

GUEST EDITORIAL PREFACE

Special Issue on Secured, Flexible Healthcare Service and Medical Data Processing in e-Health System

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Due to the coming of aging society in many countries and higher demand of life health, medical care and related subjects keep heating up and attracting concerns from political, scientific and industrial areas. E-health, as a method adopting information and communication technologies help to address the medical problem, improve the health service quality, and lower the healthcare cost, has become a powerful engine and drive a serial research and industry developments.

Recently, several research trends are observed in e-health area. First, the pervasiveness of smartphone brings new vision for mobile health and makes the personalized medicine possible and affordable in the near future. With the gradually maturing of frontend health data collection technique, the backend medical data analysis and utilization become critical to detect or pre-alert potential diseases. Second, the

medical security and data privacy become more and more important, whether it is on personal health monitoring scale or nationwide health information scale. Third, hot topics from information technique field, like cloud computing, social media, etc. are also taking part in the medical information management and personal medical care, which are mostly act on public health service, clinic decision assistant or chronic disease management, etc.

Seven articles are selected to constitute this special issue. We hope it can provide the latest research topics and development in e-health area and bring some insight to readers and field participants. The topics of these articles are roughly categorized into four aspects, but each article has its special angle and different applying domain. The same article could belong to more than one category at the same time. Summaries of these articles are presented next.

Two articles about Healthcare information and communications technologies (ICT) in healthcare area, like body sensor networks and wearable sensor systems, telemedicine, etc. are included. The first one is “Wearable ECG Monitoring System associated with Smartphone: iHeart” by Hyuma Watanabe, Masatoshi Kawarasaki, Akira Sato, and Kentaro Yoshida. In this article, the authors developed a Wearable ECG monitoring system “iHeart” which can detect heart abnormal behavior and alert through Smart-phone timely. They also developed two analysis algorithms: R-wave detection algorithm and extrasystole classification algorithm. The algorithms are implemented in wireless ECG sensor rather than in smartphone to save power consumption of ECG sensor caused by radio communication. The second one, “Cost Efficient Deployment and Reliable Routing Modeling based Multi-Objective Optimization for Dynamic Wireless Body Sensor Networks Topology” is authored by Hassine Moun gla, Nora Touati, Ahmed Mehaoua. In this article the authors focus on the issues of minimum the energy consumption, reliable routing and maximum area coverage for the Wireless Body Sensor Networks (WBSNs). A bi-objective nonlinear non-convex model based on a Min-Max formulation is proposed for deployment issue. Simulations results demonstrate that the proposed algorithm balances the energy consumption of nodes effectively and maximizes the network lifetime by meeting the enhanced WBSNs requirements including better delivery ratio and less reliable routing overhead. The proposed technology has potential to offer a wide range of benefits to patients, medical personnel and society through continuous monitoring and early detection of possible problems.

Three articles with security and privacy issues are presented with different emphasizes: one for the security recommendation for the emergent telemedicine system, one for the privacy protection of the medical data during data sharing, and one for the trust and scalability issue for national e-health system. The first article is “Securing Remote Obstetrics Monitoring Systems” by Chiu C. Tan, Michael Korostelev,

Li Bai, Dimitrios S. Mastrogiannis, and Jie Wu. The authors analyzed the security protections of recently proposed remote obstetrics monitoring systems which incorporate off-the-shelf equipment like commercial smartphones into design, to not only reduce the cost of the monitoring equipment, but also to allow for greater flexibility. It proposes recommendations to improve the security of these systems, and analyzes the implementation techniques, for example access control requirement, audit control requirement and integrity requirement and so on. The second article is “Framework design and case study for privacy-preserving medical data publishing” authored by Yu Niu, Ji-jiang Yang, and Qing Wang. The article first discusses the general concerns on the patient privacy protection during medical information sharing and interaction between different institutions, such as hospital, insurance company, bank, etc. Then a privacy preserving framework with the view of practical application is proposed. The framework focuses on three key issues of privacy protection during the data sharing, which are privacy definition/detection, privacy policy management, and data publishing. A case study for Chinese Electronic Medical Record (ERM) publishing with privacy preserving is implemented. Specific Chinese free text EMR segmentation, Protected Health Information (PHI) extraction, and K-anonymity PHI anonymous algorithms are proposed in each component. The real-life data from hospitals are used to evaluate the algorithms and prove system feasibility. The third article is “Using a Public Key Registry for Improved Trust and Scalability in National E-health Systems” by Vicky Liu, William Caelli, Yu-Nien Maggie Chen. Different with the traditional KPI system, the authors adopt centralized public key registry system with a non-certificate based scheme for large scale e-health information systems. The proposed structure removes complex certificate management, revocation and certificate validation structure while maintaining overall system security.

