Preface

The book, “Emerging Communication Technologies for E-Health and Medicine,” is the first publication of *Advances in E-Health and Medicine* series created to disseminate recent advances in electronic health (e-health), medical communications, and services and applications for e-health and medicine. This series compiles and reprint the strongest contributions published by the *International Journal of E-Health and Medical Communications* (IJEHMC) (http://www.igi-global.com/IJEHMC), IGI Global, USA (ISSN: 1947-315X, EISSN: 1947-3168). With the success of this journal publication, the book reprints the articles published in 2010. Along its twenty-four chapters, theories, systems, methods, algorithms, and applications in health, healthcare, biomedicine, telemedicine, and medical communications are presented, furnishing important contributions to the state of the art and offering, at the same time, an important updated overview about emerging communication technologies for e-health and medicine. These topics are very updated and extremely important for the community both from industry and academia. Authors around the world, also both from industry and academia, shared their contributions to offer a composition that is very useful for readers.

In the first chapter, *The mHealth Stack: Technology Enablers for Patient-Centric Mobile Healthcare*, by Benjamin Falchuk, David Famolari, Russell Fischer, Shoshana Loeb, and Euthimios Panagos, examines current usage of mobile devices and networks by mobile healthcare applications, and presents their views on how mobile devices and networks could be used for creating patient-centered healthcare applications. The patient-centered healthcare paradigm allows for increased quality of care and quality of life for patients while increasing personal freedom to move about and be always connected to caregivers and healthcare services. The structure of their discussion is analogous to layered protocol stack in communications, progressing from the network and radio technologies, service middleware, cloud services, health sensors, mobile smart phones, and applications. All these layers come into play to support future mobile healthcare services. These authors, from Telcordia Technologies, USA, offer a very interesting approach regarding the use of mobile devices and networks by mobile healthcare applications from the industry point-of-view.

The second chapter, “An Ontology Driven Multi-agent Approach to Integrated e-Health Systems,” is proposed by Weir Ying, Jaminda S. Wimalasiri, Pradeep Ray, Subhagata Chattopadhyay, and Concepción S. Wilson, from School of Information Systems, Technology and Management, University of New South Wales, Sydney, Australia. Authors present a conceptual architecture for the interoperability of e-Health systems. This architecture uses multiple cooperating software agents that actively access, recognize, and associate the information in distributed, heterogeneous e-health systems. Using a layered ontology structure, they show how ontology based multi-agent systems can be used to resolve discrepancies in terminology and/or structure. This involves a case study in a distributed Electronic Health Record (EHR)
environment. This proposal follows the objective that an integrated e-health system is to improve the quality of healthcare by providing transparent access to patient information. The current health information management environment has numerous systems with varying techniques for representing and managing patient data. The increasing mobility of patients results in patient information being spread across these systems. The chapter demonstrates how the healthcare domain can benefit from the research in Ontology Based Multi-Agent Systems (OBMAS) that potentially allow multiple intelligent agents to solve semantic interoperability problems in healthcare domain. The use of a common domain ontology allowed the authors to resolve discrepancies in terminology and structure by acting as the basis of inter-application data mediation, bridging the gap of semantic interoperability between e-health systems as illustrated in this chapter through a case study.

The third chapter, “Developing Smart Emergency Applications with Multi-Agent Systems,” by Federico Bergenti and Agostino Poggi, describes some of the main reasons why multi-agent systems are today considered one of the best technologies for the realization and deployment of advances for e-health applications, and in particular, of smart emergency applications. After an introduction on the inherent characteristics of the use of multi-agent systems for e-health, the chapter presents the results of EU-scale project CASCOM: a real multi-agent system for the execution of smart emergency tasks. Multi-agent systems have been importantly contributing to the development of the theory and the practice of complex distributed systems and, in particular, they have shown their potential to meet critical needs in high-speed, mission-critical, content-rich, distributed information applications where mutual interdependencies, dynamic environments, uncertainty, and sophisticated control play a remarkable role. Therefore, multi-agent systems are considered a suitable technology for the realization of e-health applications where the use of loosely coupled and heterogeneous components, the dynamic and distributed management of data, and the remote collaboration among users are often the most relevant requirements. Federico Bergenti and Agostino Poggi are with Università degli Studi di Parma, Italy.

