The chapters in this book provide insight into the latest research and advances in information science (IS) and technology (IT). IS and IT have applications in nearly every field and profession, necessitating a comprehensive understanding of knowledge management tools in order to successfully navigate uncertainty in disciplines ranging from the physical sciences to entrepreneurship, education, and medicine. Serving as a scholarly compendium of emerging breakthroughs in information science research, this book will provide researchers, academics, students, and practitioners with a fresh perspective into methodologies best suited to meet their various personal and organizational goals.

Chapter 1, “The Consistency of the Medical Expert System CADIAG-2: A Probabilistic Approach” by Pavel Klinov et al. defines CADIAG-2 as a well known rule-based medical expert system aimed at providing support in medical diagnosis in the field of internal medicine. Its knowledge base consists of a large collection of IF-THEN rules that represent uncertain relationships between distinct medical entities. Given this uncertainty and the size of the system, it has been challenging to validate its consistency. Recent attempts to partially formalize CADIAG-2’s knowledge base into decidable Gödel logics have shown that, on formalization, the system is inconsistent. In this chapter, the authors use an alternative, more expressive formalization of CADIAG-2’s knowledge base as a set of probabilistic conditional statements and apply their probabilistic logic solver (Pronto) to confirm its inconsistency and compute its conflicting sets of rules under a slightly relaxed interpretation. Once this is achieved, the authors define a measure to evaluate inconsistency and discuss suitable repair strategies for CADIAG-2 and similar systems.

Next, Ana Torres Morgade et al., in “Development of a Knowledge Based System for an Intensive Care Environment Using Ontologies,” explain how clinicians in intensive care units (ICUs) must monitor patients’ vital signs and make decisions regarding the drugs they administer. The patients’ lives depend on the quality of these decisions but experts can make mistakes. Recent technological strategies and tools can decrease these errors. In this chapter, the authors describe the development of a knowledge based system (KBS) to provide support to clinicians with respect to the drugs they administer to patients with cardiopathies in ICUs to stabilize them. To develop the system, knowledge from medical experts at the Meixoeiro Hospital in Vigo (Spain) has been extracted and formally represented as an 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.

The complexity of problems has led to a shift toward the use of modular neural networks in place of traditional neural networks. The number of inputs to neural networks must be kept within manageable limits to escape from the curse of dimensionality. Attribute division is a novel concept to reduce the problem dimensionality without losing information. In “Breast Cancer Diagnosis Using Optimized At-
tribute Division in Modular Neural Networks,” Rahul Kala et al. use Genetic Algorithms to determine the optimal distribution of the parameters to the various modules of the modular neural network. The attribute set is divided into the various modules. Each module computes 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. Experimental results show that optimal distribution strategy exceeds the well-known methods for the diagnosis of the disease.

“DISMON: Using Social Web and Semantic Technologies to Monitor Diseases in Limited Environments,” by Ángel Lagaes-Lemos 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. Information technology and, more precisely the internet, represent challenges and opportunities for medicine. Technology-driven medicine has changed how practitioners perform their roles, and medical information systems have recently gained momentum as a proof-of-concept of the efficiency of new support-oriented technologies. Emerging applications combine sharing information with a social dimension. DISMON combines Web 2.0 capacities and SW to provide semantic descriptions of clinical symptoms, thereby facilitating diagnosis and helping to foresee diseases, giving useful information to the company and its employees to increase efficiency by means of the prevention of injuries and illnesses, resulting in a safety environment for workers.

In “Self-Organizing Tree Using Artificial Ants,” Hanene Azzag and Mustapha Lebbah propose a new approach for topological hierarchical tree clustering inspired from the self-assembly behavior of artificial ants. The method, called SoTree (Self-organizing Tree), builds, autonomously and simultaneously, a topological and hierarchical partitioning of data. Each cluster associated to one cell of a 2D grid is modeled by a tree. The artificial ants similarly build a tree where each ant represents a node/data. The benefit of this approach is the intuitive representation of hierarchical relations in the data. This is especially appealing in explorative data mining applications, allowing the inherent structure of the data to unfold in a highly intuitive fashion.

