Health professionals are often faced with difficult choices taking into account that sometimes clinical data can be unclear. From the early 1970s, several diagnosis systems were introduced to assist physicians in the process of medical decision making and to deal with the uncertainty. Most of these systems were focused on concrete artificial intelligence techniques related to statistics and probabilistic-like Bayesian networks, probabilistic reasoning, and so forth. Today, there are several new artificial intelligence techniques that can be fully exploited to help the research and development of clinical decision support systems oriented to diagnosis. This diagnosis process can be carried out in several ways depending on the scope that appears to be covered: from the diagnosis of very concrete pathologies to the differential diagnosis of a wide range of diseases. For this reason, the creation of systems is very important with a solid powerful definition in their diagnosis models and with enough accuracy in the system design and implementation to be used in real environments. The evaluation of this kind of systems is also an important task, because depending on its evaluation we can assure the reliability of the results that they will return.

Four papers have been selected to be published in this special issue. These four papers represent the essence of the matter on the grounds that they illustrate different points of view to face the questions that the development and evaluation of medical diagnosis systems are raising.

The first article, written by Pavel Klinov et al. makes an evaluation of a well-known medical diagnosis system: CADIAG-2. CADIAG-2 is a rule-based medical expert system aimed at providing support in diagnostic decision making in the field of internal medicine. Given the knowledge base of the system, which contains a large collection of rules representing the knowledge about information related to symptoms and diseases and the relationships between them, the objective of the evaluation of this system is not based on the accuracy of their results (that is the more classical evaluation that is normally done in this kind of systems), otherwise, given that the major portion of the rules that use CADIAG-2 are uncertain, the authors make an evaluation of the system to validate its consistency. Recent attempts to partially formalize CADIAG-2’s knowledge base into a decidable fragment of a Gödel-like logic has shown that, on that formalization, CADIAG-2 is inconsistent, and for this reason the authors want to verify this result with an alternative, more expressive formalization of CADIAG-2 as a set of probabilistic conditional statements and apply their state-of-the-art probabilistic description
logic solver (Pronto) to determine satisfiability of the knowledge based and to extract minimal conflicting set of rules.

In the second paper, by Ana Torres et al., the authors face up to the problem of the monitoring patient’s vital signs in intensive care units (ICU) and the decision making regarding the drugs that physicians have to administer to the patients because the lives of patients depends on the quality of these decisions because sometimes, mistakes are made. For this reason, this work describes the development of a knowledge based system (KBS) to provide support to clinicians with respect to the drugs they have to administer to patients with cardiopathies in ICUs to stabilize them. In order to develop the system, knowledge from medical experts at the Meixoeiro Hospital in Vigo (Spain) have been extracted and formally represented as ontology. As a result, a validated KBS has been obtained, which can be helpful to experts in ICUs and whose underlying knowledge can be easily shared and reused all around the world.

Rahul Kala et al. are the authors of the third paper, which make use of genetic algorithms to determine the optimal distribution of the parameters to the various modules of a modular neural network. They propose dividing the entire attribute set into the various modules. Each module would hence compute the output using its own list of attributes. The individual results are then integrated by an integrator. This framework is used for the diagnosis of breast cancer disease. Experimental results show that optimal distribution strategy exceeds the well known methods for the diagnosis of the disease.

Fourth paper, by Angel Lagares et al. presents DISMON (Disease Monitor), a system based on Semantic Technologies and Social Web (SW) to improve patient care for Medical Diagnosis in limited environments, namely, organizations. DISMON, combines Web 2.0 capabilities and SW in order to provide semantic descriptions of clinical symptoms, thereby facilitating diagnosis and helping to foresee the diseases, giving useful information to the company and its employees in order to increase the efficiency by means of the prevention of injuries and illnesses. All this information can lead to a safer environment for workers.

As can be seen, all the papers that make up this issue propose different ways to evaluate medical diagnosis systems. In the coming years, decision-support systems research and development will continue to be a strong trend. For that reason the evaluation of these systems is a very important tool to better understand its functionalities, design and applications in clinical settings and for solving problems and several barriers to their implementation.

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