The fourth chapter, “‘Pragmatic Evaluation’: A Conceptual Framework for Designing a Systematic Approach to Evaluation of eHealth Interventions,” by Richard E. Scott, describes a simple and systematic approach to e-health evaluation in a real-world setting, which can be applied by an evaluation team and raises the quality of e-health evaluations. The framework guides and advises users on evaluation approaches at different stages of e-health development and implementation. Termed “Pragmatic Evaluation,” the approach has five principles that unfold in a staged approach that respects the collective need for timely, policy relevant, yet meticulous research. The five principles for pragmatic evaluation are the following: 1) Ask – and answer - policy relevant questions (this is “applied” research, intended to instigate evidence-informed change); 2) Adopt a scientifically valid research approach (use an appropriate study design and methods); 3) Establish a clear outcomes framework (identify and apply specific indicators, measures, and tools); 4) Align with existing strategies (maximize leverage and value by interweaving with other programs / projects / policies); and 5) Get the knowledge to where it is needed (ensure effective knowledge translation). Richard E. Scott is with University of Calgary, Canada.

The fifth chapter, “Patent Issues in eHealth, Especially of North and South Problems on Telemedicine,” by Yasumitsu Tomioka, intends to specifically verify what patent issues may be encountered in telemedicine, using 2007, 2008, and 2009 International Property Rights Index (IPRI), which is the first international comparative study that measures the significance of both physical and intellectual property rights and their protection for economic well-being. Patent issues act as a hindrance factor against spreading and promoting telemedicine, and to solve this hindrance factor, and for the purpose of spreading and promoting telemedicine so that the benefit of medicine may reach everybody, includ-
ing people living in developing countries, it seems extremely important to recognize the presence of “patent issues” in the field of “telemedicine.” The present circumstance shows that each country has its own system of intellectual property rights including the patent right, and that each evaluation index exhibits no fluctuation between the upper half ranked countries and the lower half ranked countries. Such a fact that present circumstance continues, so to speak, at a fixed state and cannot be broken down seems to form the background for the patent issues in the field of telemedicine is getting more and more obvious. It seems that the very presence of this patent issues acts as a hindrance factor against spreading and promoting the telemedicine. In order to solve this hindrance factor, i.e., the patent issues, and for the purpose of spreading and promoting the telemedicine so that the benefit of medicine may reach everybody, including the people living in the developing countries, to improve the health of people all over the world, it seems extremely important to recognize the presence of patent issues in the field of telemedicine between the developing countries and the developed countries. Yasumitsu Tomioka is with Department of Emergency and Critical Care Medicine, School of Medicine, Tokai University, Japan.

The sixth chapter, “Telemonitoring System of Neurological Signs in a Health Telematique Network,” by Silviu Folea, Camelia Avram, Sorin Vidican, and Adina Astilean, presents a new, experimental, wireless tremor telemonitoring system composed of an optional variable number of portable devices integrating three-axis acceleration mini-sensors, which are connected to very small dimensions acquisition systems with Wi-Fi transmission capabilities. The main advantages of the design system consist of the possibilities to monitor many body parts of one or multiple subjects simultaneously, and on local or more extended areas both for scheduled assessments and in an everyday life environment. Possible applications of the presented experimental system, considered as a part of a health telematics network, consist of delivering supplementary, consistent sets of data to clinicians in order to reliably assess patients’ state in home and community settings, over longer periods of time. This system consists of delivering new data necessary for differential diagnosis of different types of tremors, or to precise different stages of illness in a health telematics network. The multiple simultaneous measuring capabilities and the extended observation time period could cover eventually neglected aspects related to occasional, temporary, or an intermittent tremor. The Wi-Fi DAQ proposed system’s novelty, in contrast with existing Wi-Fi solutions, is its ultra low power Wi-Fi capability, which makes it suitable for sensing applications where battery power management is critical. Silviu Folea, Camelia Avram, and Adina Astilean are with Technical University of Cluj-Napoca, Romania, and Sorin Vidican is with Neurosurgery Clinique Cluj-Napoca, Romania.

