computational Intelligence in Biomedical Engineering*. Boca Raton, FL/New York: CRC Press/Taylor & Francis, 2007.
[9] P. Baldi and S. Brunak, Eds., *Bioinformatics: The Machine Learning Approach*. Cambridge, MA: MIT Press, 2001.
[10] G. S. Stamatakos, E. I. Zacharaki, M. I. Makropoulou, N. A. Mouravliansky, A. Marsh, K. S. Nikita, and N. Uzunoglu, “Modeling tumor growth and irradiation response in vitro: A combination of high performance computing and web based technologies including VRML visualization,” *IEEE Trans. Inf. Technol. Biomed.*, vol. 5, no. 4, pp. 279–289, Dec. 2001.
[11] A.-M. Zou, J. Shi, J. Ding, and F.-X. Wu, “Charge state determination of peptide tandem mass spectra using support vector machine (SVM),” *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2010.2040287.
[12] M. R. Ogiela and R. Tadeusiewicz, Eds., *Modern Computational Intelligence Methods for the Interpretation of Medical Images*. NewYork: Springer-Verlag, 2008.
[13] P. D. Korfiatis, A. N. Karahaliou, A. D. Kazantzi, C. Kalogeropoulou, and L. I. Costaridou, “Texture based identification and characterization of interstitial pneumonia patterns in lung multidetector CT,” *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2009.2036166.
[14] M. Karaolis, J. A. Moutiris, D. Hadjipanayi, and C. S. Pattichis, “Assessment of the risk factors of coronary heart events based on data mining with decision trees,” *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2009.2038906.

[15] T. Broens, A. Van Halteren, M. Van Sinderen, and K. Wac, "Towards an application framework for context-aware m-health applications," *Int. J. Internet Protoc. Technol.*, vol. 2, no. 2, pp. 109–116, Feb. 2007.

[16] T. C. Panagiotakopoulos, D. P. Lyras, M. Livaditis, K. N. Sgarbas, G. C. Anastassopoulos, and D. K. Lymberopoulos, "A contextual data mining approach towards assisting the treatment of anxiety disorders," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2009.2038905.

[17] Y. Hao and R. Foster, "Wireless body sensor networks for health-monitoring applications," *Physiol. Meas.*, vol. 29, pp. R27–R56, Nov. 2008.

[18] S. G. Mougiakakou, C. Bartsocas, E. Bozas, N. Chaniotakis, D. Iliopoulou, I. Kouris, S. Pavlopoulos, A. Prountzou, M. Skevofylakas, A. Tsoukalis, K. Varotsis, A. Vazeou, K. Zarkogianni, and K. S. Nikita, "SMARTDIAB: A communication and information technology approach for the intelligent monitoring, management and follow-up of type 1 diabetes patients," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2009.2039711.

[19] A. Pantelopoulos and N. Bourbakis, "*Prognosis*—A wearable health monitoring system for people at risk: Methodology and modeling," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2010.2040085.

[20] J.-Y. Oh, J.-H. Kim, H.-S. Lee, and J.-Y. Kim, "PSSK modulation scheme for high data rate implantable medical devices," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2009.2036255.

[21] Y. Davilis, A. Kalis, and A. Ifantis, "On the use of ultrasonic waves as a communications medium in biosensor networks," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2009.2039755.

[22] P. K. Artemiadis and K. J. Kyriakopoulos, "An EMG-based robot control scheme robust to time-varying EMG signal features," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2010.2040832.

[23] E. Hudlicka, "To feel or not to feel: The role of affect in human-computer interaction," *Int. J. Hum.-Comput. Stud.*, vol. 59, no. 1–2, pp. 1–32, Jul. 2003.

[24] B. Reeves and C. Nass, *The Media Equation: How People Treat Computers*. Cambridge, U.K.: Cambridge Univ. Press, 1996.

[25] M. Pantic and L. J. M. Rothkrantz, "Toward an affect-sensitive multimodal human-computer interaction," *Proc. IEEE*, vol. 91, no. 9, pp. 1370–1390, Sep. 2003.

[26] C. A. Frantzidis, C. Bratsas, C. L. Papadelis, C. Pappas, and P. D. Bamidis, "Using multi-channel neuro-physiological recordings & affective visual stimuli," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2010.2041553.

[27] G. A. Calvert, C. Spence, and B. E. Stein, *The Handbook of Multisensory Processes*. Cambridge, MA: MIT Press, 2004.

[28] E. Magosso, "Integrating information from vision and touch: A neural network modelling study," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2010.2040750.

[29] G. Schaefer, A. Hassanien, and J. Jiang, Eds., *Computational Intelligence in Medical Imaging: Techniques and Applications*. Boca Raton, FL/New York: CRC Press/Taylor & Francis, 2009.

[30] M. A. Denaï, M. Mahfouf, S. M. Samuri, G. Panoutsos, B. H. Brown, and G. H. Mills, "Absolute electrical impedance tomography (aEIT) guided ventilation therapy in critical care patients: Simulations and future trends," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2009.2036010.

[31] T. A. Manos, D. P. Sokolis, A. T. Giagini, C. H. Davos, J. D. Kakisis, E. P. Kritharis, N. Stergiopulos, P. E. Karayannacos, and S. Tsangaris, "Local hemodynamics and intimal hyperplasia at the venous side of a porcine arteriovenous shunt," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2010.2040288.

[32] J.-L. Coatrieux and J. Bassingthwaighte, "Guest editorial—Special issue on the physiome and beyond," *Proc. IEEE*, vol. 94, no. 4, Apr. 2006.

[33] V. P. Oikonomou, E. E. Tripoliti, and D. I. Fotiadis, "Bayesian methods for fMRI time series analysis using a non stationary model for the noise," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2009.2039712.

[34] K. Karathanasis, I. Gouzouasis, I. Karanasiou, M. Giamalaki, G. Stratakos, and N. Uzunoglu, "Non-invasive focused monitoring and irradiation of head tissue phantoms at microwave frequencies," *IEEE Trans. Inf. Technol. Biomed.*, vol. 14, May 2010. DOI: 10.1109/TITB.2010.2040749.

[35] P. James, Ed., *Proteome Research: Mass Spectrometry*. Berlin, Germany: Springer-Verlag, 2001.

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