Guest Editorial

Broadband Multimedia Sensor Networks in Healthcare Applications

Since the first special issue on "Telemedicine and Applications" was published in April 2000, advances in broadband network communication technology both wired and wirelesses have expanded telemedicine to a pressing need of high speed networks in medicine and public health care. Recent achievements in these fields have helped to better understanding of computing and communication infrastructure associated with various applications. With appropriately developed advanced infrastructures in network technology the future medicine should provide the increasingly aging world with great benefits for public health care. Such applications are expected to improve future healthcare practices, especially in the areas of telemedicine, sensor network-integrated health care, electronic health records, chronic disease monitoring. It is believed that the wireless broadband network will eventually merge with the wired broadband network to offer both reliability and mobility in the future telemedicine and health care applications. Keeping this goal in mind this special issue is devoted to the theme on "Broadband Multimedia Sensor Networks in Healthcare Applications" in addressing and focusing on the issues of wired and wireless networks in the state-of-art medicine and health care on applications of high speed networks to medicine and healthcare as well as mutual understanding between the network technology and medicine and health care applications. A total of seven papers are selected, each of which is briefly described as follows.

The first paper on "International Internet2 Connectivity and Performance in Medical Imaging Applications" by B.J. Liu, Z. Zhou, M.A. Gutierrez, J. Documet, L. Chan and H.K. Huang describes a methodology of connecting international Internet2 among three different internationally linked sites located in University of Southern California in USA, Hong Kong Polytechnic University in Hong Kong and University of Sao Paulo in Brazil respectively. The Internet2, also known as Next Generation Internet (NGI) is an advanced high speed computer network which has been widely used for medical image communication for teleradiology. Its connectivity and security issues were previously investigated via a local site case study in the special issue on Telemedicine and Application, April 2000 (*Journal of High Speed Networks*, vol. 9, no. 1, pp. 3–13, April 2000). This paper further explores the utility of the Internet2 in connecting three international sites with applications in clinical environments.

The second paper on "The Role of a Data Grid in Worldwide Imaging-Based Clinical Trials" by Z. Zhou, M. Gutierrez, J. Documet, L. Chan, H.K. Huang and B. Liu develops a data grid architecture for worldwide imaging-based clinical trials where the data testbed for study is set up among three international sites described in the first paper, University of Southern California in USA, Hong Kong Polytechnic University in Hong Kong and University of Sao Paulo in Brazil which are connected by Internet2 via the Hong Kong Academic and Research Network (HARNET) and Brazilian National Research and Education Network (RNP2). The clinical trials considered in this paper are image-based experiments where medical images provide a unique and fast diagnosis with visual assessment.

The third paper on "Sensor-Based Pervasive Healthcare System: Design and Implementation" by H.Y. Kung, C.Y. Hsu and M.-H. Lin proposes a Sensor-based Pervasive Healthcare (SPH) system which can effectively reduce health labor cost and provide a streamlined, convenient and low healthcare cost platform for patients and professional medical staff. In order to accomplish its goal, the SPH is developed by integrating three systems, Home Healthcare End (H^2E) system, e-healthcare Service Provider (ESP) and e-healthcare Control Center (EC^2). The

H^2E system consists of sensor equipments and healthcare engine where the former includes vital sign and video sensors, while the latter receives the signals from the sensors and sends query commands back to sensor equipments to look up patients' health status. The ESP provides medical staff and patients with medical information services via a particularly developed Healthcare Service Middleware (HDM) platform. The EC^2 allows medical staff to remotely monitor the physiological status of patients via the developed H^2E system.

The fourth paper on "A Mobile Physiological Monitoring System for Patient Transport" by J.C. Shen, D.-H. Shih, H.-S. Chiang and S.-B. Liu proposes a mobile tele-monitoring system to address an issue of physiological monitoring during patient transport between hospitals which requires high speed wireless technology to make transport safe and smooth. The developed system integrates current available smart phones with wireless network technologies such as Bluetooth and RFID system to enable medical staff to continuously monitor patients' status during transport.

The fifth paper on "A Tree-Based Scheme for Security of Many-to-Many Communication" by R.-H. Lin and J.-K. Jan addresses security issue arising in a broadcast system which involves many parties in communication. This is particularly important for broadband network systems involving healthcare where the patients' information must be protected from illegal and unauthorized break-in for access. This paper provides a tree structure-based group keying scheme for many-to-many secure communication. In this case, only the party holding the key can have access to the network to freely communicate one another without a group controller.

The sixth paper on "Towards to Design of a Nailfold Capillary Microscopy Image Analysis and Diagnosis Framework Using Grid Computing Technology" by K.-C. Li, C.-H. Wen, C.-N. Chen and J.-L. Lan develops a high-speed Grid-based computing system platform for nailfold capillary microscope image acquisition and analysis where the platform can be interconnected by a number of clusters located in remote sites. The system built on this platform consists of two major modules, an image pre-processing module to perform image enhancement followed by a content feature detection module perform recognition between normal and abnormal nailfold capillaries.

The seventh paper on "Understanding of Human Behaviors from Videos in Nursing Care Monitoring Systems" by C.-D. Liu, P.-C. Chung, Y.-N. Chung and M. Thonnat studies understanding of human behaviors from surveillance video monitoring systems for nursing care. It uses a Negation-Selection process based on the posture sequence and motion history map for activity recognition. A multi-state scenarios-based state machine is then designed to understand human behaviors through their activities and surrounding contexts. With including such human behavior understanding a monitor system is further developed for nursing care, which comprises of four modules: behavior understanding module, behavior statistic module, announcement service module and tele-consultation module to implement necessary functions required for nursing monitoring.

The scope of topics presented in this special issue only offers a quick glimpse of this fast growing area in various applications such as medical image communications (first paper), clinical trials via telemedicine (second paper), sensor network-based healthcare system (third paper), patient transport mobile monitoring system (fourth paper), communication security in a many-to-many broadband system (fifth paper), grid-based high computing performance network used for nailfold capillary image acquisition and analysis (sixth paper) and remote surveillance video monitoring system for nursing care (seventh paper). Needless to say, there are also many interesting applications in healthcare which we are not able to cover in this issue. Nevertheless, we hope that this special issue has served its goal well as an initiative and further stimulates readers' interest in this fascinating area for many years to come.

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