In the seventh chapter, “Aspects of Information Communications Technology for Better Medical Control,” by Isao Nakajima and Yasumitsu Tomioka, the work describes Japanese aspects of mobile e-health to support ambulatory applications. The 3G mobile phone has propagation problems at urban area and severe congestions after major disaster to support mobile e-health. So, the authors are expecting the Quasi-zenith satellite with nationwide coverage. In near future, the data transmission of image of pharygoscopy, motion picture of light reflex, 12-leads ECG (electrocardiogram), automated ultrasonic echo, and vital signs from ambulances shall be performed to assist medical control. For example, Thrombolytic agents are reportedly effective even when injected into a vein, if injected in the early stages of acute myocardial infarction, which will reduce medical costs, resulting in high-quality services available uniformly across the nation. These authors, combining the knowledge and expertise of a medical doctor, Isao Nakajima, with technological skills and expertise of Yasumitsu Tomioka, provide a very interesting Japanese case-study, based on most recent technologies of mobile eHealth to support ambulatory applications. Isao Nakajima is with Tokai University School of Medicine, Japan, and has
long experience on e-Health, and Yasumitsu Tomioka is also with Tokai University School of Medicine and with University of Hyogo Graduate School of Applied Informatics, Japan.

In the eighth chapter, “Biosensor Based on Giant Magnetoresistance Material,” Mitra Djamal, Ramli, Yulkifli, Suprijadi, and Khairurrijal demonstrate a comprehensive review on novel approach in biosensor based on Giant Magnetoresistance Material (GMR) material. Compared with the traditional optical detection that widely used in biomedicine, GMR sensors are more sensitive, portable, and give a fully electronic readout. In addition, GMR sensor is inexpensive, and the fabrication is compatible with the current VLSI (Very Large Scale Integration) technology, so GMR sensors can be easily integrated with electronics and microfluidics to detect many different analytes on a single chip. Mitra Djamal and Khairurrijal are with Institut Teknologi Bandung, Indonesia, while Ramli and Yulkifli are with Institut Teknologi Bandung and Universitas Negeri Padang, Indonesia; Suprijadi is with Institut Teknologi Bandung, Indonesia.

The ninth chapter, “Toward Applications of EMG and Preliminary Study in the Next Design of Compact Integrated Bio-signal Recording System,” by Kastam Astami and Arga Aridarma, demonstrates the developed system consisting of multi-channel analog circuitry and also microcontroller based to facilitate connectivity with computer or laptop as a recording platform. From this developed system, they further improve the system by referring to the previous result. One of the improvements will be the user controllable gain of each channel. Beside improvement to the system, they use it in acupuncture experiment, for recording muscle signal during acupuncture process. They also further study the possibility of implementing muscle signal as a control for an assistive system and integrating it for an integrated bio-signal recording system. Kastam Astami and Arga Aridarma are with Institut Teknologi Bandung, Indonesia.

The tenth chapter, “Active Noise Control for Hearing Screening Test: Simulation and Experiment,” by Dhifaf Azeez, Mohd Alauddin Mohd Ali, Hafizah Husain, Gan Kok Beng, and Cila Umat, proposes active noise control (ANC) to reduce the ambient noise using a personal computer in hearing screening test. The ANC algorithm was simulated in MATLAB software and implemented using a computer with data acquisition modules and LabVIEW software. The results showed that the anti-noise was successfully generated in the electrical domain but no reduction was observed in the acoustic domain. The ANC is a deterministic application that requires real-time operating system to respond to the input with precisely timed output. In order to have an effective ANC system, the processing time has to be less than 0.125 ms at 8 KHz sampling rate. The authors are with Universiti Kebangsaan Malaysia, Malaysia.

The eleventh chapter, “Safety System Design Simulation for Transcutaneous Electrical Nerve Stimulator using Electrode Contact Test,” by Mervin T. Hutabarat and Subaryani D. H. Soedindro, proposes TENS (Transcutaneous Electrical Nerve Stimulator), a therapeutic device used to deliver electric current through one skin. As the device is used on human body, safety becomes a matter that needs special concern. One of the options for electrical safety is by testing the electrode for whether it has attached properly to skin. The test is done in the interval of simulator pulse. This option is used to protect the user from electrical shock that can be caused from this device. Using 74HC4066 as the analog switch, this design can support TENS specification. The authors are with Institut Teknologi Bandung, Indonesia.

