Preface

When the *artificial simulation of human thought processes with computers* was raised to the exciting new scientific and technological field of *artificial intelligence* (AI), immediate efforts were made to use any freshly obtained knowledge from this research to develop intelligent systems in various fields of medical theory and practice. Medical expert systems endowed with large quantities of explicitly formulated medical knowledge on definitional, causal, statistical, and heuristic relationships between patients' symptoms, signs, and test results and their underlying pathologies were rapidly constructed and tested in clinical settings. This was followed by expert systems that offered treatment proposals, prognostic information, and decisions regarding patient management.

Among the earliest medical expert systems for diagnostic and therapeutic decision support were CASNET, a model of causal medical connections developed in 1974, the diagnostic system INTERNIST (1975), the production rule system MYCIN (1975), and the Present Illness Program (PIP, 1976). All of these became well-known AI systems in medicine. Following Ledley's and Lusted's thoughts on the *Reasoning Foundations of Medical Diagnoses*, which were published in the prestigious journal *Science* in 1959, a computer system for assisting differential diagnosis in hepatology and rheumatology, later termed CADIAG-I (computer-assisted diagnosis, system version 1), was developed in 1968. After intensive incorporation of Zadeh's invention of fuzzy set theory (1965) and fuzzy logic (1975), the system was expanded into the subsequent CADIAG-II to -IV systems (from 1980 until the present time).

Tables, rules, decision trees, networks, and frames were the main methods to explicitly store medical knowledge in the above-mentioned systems. Given the patient's symptoms, pathological signs, laboratory test results, and any additional clinical findings, crisp or fuzzy logical inferences, probabilistic and heuristic deduction, or more ad hoc network traversing algorithms were developed to arrive at diagnostic or therapeutic conclusions.

These knowledge-based medical AI systems were later supplemented by the renewed advent of artificial neural networks providing machine learning capabilities. Explicitly formulated medical knowledge seemed no longer necessary. Only gold standard examples to adjust network parameters in a preceding training phase are used to give the system the ability to aid in making diagnostic and therapeutic decisions. Fuzzy-set- and fuzzy-logic-based approaches and genetic algorithms complemented these techniques which are now known as *soft computing* methodologies.

Today, many of these techniques are being used in medical AI systems and applied in medicine, human biology, and health care. An increasing number of medical expert systems are being offered through the World Wide Web (WWW).

These intelligent systems in medicine now clearly demonstrate that human thought processes can be artificially simulated with computers. Thus the early aims of AI are becoming reality.

This *Proceedings* contains papers presented at the Workshop on *Intelligent Systems in Patient Care* held in Vienna, Austria, October 5, 2001 under the patronage of EUNITE—The European Network on Intelligent Technologies for Smart Adaptive Systems (a project funded by the Future and Emerging Technologies Arm of the IST Programme FET K. A. Line 8.12 Networks of Excellence and Working Groups) and the Austrian Society for Artificial Intelligence (ÖGAI—Österreichische Gesellschaft für Artificial Intelligence). The event will bring together scientists and researchers from computer science, engineering, mathematics, and medical sciences. The specialists will be invited to present results achieved in the theory and application of artificial intelligence in medicine.

Thirty scientific contributions to the EUNITE-Workshop from researchers of nine countries are included in the *Proceedings.* The scientific topics presented in the *Proceedings* at hand cover issues concerning the methodological research and practical deployment of intelligent systems in patient care—be it in the hospital, the laboratory, the operating theatre, the intensive care unit, the medical practitioner's office, even the patient's home, or the healthcare industry.

The presentations are interdisciplinary in nature and may therefore be of interest to a variety of professionals: medical computer and health information scientists, biomedicine researchers and practitioners, artificial and computational intelligence researchers, fuzzy and non-fuzzy mathematicians, medical physicists and technical engineers, physicians, nurses, other health personnel, and consultants in several fields of health care.

The variety of scientific topics and countries represented in this issue will ensure both, an interesting international EUNITE-Workshop and a fruitful study of the *Proceedings* by those interested in *Intelligent Systems in Patient Care*.

I am most grateful to Andrea Rappelsberger for her careful and extensive work in the preparation of the *Proceedings* on hand. Without her help it would have been impossible to produce such a valuable and comprehensive book. The support of the Austrian Computer Society is also gratefully acknowledged.

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