

Preface

For most of our history the wealth of a nation was limited by the size and stamina of the work force. Today, national wealth is measured in intellectual capital. Nations possessing skillful people in such diverse areas as science, medicine, business, and engineering produce innovations that drive the nation to a higher quality of life. Artificial intelligence (AI) has been studying the science and engineering of constructing intelligent systems. It is extensively used by combining with information science and technology. To better utilize these valuable resources, artificial intelligence (AI) technology has evolved at a rapid and significantly expanding rate. Nowadays, it is difficult to imagine the development of the modern world without extensive use of the AI and information technology and their integration that are rapidly transforming the global, knowledge-based economy as well as entire societies.

Overview on Recent Advances, Issues and Challenges in AI and IIS

Most work in AI has focused on components of the overall system — such as learning, planning, knowledge representation, perception, and action. Information system/technology and intelligent knowledge management are playing an increasing role in business, science and technology. The breadth of the major application areas of intelligent, knowledge-based systems, and integrated intelligent information systems technologies is very impressive. These include, among other areas: agriculture, business, chemistry, communications, computer systems, education, electronics, engineering, environment, geology, image processing, information management, law, manufacturing, mathematics, medicine, metrology, military, mining, power systems, science, space technology, and transportation.

In recent years, with the advancement of artificial intelligence (AI) and information science and technology, there has been a resurgence of work in combining individual intelligent systems (knowledge-based systems, fuzzy logic, neural networks, genetic algorithms, case-based reasoning, machine learning and knowledge discovery, data mining algorithms, intelligent

agents, soft computing, user intelligent interfaces, etc.) into integrated intelligent systems to solve complex problems. Hybridization of different intelligent systems is an innovative approach to construct computationally intelligent systems consisting of artificial neural network, fuzzy inference systems, approximate reasoning and derivative free optimization methods such as evolutionary computation and so on. The integration of different learning and adaptation techniques, to overcome individual limitations and achieve synergetic effects through hybridization or fusion of these techniques, has contributed to a large number of new intelligent system designs. Hybrid intelligent systems are becoming a very important problem solving methodology affecting researchers and practitioners in areas ranging from science, technology, business and commerce.

Specifically, there have been many attempts to solve decision making problems (assessment or evaluation and selection) by applying neural network and (fuzzy) rule-based expert systems techniques. The capabilities of rule-based (fuzzy) expert systems are inherently well suited for decision making problems. The major drawback, however, is that the programmer is required to define the functions underlying the multi-valued or ranked possibility optimization. Furthermore, expert-type rules use a comprehensive language system that may have built-in biases, embedded goals, and hidden information structures, which may result in errors. Neural networks using mathematical relationships and mappings to design and optimize systems are capable of statistical decision-making given incomplete and uncertain information, and can be used to adapt to the user/designer's requirements. Unlike rule-based (fuzzy) expert systems, they evaluate all the conflict constraints or fusion information simultaneously, and model/learn the knowledge base using black-box techniques. They do not use rules in the formal sense so the evaluation or decision making time can be greatly reduced from that of rule-based modeling. The strengths of neural networks accrue from the fact that they need not priori assumptions of models and from their capability to infer complex, nonlinear underlying relationships. From the statisticians' point of view, neural networks are essentially statistical devices to perform inductive inference and are analogous to non-parametric, nonlinear regression models. However, existing neural schemes use two or more separate neural networks to accomplish some tasks respectively, and need to train them separately. This is tedious and costly, and sometimes very difficult. In order to overcome the suffered shortcomings or difficulties above, more research endeavors are necessary to develop more general topologies of neural models, learning algorithms and approximation theories so that those models are applicable in the system modeling and control of complex systems. A new kind of hybrid neural networks is therefore required for decision support. It must also be conceded that rule-based (fuzzy) expert systems are much easier for humans to error-check than an ensemble of continuous equations in neural networks. In view of these practical requirements and current research status and future trend of intelligent decision support, an evolutionary neuro-fuzzy network or fuzzy neural network (FNN) model has been developed for supporting computational intelligent decision making and simulation. There is now a growing need in the intelligent community that complex decision making problems require hybrid solutions.

It is well known that intelligent systems, which can provide human-like expertise such as domain knowledge, uncertain reasoning, and adaptation to a noisy and time-varying environment, are important in tackling practical computing problems. Soft computing is an emerging collection of computing methodologies to exploit tolerance for uncertainty, imprecision and partial truth to achieve useable robustness, tractability, low total cost and approximate solutions. It is particularly efficient and effective for NP-hard problems. Recently, many different

challenges posed by data mining have been solved by various soft computing methodologies. At this juncture, the principal constituents of soft computing are fuzzy logic, neuro-computing, evolutionary computing and probabilistic computing, simulating annealing, tabu search approach, swarm intelligence systems (such as particle swarm optimization, ant systems and ant colony systems) with the later subsuming belief networks, chaotic systems and parts of learning theory. Each of them contributes a revealable methodology which only in a cooperative rather than competitive manner for persuading problems in its field. Soft computing techniques facilitate the use of fuzzy logic, neuro-computing, evolutionary computing and probabilistic computing in combination, leading to the concept of hybrid intelligent systems. Such systems are rapidly growing in importance and visibility. In most cases, their purpose is not to replace the conventional techniques but to supplement and complement them so that a much wider range of situations can be adequately dealt with. Soft computing hybrid intelligent systems have a wide range of applications, such as synthetic battlefield agents for training, intelligent players and teams for computer entertainment, autonomous spacecraft, rovers, submersibles, and aerial vehicles, intelligent design and manufacturing. They can provide a unified, intelligent computational framework for human-machine system design and simulation. Systematic methodologies have also been proposed for the fusion of soft computing and hard computing. The principal research focus is on creating hybrid intelligent systems for real-world applications, and the core methodologies of soft computing are: evolutionary computation, fuzzy logic, and neural networks; with a representative collection of complementary hard computing techniques.

