# Preface

Advances in information and communication technologies (ICT) have provided the tools and the environment to study, analyze, and better understand complex medical problems. This technological development has enabled researchers to provide increasingly advanced services, including computer-assisted radiology, telemedicine, robotized tele-operating systems, and so forth.

In recent years, research in computer applications applied to healthcare and biomedicine has dramatically intensified. The *Handbook of Research on Informatics in Healthcare and Biomedicine* aims to provide a platform for researchers to describe and analyze recent breakthroughs in these areas. This handbook will be most helpful as it provides comprehensive coverage and definitions of the most important issues, concepts, new trends and advanced technologies in healthcare and biomedicine. This important new handbook will be distributed worldwide among academic and professional institutions and will be instrumental in providing researchers, scholars, students, and professionals access to the latest knowledge related to information science and technology in the areas of healthcare and biomedicine.

This handbook provides a compendium of terms, definitions, and explanations of concepts, processes, and acronyms. Additionally, this volume features short chapters authored by leading experts offering an in-depth description of key terms and concepts related to different areas, issues, and trends in information science and technologies in hospitals and other organizations worldwide.

The *Handbook of Research on Informatics in Healthcare and Biomedicine* is an excellent source of comprehensive knowledge and literature on the topic of health and biomedical informatics.

The topics in this handbook cover useful areas of general knowledge including medical data and health information systems, standardization and classification systems in medicine, virtual reality applications in medicine, virtual learning environments in healthcare and biomedicine, computer-assisted diagnosis, data mining and medical decision making, current aspects of knowledge management in medicine, telemedicine and e-health services, image processing and archiving systems, signal processing techniques, use of new technologies in biomedicine, ergonomic and safety issues in computerized medical equipment, health economics, and health services research. Speicifically, these useful terms and key words have been included and analyzed in the concrete sections of this publication.

A healthcare provider's competitiveness, level of efficiency, and quality of care may be in direct relationship to the rate of progress toward a paperless system—with digital documentation of all clinical and administrative care processes. Each small step toward the electronic health record should be analyzed according to its benefits and costs. Hospitals and delivery networks must share secure health information and improve processes and efficiency in handling IT. The first section, "Medical Data and Health Information Systems", contains chapters related to the current status and future prospects of the electronic health record systems, the security in health information systems, and various applications in the area of health informatics.

For more than 130 years the systematic collection and record of medical information has been based on the use of traditional classifications, nomenclatures, and coding schemes of various kinds. Until relatively recently, such schemes were used mainly for recording causes of death and gathering minimal diagnostic

information for statistical and epidemiological purposes. Despite their many limitations, schemes such as the international classification of diseases (ICD) have been successful in supporting the collation and comparison of national and international statistics on morbidity and mortality, and advancing our understanding of the distribution and causes of diseases. The second section, "Standardization and Classification Systems in Medicine", contains chapters related to standardization and classification systems in health.

Medicine will benefit from virtual reality. As recorded in the military, virtual reality can provide an excellent training mechanism when there is no room for mistakes. Doctors will be able to practice alone or in teams to fine tune their skills for highly sensitive operations without having to risk a human life. Virtual reality can improve the doctor's performance during operations by superimposing vital information on the patient during an operation. Superimposed images can increase the effectiveness of radiation treatment and reduce the scarring of a surgery. In the third section, "Virtual Reality Applications in Medicine", various virtual reality applications in (bio) medicine and their benefits are presented.

The application of computer technology to education often refers to computer-assisted learning (CAL), computer-based education (CBE), or computer-aided instruction (CAI). Computer-based learning has been developed for the beginning medical student and the experienced practitioner, for the lay person and the medical expert. In the fourth section, "Virtual Learning Environments in Healthcare and Biomedicine", examples of actual programs that are being used to support medical education for each of these categories of learners are presented.

Digital imaging still remains one of the key technologies for progress in healthcare. With further advances in processing, display, and communication of medical imaging it becomes the key to solve many problems in diagnosis and therapy. As well as computer-assisted diagnosis, computer-assisted surgery relies increasingly on some type of image management. Typical examples can be found in craniofacial surgery, neurosurgery, orthopaedic surgery of the hip and spine, plastic/reconstructive surgery, otolaryngology, and so forth. The fifth section, "Computer-Assisted Diagnosis", includes a large number of examples in the area of computer-assisted diagnosis.

The process of extracting useful information from a set of data is called "data mining". Data mining techniques have been used as a recent trend for gaining diagnostic results especially in medical fields such as kidney dialysis, skin cancer, and breast cancer detection and also biological sequence classification. Various "Data Mining and Medical Decision Making" are presented in the Section VI.

Knowledge management is a basic tool for all those who work in the health field and in hospitals. It helps sending the right information, to the right part, to the right person, at the right time, so that the right decisions can be made, depending on the existing problems. It is certain that with the help of knowledge management the effectiveness in the health field will be increased through unified systems, processes and methods, the cultivation of exchanging knowledge, and the promotion of the effective use of available information. In Section VII, basic principles and theoretical aspects of the use of knowledge management in medicine are clearly presented.

Rapidly emerging information and communication technologies (ICT) have spurred the recent escalation of various telehealth applications. It is true that there is an enormous interest in finding new ways to apply telehealth as much as telemedicine as a special part of telehealth. Section VIII, "Telemedicine and E-Health Services", has, along with providing a better understanding of what telehealth is, investigated the ways in which such an avant-garde, advancing, and newly emerging technology could be used in order to make an upper healthcare level to be available. This section aims to help someone to clarify confused terms such as telehealth and telemecine or even telecare and e-health.

The rapid progress in imaging technologies during the last decades has stimulated many developments and applications in medicine, biology, industry, aerospace, remote sensing, meteorology, oceanography, and environment. New developments are continually making the technology faster, more powerful, less invasive, and less expensive. Imaging technology was primarily used in medical diagnosis initially, but it is being increasingly used in pure neuroscience, psychological research, and in many other fields. The quantitative nature of data will be relevant to the effective diagnostic as well as therapeutic management of patients—

whatever disease they may have. In the ninth section, "Image Processing and Archiving Systems", various imaging technologies and their applications in Biomedicine are clearly presented.

In digital signal processing, numerous powerful algorithms, both linear and non-linear, have been developed during the past three decades. These have given rise to tremendous progress in speech and image processing. But digital signal processing is not restricted to communications and information processing. It also plays a leading role in such diverse fields as measurement, automatic control, robotics, medicine, biology, and geophysics to mention just the most important ones. New signal processing techniques for use in medicine are clearly presented in Section X.

Medical technology is a science discipline that has been rapidly growing over the last decades. It is characterized by a constant flow of innovations and a high level of research and development. Many technological achievements have dramatically changed the way that medicine diagnoses and treats human disease. Improved healthcare technology has presented many revolutionary medical devices that reduced mortality and morbidity. New various technologies applied in biomedicine are presented in Section XI.

As the cost of microcomputer technology continues to drop, computers are being used increasingly in medical systems and equipment such as ventilators or pacemakers, sometimes with safety-critical results. "Ergonomic and Safety Issues in Computerized Medical Equipment" are clearly presented and discussed in Section XII.

Health services research is research that seeks to improve the quality, organisation and financing of health services. Its concern extends from the care of individuals through health care organisations to national and international policies. Section XIII contains chapters related to health economics and health services research.

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