In the twelfth chapter, “Privacy Challenges in the Use of eHealth Systems for Public Health Management,” Karpurika Raychaudhuri and Pradeep Ray present a survey of published work covering privacy challenges in the use of eHealth systems, especially in the context of public health management. The authors identify and present the major privacy challenges, as well as their effects on personal patient privacy and public health management based on the review of research in electronic data privacy and
In the thirteenth chapter, “A Framework for Detecting Interactions between Co-Incident Clinical Processes,” Kerry Hinge, Aditya Ghose, and Andrew Miller address a topic related with the detection of treatment conflicts between multiple treatment protocols that are co-incident. This is a difficult and open problem that is particularly exacerbated regarding the treatment of multiple medical conditions co-occurring in aged patients. For example, a clinical protocol for prostate cancer treatment requires the administration of androgen-suppressing medication, which may negatively interact with another, co-incident protocol if the same patient were being treated for renal disease via haemodialysis, where androgen-enhancers are frequently administered. These treatment conflicts are subtle and difficult to detect using automated means. Traditional approaches to clinical decision support would require significant clinical knowledge. In this chapter, the authors present an alternative approach that relies on encoding treatment protocols via process models (in BPMN) and annotating these models with semantic effect descriptions, which automatically detects conflicts. This chapter describes an implemented tool (ProcessSEER) used for semantic effect annotation of a set of 12 cancer trial protocols and depicts the machinery required to detect treatment conflicts. The authors also argue whether the semantic effect annotations of treatment protocols can be leveraged for other tasks. Kerry Hinge, Aditya Ghose, and Andrew Miller are with University of Wollongong, Australia.

The fourteenth chapter, “Fostering User Participation in Ambient Assisted Living Projects,” by J. Artur Serrano, focuses on the involvement and accession of users in ambient assisted living (AAL) projects. AAL research area aims at developing technological services and applications helping the elderly population to maintain and increase their independent living. The most successful AAL application to the present is the “panic button,” a simple device, consisting of a button that the user can press when in an emergency situation. The challenge is the design and development of simple and effective AAL services, which provide a concrete and visible benefit to the elderly. Not complex, “sci-fi,” technological gadgets that will only make the life of its user more difficult and bring stress to an already reluctant person to the so called “new technologies.” The author has proposed in this chapter to bring some answers to the questions below. When and how are the users involved in the process? How are the users’ needs and requirements transferred to the technologists? How is it verified that these requirements have been satisfied in the developed prototypes? Some suggestions have been given providing answers to the questions set at the start. These are not to be taken as final answers, but as an initial basis for further research in a still, to a great extent, unexplored field. As to the final question: how to make the users’ voice heard across the development of complex ubiquitous healthcare services? The author could only give an honest view of the current state-of-the-art in the AAL – Ambient Assisted Living field. If a voice is to be heard, not only does one have to provide methods to let it out, but in addition, the recipient’s ears must be prepared to listen. This is to say that no matter how good a method can be, only if the outcomes are correctly taken into consideration will the results be positive. J. Artur Serrano is with University Hospital of North Norway, Norway.

In the fifteenth chapter, “Blood Vessel Segmentation in Complex-Valued Magnetic Resonance Images with Snake Active Contour Model,” by Astri Handayani, Andriyan B. Suksmono, Tati L R Mengko, and Akira Hirose, the research proposes a specific snake active contour model-based blood vessel segmentation framework for complex-valued magnetic resonance images. Accurate blood vessel segmentation plays a crucial role in non-invasive blood flow velocity measurement based on complex-valued magnetic
resonance images. The proposed framework combines both magnitude and phase information from a complex-valued image representation to obtain an optimum segmentation result. Magnitude information of the complex-valued image provides a structural localization of the target object, while phase information identifies the existence of flowing matters within the object. Snake active contour model, which models the segmentation procedure as a force-balancing physical system, is being adopted as a framework for this work due to its interactive, dynamic, and customizable characteristics. Two snake-based segmentation models are developed to produce a more accurate segmentation result; namely, the Model-constrained Gradient Vector Flow-snake (MC GVF-snake) and Stochastic-snake. MC GVF-snake elaborates a prior knowledge on common physical structure of the target object to restrict and guide the segmentation mechanism, while Stochastic-snake implements the simulated annealing stochastic procedure to produce improved segmentation accuracy. The developed segmentation framework has been evaluated on actual complex-valued MRI images, both in noise-free and noisy simulated conditions. Evaluation results indicate that both of the developed algorithms give an improved segmentation performance as well as increased robustness, in comparison to the conventional snake algorithm. The researchers Astri Handayani, Andriyan B. Sukmono, and Tati L R Mengko are with School of Electrical Engineering and Informatics, Institut Teknologi Bandung, Indonesia, and Akira Hirose is with Department of Electronics and Electrical Engineering at the University of Tokyo, Japan. Their contribution represents an important contribution for medical practice on the Magnetic Resonance Imaging.