Inspired by evolutionary game theory, “Co-Evolutionary Algorithms Based on Mixed Strategy” by Wei Hou et al. modifies previous mixed strategy framework, adding a new mutation operator and extending to crossover operation, and proposes co-evolutionary algorithms based on mixed crossover and/or mutation strategy. The mixed mutation strategy set consists of Gaussian, Cauchy, Levy, single point, and differential mutation operators; the mixed crossover strategy set consists of cuboid, two-points, and heuristic crossover operators. The novel algorithms automatically select crossover and/or mutation operators from a given mixed strategy set, and improve the evolutionary performance by dynamically utilizing the most effective operator at different stages of evolution. The proposed algorithms are tested on a set of 21 benchmark problems. The results show that the new mixed strategies perform equally well or better than the best of the previous evolutionary methods for all of the benchmark problems. The proposed MMCGA has shown significant superiority over others.

He Jiang et al. then describe “A Hyper-Heuristic Using GRASP with Path-Relinking: A Case Study of the Nurse Rostering Problem.” The goal of hyper-heuristics is to design and choose heuristics to solve complex problems. The primary motivation behind the hyper-heuristics is to generalize the solving ability of the heuristics. In this chapter, the authors propose a Hyper-heuristic using GRASP with Path-Relinking (HyGrasPr). HyGrasPr generates heuristic sequences to produce solutions within an iterative procedure. The procedure of HyGrasPr consists of three phases, namely the construction phase, the local search phase, and the path-relinking phase. To show the performance of the HyGrasPr, the authors use the nurse rostering problem as a case study. The authors use an existing simulated annealing based hyper-heuristic
as a baseline. The experimental results indicate that HyGrasPr can achieve better solutions than SAHH within the same running time and the path-relinking phase is effective for the framework of HyGrasPr.

Most engineering optimization uses multiple objective functions rather than a single objective function. To realize an artificial life algorithm based multi-objective optimization, “Pareto Artificial Life Algorithm for Multi-Objective Optimization” by Jin-Dae Song and Bo-Suk Yang proposes a Pareto artificial life algorithm that is capable of searching Pareto set for multi-objective function solutions. The Pareto set of optimum solutions is found by applying two objective functions for the optimum design of the defined journal bearing. By comparing with the optimum solutions of a single objective function, it is confirmed that the single function optimization result is one of the specific cases of Pareto set of optimum solutions.

“An Optimization Model for the Identification of Temperature in Intelligent Building” by Zhen-Ya Zhang et al. investigates methods for the reconstruction of temperature fields in an intelligent building with temperature data of discrete observation positions. To reconstruct temperature field with observation data, it is necessary to model the identification of temperature in each observation position. In this chapter, models for temperature identification in an intelligent building are formalized as optimization problems based on observation temperature data sequence. To solve the optimization problem, a feed forward neural network is used to formalize the identification structure, and connection matrixes of the neural network are the identification parameters. With the object function for the given optimization problem as the fitness function, the training of the feed forward neural network is driven by a genetic algorithm. The experiment for the precision and stability of the proposed method is designed with real temperature data from an intelligent building.

Next, Hongwei Mo and Zhidan Xu describe their “Research of Biogeography-Based Multi-Objective Evolutionary Algorithm.” Biogeography-based optimization algorithm (BBO) is an optimization algorithm inspired by the migration of animals in nature. A new multi-objective evolutionary algorithm is proposed, which is called Biogeography-based multi-objective evolutionary algorithm (BBMOEA). The fitness assignment and the external population elitism of SPEA2 are adapted to ensure even distribution of the solution set. The population evolutionary operators of BBO are applied to the evolution of the external population to ensure the convergence of the solution set. Simulation results on benchmark test problems illustrate the effectiveness and efficiency of the proposed algorithm.

Analyzing the beneficial effects of investments in information technology (IT) is an area of research that interests investors and academics. A number of studies have examined whether investments in IT have a positive effect on some measure of earnings or other forms of financial return. Results from these studies have been mixed. “The Effects of Investments in Information Technology on Firm Performance: An Investor Perspective” by Jeffrey Wong and Kevin E. Dow extends the literature by adopting an investor’s perspective on firm performance when IT investments are made, using the preservation of capital as a performance measure. The authors examine companies that made public announcements of their investments in technology to see if they were able to mitigate losses to investors by reducing their downside risk to investors. This chapter further discusses whether different types of IT investments have different impacts on firm risk from an investor’s viewpoint. Findings suggest that IT investments impact a firm’s downside risk, and the authors offer an alternative perspective on the benefits of IT investments, particularly where no positive incremental financial results are evident.