Besides constructing and designing the mobile body sensing system, the analysis of collected bio-signal and data are also very

important. Early detection and diagnosis based on these analysis can be used to significantly reduction of the cost of patient care associated with advanced stages of many diseases. Here two articles explore the bio-signal analysis issues. The first one is the above mentioned ECG signal R-wave detection and extrasystole classification for heart attack alert work by Hyuma Watanabe and his colleges. And the second one is “Neural Networks for an Analysis of the Hemometabolites Biosensor Response” by José Renato Garcia Braga, Alexandre Carlos Brandão Ramos, Alvaro Antonio Alencar de Queiroz, and Demétrio Artur Werner Soares. This article presents the application of artificial neural network (ANN) to analysis the signals of amperometric biosensors response to glucose, urea and cholesterol in in-vitro assays, which are highly related factors for development of cardiovascular or renal diseases. The ANN employed for data treatment could substantially improve biosensor selectivity and allow exact identification of the biomarker molecule present in blood. The experiment shows that proposed algorithm is able to detect the conditions with accuracy up to 90%, and is also efficiency to identify other characteristic points of the

generated current-time curves such as the peak area and the peak width.

The last article is “The Application of Intelligent Keywords to Patient Adherence Management System” by Yin-Pin Yang and Tsai-Ya Lai. In this research, a Patient Adherence Management System applying Intelligent Keyword (PCMSIK) was proposed to assist users to enhance their adherence behavior by leveraging peer power. Three major components of PAMSIK are proposed: an autonomous User Behavior Collector for identifying patient’s personal adherence problems, a Patient Similarity Analyzer for dynamically clustering peers, and a Cure Service Dispatcher for recommending suitable cures. Thanks to the blooming internet social media, unbounded people network resources are used to form an effective peer learning mechanism, which is considered as the key to make the said management system successful.

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Jian Song received his B. Eng and PhD degrees from Electronic Engineering Department, Tsinghua University, China in 1990 and 1995, respectively. He worked for the same university as an assistant professor upon his graduation, and then conducted Postdoctoral research work in The Chinese University of Hong Kong and University of Waterloo, Canada in 1996 and 1997, respectively. He joined the industry in 1998 and has been with the Advance Development Group of Hughes Network Systems in USA for seven years, working in the areas of wireless communications, satellite communication, powerline communication, and the electronic scanning antenna before joining the faculty team in Tsinghua University in 2005 as a full professor. He is now the Director of DTV Technology R&D Center and this center is one of the major technical contributors for the Chinese digital terrestrial television broadcasting standard. Dr. Song is very active in serving the community and is Fellow of IET as well as a senior member of IEEE. He now serves as the Associate Editor of IEEE Transaction on Broadcasting as well as the member of BTS AdCom. He founded IEEE BTS Beijing Chapter in 2007 and has been the Chairman since then. He is the TPC co-chair of ISPLC2012 and General Chair Healthcom2012. He acted as the technical committee members for many conferences, gave invited talks and served as panelist. Dr. Song's primary research interest is in the physical layer and he has been working in different areas, such as fiber-optic, satellite, wireless as well as the powerline communications. His current research interest is in digital TV broadcasting area, eHealth, and the powerline communications. Dr. Song has published more than 100 peer-reviewed journal and conference papers with good citation record, holds two US and more than thirty Chinese patents.

Ji-Jiang Yang got his B.S. and M.S. degree from Tsinghua University, and Ph.D from National University of Ireland (Galway). His research areas involve in e-health, e-government/e-commerce, privacy preserving, and Information resource management. Now he is an associate professor in Research Institute of Information Technology, Tsinghua University. Dr. Yang worked for CIMS/ERC (Computer Integrated Manufacturing System/Engineering Research Center) of Tsinghua university from 1995-1999. He has joined and been in charge of different projects funded by the State Hi-Tech program (863 program), NSF (China), and European Union. From 2009, Prof. Yang's main focus is e-health and medical service. He has undertaken a few projects in the National Science & Technology Supporting Program about Digital Medical Service model and key technologies. He is also collaborating with a lot of medical institutions and hospitals, such Peking Union Hospital, Chaoyang Second Hospital, Fengtai Maternal and Child Health hospital, etc. He has published more 50 papers on professional Journals and Conferences. He is the member of Expert committee of IoT (Internet of Things) in Health at Chinese Electronic Association, Expert committee of Remote medicine and Cloud computing at Chinese Medicine Informatics Association. Dr. Yang was the Program Chair of HealthCom2012. He was/is also a chair/co-chair of workshop SSS(Service Science systems) in IEEE CompSoc from 2010.