The sixteenth chapter, “Non-Compactness Attribute Filtering to Extract Retinal Blood Vessels in Fundus Images,” by I. K. E. Purnama, K. Y. E. Aryanto, and M. H. F. Wilkinson, covers a new segmentation method for blood vessels in retinal images. In the method, attribute filtering with a so-called Max-Tree is used to represent the image based on its gray value. The filtering process is done using the branches filtering approach in which the tree branches are selected based on the non-compactness of the nodes. The selection is started from the leaves. This experiment was performed on 40 retinal images, and utilized the manual segmentation created by an observer to validate the results. The proposed method can deliver an average accuracy of 94.21%. I. K. E. Purnama is with Sepuluh Nopember Institute of Technology (ITS), Indonesia; K. Y. E. Aryanto is with Universitas Pendidikan Ganesha, Indonesia; M. H. F. Wilkinson is with University of Groningen, The Netherlands.

In the seventeenth chapter, “An Automated Method for Differential Blood Counting Using Microscope Color Image of Isolated WBC,” Anant R Koppar and Venugopalachar Sridhar propose a simple and pragmatic software system built on innovative, yet simple imaging algorithms for achieving better efficiency and accuracy of results. It is proposed because healthcare delivery systems are becoming overloaded in developed and developing countries. It is imperative that more efficient and cost effective processes be employed by innovative applications of technology in the delivery system. One such process in Haematology that needs attention is generation of report on the differential count of blood. Most rural centers in India still employ traditional, manual processes to identify and count White Blood Cells (WBC) under a microscope. This traditional method of manually counting the white blood cells is prone to human error and time consuming. Medical Imaging with innovative application of algorithms can be used for recognizing and analyzing the images from blood smears to provide an efficient alternative for differential counting and reporting. The resulting work-flow process with this proposal has enabled truly practical tele-pathology by enabling e-collaboration between lesser skilled technicians and more skilled experts, which cuts down the total turnaround time for differential count reporting from days to minutes. The system can be extended to detect malarial parasites in blood and also cancerous cells. This automated system reduces fatigue by providing images on the screen and avoiding visual
inspection of microscopic images. The system presents a high degree of accuracy and better speed in
detecting and analyzing the blood cells. The self-learning ability of the system increases the probability
of correctness in classification as usage increases. It is a very cost effective and simple to use system
that can be deployed in rural areas and in smaller clinics. Anant R Koppar and Venugopalachar Sridhar
are with P E T Research Center, India.

The eighteenth chapter, “Cancer Cell Image Analysis and Visualization,” by Tae-Yun Kim, Hae-Gil
Hwang, and Heung-Kook Choi, reviews computerized cancer cell image analysis and visualization
research over the past 30 years. They focused their state-of-art review on image acquisition, feature
extraction, classification, and visualization from two-dimensional to three-dimensional image algo-

rithms are introduced case studies of bladder, prostate, breast, and renal carcinomas. Computer-based
cell image processing and analysis can now be performed on personal computers, and software tools are
being developed to support multidimensional image analysis. In addition, microscopy image research
has progressed from pictures of tissues to cells to cell nuclei, to molecules, and to smaller scales. This
research will greatly improve the accuracy of cancer diagnosis. Tae-Yun Kim and Hae-Gil Hwang are
with School of Computer Engineering, Inje University, Korea, while Heung-Kook Choi, a well-known
researcher in this area, is with Ubiquitous Healthcare Research Center, Inje University, Korea.