Due to the unprecedented growth of outsourcing ICT projects by the Iranian government, a critical need exists for the proper execution and monitoring of these projects. In “Design of an Integrated Project Management Information System for Large Scale Public Projects: Iranian Case Study,” Mona Taghavi
et al. propose a Web-based project management system to improve the efficiency and effectiveness of the management processes and accelerate decision making. Based on the requirements and information flow between various units involved in the complete life-cycle of ICT project management, a functional model and system architecture with various underlying structures has been designed. The functional model contains two sub-systems: process management and information service. The proposed system structure is based on a four-layer client-server computing model. As a part of a publically available ICT system, it must be secure against cybercrime activities. This system can bring efficiency in managing the projects, improve decision making, and increase the overall management process with total accounting and management transparency. The proposed system overcomes the problems associated with a central system and traditional management processes, as is currently the case in Iran.

The next chapter, “An Aspect Oriented Component Based Archetype Driven Development,” by Rachit Mohan Garg and Deepak Dahiya, incorporates the concepts of aspects and software reuse in archetype driven architecture. The proposed work develops the software by partitioning the whole system into different independent components and aspects to facilitate component reuse. The authors illustrate the ease of modeling the components separately and emphasize concerns that the OOP paradigm has failed to address. This chapter places emphasis on designing and modeling the software rather than coding. Identification of reusable components is carried out using the hybrid methodology and aspects are identified by domain experts. Along with the components, the PIM and aspects developed are stored in separate repositories to be used in development of other software of similar requirements and basic structure.

In Chapter 14, “Software Developers in India and Norway: Professional or National Cultures?” Gheorghita Ghinea et al. investigate the professional practices of software developers from two different cultures—Norway and India. The authors examine if systematic differences exist between Norwegian and Indian software developers in their professional practice. Using Hofstede’s cultural dimensions, the authors expected to find cultural differences between the two groups of professionals. Building on a survey among software developers in the two countries, the authors have the following conclusions. Firstly, the main finding is that there are surprisingly few differences between the two groups, giving support to the view of a common professional culture. Secondly, the few differences that are observed cannot easily be explained by Hofstede’s cultural dimensions.

Next, Petros Belsis explores “Secure Electronic Healthcare Records Management in Wireless Environments.” Wireless technologies have lately been integrated in many types of environments; their development is able to provide innovative services minimizing costs and the time necessary to identify the necessary information. However medical information is very sensitive since it contains critical personal data. Security and privacy preservation are very critical parameters. Lately, innovative technologies such as software agents’ technology have been utilized to support distributed environments. Presented is an architecture that allows secure medical related information management using software agents; this work expands previous research (Belsis, Skourlas, & Gritzalis, 2011). The authors present a security oriented solution and also provide experimental evidence about the capability of the platform to operate in wireless environments with large number of users.

Currently, organizations are increasingly aware of the need to protect their computer infrastructure to maintain continuity of operations. This process involves a number of different concerns including: managing natural disasters, equipment failure, and security breaches, poor data management, inadequate design, and complex/ impractical design. The purpose of the next chapter, “Enhancing the Disaster Recovery Plan through Virtualization” by Dennis C. Guster and Olivia F. Lee, is to delineate how virtualization of hosts and cloud computing can be used to address the concerns, resulting in improved computer
infrastructure that can easily be restored following a natural disaster and which features fault tolerant hosts/components, isolates applications security attacks, is simpler in design, and is easier to manage. Further, because this technology has been out for a number of years and its capabilities have matured, an attempt has been made to describe those capabilities as well as document successful applications.

The final chapter is “The Value of Government Mandated Location-Based Services in Emergencies in Australia” by Anas Aloudat et al. The adoption of mobile technologies for emergency management has the capacity to save lives. In Australia in February 2009, the Victorian Bushfires claimed 173 lives, the worst peace-time disaster in the nation’s history. The Australian government responded swiftly to the tragedy by going to tender for mobile applications that could be used during emergencies, such as mobile alerts and location services. These applications have the ability to deliver personalized information direct to the citizen during crises, complementing traditional broadcasting mediums like television and radio. Indeed governments have a responsibility to their citizens to safeguard them against both natural and human-made hazards and today national security has grown to encapsulate such societal and economic securitization. However, some citizens and lobby groups have emphasized that such breakthrough technologies need to be deployed with caution as they are fraught with ethical considerations, including the potential for breaches in privacy, security, and trust. The other problem is that real world implementations of national emergency alerts have not always worked reliably, and their value has come into question as a result. This chapter provides a big picture view of the value of government-mandated location-based services during emergencies, and the challenges ensuing from their use.