

Guest Editorial

Service Science for *e*-Health

SERVICE science is an emerging interdisciplinary approach to design, implement, and evaluate complex service systems [1]. It brings together science, ICT technologies, and business to provide an added value to domain-specific applications of service-based systems. Service science is often defined as an application of scientific, engineering, and management disciplines that integrate elements of computer science, operations research, industrial engineering, business strategy, management sciences, and social and legal sciences, in order to encourage innovation in how organizations create value for customers and shareholders that could not be achieved through such disciplines working in isolation. The application of service science in the *e*-Health area seems to be a natural approach to build platforms, systems, and applications which meet current and future demands of the healthcare domain.

The aim of this special section is to present recent advances on the adoption of service science for *e*-Health. The articles were selected among the submissions received following an open call for papers, after a thorough and selective review process. The call for papers solicited high-quality interdisciplinary papers presenting the utilization of service science to develop new or enhance existing healthcare systems and services.

The papers in this special section cover a wide range of topics, from mobile health systems to service-oriented decision support in medical systems and service quality evaluation.

The article “*An Automatic Rules Extraction Approach to Support OSA Events Detection in a mHealth System*,” authored by G. Sannino, I. De Falco, and G. De Pietro, focuses on the detection and real-time monitoring of obstructive sleep apnea episodes. For this purpose, the paper proposes an easy-to-use and inexpensive mobile-based approach. Three main steps are considered: 1) collection of single-channel ECG data from a patient via a wearable sensor and recording on a mobile device; 2) offline automatic extraction of knowledge about that patient in terms of a set of rules; and 3) use of the derived rules in the real-time mobile monitoring system: the same wearable sensor collects the single-channel ECG data and sends them to the same mobile device, which now processes those data online.

The article “*Logic-Centred Architecture for Ubiquitous Health Monitoring*,” authored by J. Lewandowski, H. E. Arochena, R. N. G. Naguib, K.-M. Chao, and A. Garcia-Perez, addresses smart wearable systems and presents an integrated architecture for multiparametric, intelligent, and ubiquitous wireless sensing platforms. The novelty of this system lays in a rapid visual development and remote deployment model. The complementary visual Inference Engine Editor that comes with the

package enables artificial intelligence specialists, alongside with medical experts, to build data processing models by assembling different components and instantly deploying them (remotely) on patient mobile devices.

The article “*Online Anomaly Detection in Wireless Body Area Networks for Reliable Healthcare Monitoring*,” authored by O. Salem, Y. Liu, A. Mehaoua, and R. Boutaba, also focuses on body area networks and proposes a lightweight approach for online detection of faulty measurements by analyzing the data collected from medical wireless body area networks. The main objective is to raise alarms only where appropriate and to reduce false alarms triggered by faulty measurements, that can result in an unnecessary healthcare intervention.

In the article “*Service-Oriented Medical System for Supporting Decisions With Missing and Imbalanced Data*,” the author M. Zieba proposes a service-oriented support decision system for diagnostic problems. The pivotal point of the presented solution is that it is insensitive to the problems of the imbalanced data and missing values of the attributes, which are widely observed in medical domain. The issue of the imbalanced data is solved by the application of cost-sensitive SVM and the problem of missing values of attribute is handled by proposing the novel ensemble-based approach that splits the incomplete data space into complete subspaces that are further used to construct base learners.

The article “*A Study on Quality Assessment for Medical Ultrasound Video Compressed via HEVC*,” authored by M. Razaak, M. Martini, and K. Savino focuses on quality of experience and diagnostic accuracy for compressed medical ultrasound video. The authors evaluate the performance of seven state-of-the-art video quality metrics with respect to compressed medical ultrasound video sequences. Both diagnostic accuracy and visual quality are evaluated, by medical experts in the first case and nonexperts in the latter case. Via the calculation of the correlation of each metric with the subjective opinions, the authors provide an indication on the metrics showing the best correlation with the subjective scores provided by medical experts.

The guest editorial team wishes to express their appreciation to all the authors of the papers submitted to this special section. We would like to thank all the reviewers for their hard work and expert contributions.

Finally, special thanks go to the IEEE JOURNAL ON BIOMEDICAL AND HEALTH INFORMATICS team (Editor-in-Chief, Board representative, and Executive Director) and the IEEE publications staff for their cooperation in the preparation of this special section.

We hope you will enjoy reading the high quality papers presented in this section.

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REFERENCE

- [1] J. Spohrer, P. Maglio, J. Bailey, and D. Gruhl, "Steps toward a science of service systems," *Computer*, vol. 40, no. 1, pp. 71–77, Jan. 2007.