In the nineteenth chapter, “Development of Dual Video Acquisition and Parallel AVI Player with
Camera Calibration System for Supporting Dual View Motion Detection,” by Amar Vijai Nasrulloh,
Tati L. R. Mengko, and Tommy Apriantono, presents an approach where the development of dual video
acquisition methods and continued with dual and parallel Audio Video Interleave (AVI) player display can
visually display dual view motion detection and successfully identify the depth of the motion detection.
Both recorded AVI file stores on the data storage were played at the same time. Times and frames are
played together in dual AVI player display. The purpose of locating position by mouse cursor program
is to tag the markers position every single motion manually and then recorded for supporting two view
graphics movement of the joints represented by the markers. The software module to find Ln of two
camera calibration, which connect 2 dimension image plane and 3 dimension world coordinates, was built
by the use of Direct Linear Transformation equation with distance error ±0.44 pixels for video camera 1
and ±1.03 pixels for video camera 2. Amar Vijai Nasrulloh is with Institut Teknologi Bandung, Indonesia
and Universitas Lambung Mangkurat, Indonesia, and Tati L. R. Mengko and Tommy Apriantono are
with Institut Teknologi Bandung, Indonesia.

In the twentieth chapter, “Phase Unwrapping Using Energy Minimization Methods for MRI Phase
Image,” Kusworo Adi, Tati Latifah R. Mengko, Andriyan B. Suksmono, and H. Gunawan have devel-
oped the Phase Unwrapping algorithms using the energy minimization in level first and third pixels
configuration approach and giving the increasing value of Peak Signal of Noise Ratio (PNSR) for some
images. The capability of the proposed method to unwrap simulated and actual Magnetic Resonance
Imaging (MRI) phase images is also demonstrated. In current MRI phase image, Phase Unwrapping
can be implemented for water and fat separation. To verify this method, authors use synthetic and actual
MRI image. Then the Phase Unwrapping (PU) result is implemented for water and fat separation. At the
end, the authors will see how large the effect of PU to the water and fat separation is. Kusworo Adi is
with Bandung Institute of Technology (ITB), Indonesia and Physics Department, Diponegoro University,
Indonesia, and Tati L. R. Mengko, Andriyan Bayu Suksmono, and Hendra Gunawan are with Bandung
Institute of Technology (ITB), Indonesia.
In the twenty-first chapter, “An Improved Olympic Hole-Filling Method for Freehand Three-Dimensional Ultrasound Reconstruction of the Spine,” D.E.O. Dewi, M.H.F. Wilkinson, T.L.R. Mengko, I.K.E. Purnama, P.M.A. van Ooijen, A.G. Veldhuizen, N.M. Maurits, and G.J. Verkerke propose an improved Olympic operator for Hole-filling algorithm, and apply it to generate the volume in freehand 3D ultrasound reconstruction of the spine. The conventional Olympic operator defines the empty voxels by sorting the neighboring voxels, removing the $n\%$ of the upper and lower values, and averaging them to attain the value to fill the empty voxels. The empty voxel estimation can be improved by thresholding the range width of its neighboring voxels and adjusting it to the average values. The method is tested on a hole-manipulated volume derived from a cropped 3D ultrasound volume of a part of the spine. The proposed technique shows improved result compared to all tested existing methods. D.E.O. Dewi, A. G. Veldhuizen, and M. H. F. Wilkinson are with University of Groningen, The Netherlands; T. L. R. Mengko is with Institut Teknologi Bandung, Indonesia; I. K. E. Purnama is with Institut Teknologi, Indonesia.