Paweł Świątek received the M.Sc. and Ph.D. degrees in computer science from the Wrocław University of Technology, Wrocław, Poland, in 2005 and 2009, respectively.

Since 2009, he has been with the Institute of Computer Science, Wrocław University of Technology, where since 2010, he has been an Assistant Professor. His main scientific interests include services optimization and personalization, optimization of service-based systems, resources allocation, QoS delivery in heterogeneous networks, mobility management in wireless networks, and applications of service science for e-health. He is an author of more than 80 journal and conference papers and an editor of three books. He was also a Leader in multiple research EU-funded project which focused mainly on service oriented systems, future Internet architectures, and applications of service science and ICT in e-health. He serves as a Reviewer and TPC Member for multiple international journals and conferences.



Maria G. Martini (SM'xx) received the Laurea degree in electronic engineering (*summa cum laude*) from the University of Perugia, Perugia, Italy, in 1998, and the Ph.D. degree in electronics and computer science from the University of Bologna, Bologna, Italy, in 2002.

She is a Reader (Associate Professor) in the Faculty of Science, Engineering and Computing, Kingston University, London, U.K., where she also leads the Wireless Multimedia Networking Research Group and she is the Course Director for the M.Sc. in "Networking and Data Communications." She has led the KU team in a number of national and international research projects, funded by the European Commission, U.K. research councils, and international industries. She is a (Guest) Editor and Reviewer for international journals and she has been in the organizing and programme committee of several international conferences. Her research interests include wireless multimedia networks, cross-layer design, joint source and channel coding, 2-D/3-D error resilient video, 2-D/3-D video quality assessment, and medical applications. She is the author of more than 90 international scientific articles and book chapters, and the inventor of several

patents on wireless video.

Dr. Martini is an Associate Editor for the IEEE TRANSACTIONS ON MULTIMEDIA. She has also been Lead Guest Editor for the IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS special issue on "QoE-aware wireless multimedia systems" (2012) and Guest Editor for the *International Journal on Telemedicine and Applications* among others. She was the General Chair of the ICST/ACM MOBIMEDIA 2009 conference and of EUMOB 2008. She has co-organized the First and Second IEEE International workshop on Service Science for e-Health (SSH 2013 and 2014), the First Workshop on Wireless Solutions for Healthcare Applications (2014), the IEEE Workshop on Streaming and Media Communications (ICME 2011), and the First International Workshop on Cross-Layer Operation Aided Multimedia Streaming (IEEE VTC 2011). She coordinated (2008–2010) the edition of the Strategic Applications Agenda on mobile health and inclusion applications in the eMobility European Technology Platform. She is a part of international committees and expert groups, including the IEEE Multimedia Communications Technical Committee, where she serves as the Chair (2012–2014) of the 3-D Rendering, Processing, and Communications Interest Group and she has been a key Member for QoE and multimedia streaming, and the Net!Works European Technology Platform expert group.



Katarzyna Wac (SM'xx) received the B.Sc. and M.Sc. degrees in computer science from the Wrocław University of Technology, Wrocław, Poland, in 2003, the M.Sc. degree in telematics from the University of Twente, Enschede, The Netherlands, in 2004, and the Ph.D. degree in information systems from the University of Geneva, Geneva, Switzerland, in 2009.

She is a Senior Scientist (French “MA” 2010–2012 and “MER” since 2012) at the Center for Informatics, University of Geneva and the Leader of the Quality of Life (QoL) research area. In 2003–2004, she was a Research Staff Member at the University of Twente. In 2004, she joined the University of Geneva as a Research and Teaching Assistant, while keeping her affiliation with the University of Twente. In 2007–2010, she was also affiliated with the MobiHealth BV start-up company. In 2009–2010, she was on leave for a one-year Swiss NSF postdoctoral fellowship at the Human-Computer Interaction Institute, Carnegie Mellon University. In Summer 2013, her research was supported by the Swiss NSF International Visits program to research at Stanford University, and particularly at the Stanford Human-Sciences and Technologies Advanced

Research Institute. Her research interests include quality of experience-aware mobile systems and services with special emphasis on support of adaptive multimedia protocols and quality-of-service mechanisms, especially in the mobile healthcare (i.e., mHealth) domain. She strives toward effective and efficient pervasive mobile computing and communication—meeting the end-user quality-of-service requirements and quality-of-experience expectations.

Dr. Wac has been an Associate Expert of the International Telecommunication Union European Regional Initiative for mHealth since 2012. She is a Member of the Association for Computing Machinery.



Kevin Patrick received the M.S. and M.D. degrees.

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Dr. Patrick is the Editor-in-Chief of the *American Journal of Preventive Medicine*.