In the twenty-second chapter, “Response Time Estimation of a Web-Based Electronic Health Record (EHR) System Using Queuing Model,” de la Torre et al. present a comparison of the response times of a Electronic Health Record (EHR) Web system, TeleOftalWeb, using different databases. In order to calculate these times, M/M/1 queuing models is used. Four databases were selected: Oracle 10g, dbXML 2.0, Xindice 1.2, and eXist 1.1.1. The final objective of the comparison is choosing the database system resulting in the lowest response time to TeleOftalWeb. Authors concluded that TeleOftalWeb can process EHRs of up to 7500 patients per hour using an Oracle 10g database with a 1 Mb Internet connection, and up to 7550 patients per hour using an Xindice 1.2 database with the same Internet connection. dbXML 2.0 database can process up to 1500 EHRs in an hour, and Xindice 1.2 up to 1300 EHRs, with a 1 Mb Internet connection. With a 100 Kb connection, values considerably diminish. Using any foregoing database, TeleOftalWeb can process up to 1250 EHRs. With the comparison performed in this work, it can be concluded that the best database for this application is eXist 1.1.1. At present, the Web system with the most efficient database, eXist 1.1.1, which provides the best response times, and its features like cost, availability, and maintenance are favorable, is being used by specialists from the Institute of Applied Ophthalmobiology (Instituto de Oftalmobiología Aplicada, IOBA) of the University of Valladolid, Spain. At this time there are more than 2000 EHRs and fundus photographs in the system. Records gathered in TeleOftalWeb come from patients who participate in a telemedicine programme for the diabetic retinopathy screening conducted in a Spanish rural area. Isabel de la Torre Díez, Francisco Javier Díaz Pernas, Miguel López Coronado, Roberto Hornero Sánchez, and Miriam Antón Rodríguez are with University of Valladolid, Spain, and María Isabel López Gálvez is with University Institute of Applied Ophthalmobiology (IOBA) and University of Valladolid, Spain.

In the twenty-third chapter, “A Semantic-Based Dynamic Search Engine Design and Implementation for Electronic Medical Records,” Weider D. Yu and Seshadri K. Yilayavilli investigate and design a dynamic, question-answer search engine that enables searching by attributes for more precise and relevant information in Electronic Medical Record (EMR) field. Keyword-based search engines have their limitations. The search results do not have the user-context. The search results are not precise. Human intervention is necessary. Question-based search is very useful, yields precise results, and is easy to use against an EMR system, where medical terminologies can be very difficult for humans to parse. Question-based, search-by attribute works the best. Google Inc and Microsoft are making huge investments in the Healthcare sector. Question-based search will be very useful for patients against these Healthcare systems. The semantic-based dynamic search engine is a powerful second-generation search engine that overcomes the limitation posed by the current keyword-based search engine. The
search engine provides a way to search by attributes. The search results are small and precise. Semantic, in the form of question posed by search system, provides sufficient user-context to the search, to make the search results more relevant. The interactive and easy to use system functions make the end users very comfortable to use the system. The semantic-based dynamic search engine also provides additional features. The search engine is domain specific, but can operate in various domains. The two search types (Point-based and Set-based) provide more than one solution to do the search. The search engine can be very powerful against critical systems such as Universal Health System. This type of search engine can be life saving in urgent situations for individuals. Weider D. Yu and Seshadri K. Yilayavilli are with Computer Engineering Department, San Jose State University, San Jose (Silicon Valley), California.

Finally, in the last chapter, but not the least, “Web 2.0 Teacher Community in a National Health E-Learning Network,” Mei-Ju Su et al. present an e-learning environment, that is a result of the project of Ministry of Education Taiwan, one of the e-Generation projects, established the digital e-learning Web that includes Health, Life, Natural, Science, Arts and Cultural e-learning Networks. The health e-Learning Network combines experts in the field of health and physical education and primary and secondary school teachers to develop practical and high quality e-learning content, while also developing lesson plans and related activities. They can be divided into three areas: health education, medical care, and sports and leisure, which encompass the “Health e-Learning Network” (HeN). The curriculum of HeN covers seven thematic strands and has lesson plans, material, knowledge, and multimedia learning modules for teachers to utilize during class time. Web 2.0 (World Wide Web version 2.0) is used to lead into the HeN website, enabling teachers the initiative to participate in e-learning, while also giving users their own initiative to build development, two-way interaction, fast response, and so forth. Mei-Ju Su, Jia-Wei Lin, Sao-Jie Chen, and Heng-Shuen Chen are with National Taiwan University, Taiwan; Yen-Ting Chen is with Seattle Central Community College, USA; Yaw-Jen Lin is with Central Taiwan University of Science and Technology, Taiwan; Yu-Huei Su is with National HsinChu University of Education, Taiwan.

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