Petri net, coined by Professor C. A. Petri in 1962, is an important analytical and modeling tool for the discrete event dynamic systems. It has been modified, extended and analyzed in detail and possesses the potential to be integrated into an artificial intelligence (AI) framework. Petri nets not only can represent a variety of physical and synthetic process (e.g. design process, assembly process) well but also can be used for creation and development of integrated & hybrid intelligent information systems. To this connection, a new field, knowledge & intelligent Petri nets, is opened, in which the research is to investigate how to carry out knowledge /intelligent extension for Petri nets to build a unified, complete framework to represent multi-view knowledge and to perform reasoning and learning. For instance, a novel class of knowledge intensive Petri nets has been created by the editor and co-workers through combining artificial intelligence techniques with Petri nets, including knowledge Petri net, fuzzy knowledge Petri net, expert Petri net, fuzzy expert Petri net, neuro-fuzzy Petri net, and so forth. Such extended Petri net-based approach would be widely used in science, technology, business and commerce.

Reflecting the most fascinating AI-based research and its broad practical applications, integrated intelligent information system (IIIS) technologies, with the extensive use of the AI and information technology and their integration, are being utilized to advance engineering technology, increase manufacturing productivity, and improve medical care, as well as play a significant role in a very wide variety of other areas of activity with substantive significance. Integrated intelligent information systems (IIIS) are gaining better acceptance both in academia and in industry. The driving force behind this is that integrated and hybrid intelligence and distributed 3C (collaboration, cooperation, and coordination) allow the capture of human knowledge and the application of it to achieve high quality applications. Further motivation arises from steady advances in individual and hybrid intelligent-systems techniques, and the widespread availability of computing resources and communications capability through the world-wide web. However, the difficulties in distributed & integrated

information systems development are increased due to the issues of intra- and inter- enterprise network communication, system heterogeneity, and information security, different engineering data formats and database formats. Many kinds of distributed information systems have been designed and implemented to address those difficulties in DIS development, which can provide an “information pipeline” that supports the sharing of information, specifically, in the context of collaborative/cooperative engineering. These systems are based heavily on industry standards (e.g., STEP, Standard for the exchange of product model data, officially ISO 10303) to provide an open and evolvable environment that can flow with, as well as contribute to, commercial best practices and trends.

The need for an infrastructure based upon distributed computing, information and communication technology (i.e., a cyber-infrastructure) becomes increasing paramount as we progress closer to a knowledge economy. A recent report of US National Science Foundation (NSF) indicates that such a cyber-infrastructure (CI) will play a pivotal role in supporting system design and realization. Factors in achieving seamless networks are: (1) connectivity, bandwidth for large scale data and information transfer; (2) reach, the ability to access and provide right information that is distributed across the networked enterprise; (3) interactivity, the ability to interact with people, computational tools and physical tools across time and space. Any cyber-infrastructure has to support along all these three aspects. Technical challenges in cyber-infrastructure for collaborative engineering applications (design and manufacturing) are (Ram Sriram at 2005 NSF EXCITED Workshop): (1) knowledge management, shared information and knowledge; (2) repositories, capture and reuse; (3) immersive environments; (4) standards; (5) constraint management; (6) negotiation tools and techniques; (7) database organization and access; (8) design and manufacturing supply chains; (9) remote monitoring and sharing; (10) security. An information repository/shared information system (IR/SIS), as an integrative information-sharing infrastructure, is crucial for information sharing, exchange and re-use in three dimensions: technology, functionality and information needs. This can be accomplished by addressing the following issues and challenges:

1. **Information needs.** Investigating the requirements for the shared information and classifying the information into two levels: full access and limited access. (1) Full access: Authorized partners have full access privilege to the specific information; (2) Limited access: Authorized partners can partially access to the specific information.
2. **Technological issues.** Investigating the information-sharing interface based on industry standards (STEP) and Extensible Markup Language (XML), web services for solutions to technological issues. (1) Multi-user interface: Partners perform diverse tasks, multiple information views need to be built from the same data storage and the same information storage may be updated from different partner views; (2) Heterogeneity: IR/SIS is constructed from a variety of different networks, operating systems, computer hardware, and programming languages; (3) Openness: IR/SIS is formed dynamically and allows arbitrary partner to communicate with another partner; (4) Security: IR/SIS is required to provide secure communication, against disclosure to unauthorized individuals and against un expected interference; (5) Concurrency control: The operation in IR/SIS is synchronized that its data remains consistent with multiple access from partners.

3. **Functionalities.** Investigating object-oriented database management system, universal description, discovery and integration (UDDI) for web services solutions to functionality requirements. (1) Distribution: application and data are spread out over more than one computer; (2) Storage: a repository is needed to keep and organize data in an organized way; (3) Sharing: A sharing mechanism (e.g., ontology) is required to facilitate interoperability between different partners; (4) Tracking: IR/SIS can document the up-to-date changes and provide disciplined backtracking capability.
4. **Modeling shared information space (SIS).** Developing SIS models and ontologies with Unified Model Language (UML/SysML), resource description framework (RDF), and Web Ontology Language (OWL).

The importance of integrating knowledge engineering (KE) practices into domains has been acknowledged by a number of researchers. Earlier studies focused on integrating reasoning mechanisms in domain specific support systems, mainly as diagnostic tools. Gradually, the research focus has shifted from the reasoning mechanism to the knowledge base. Recent studies focus on system and/or task structures, unified data and knowledge modeling and representation (e.g., UML/SysML), data management, standards, etc., concentrating on how these are integrated. Latest research indicates a trend towards semantic data and knowledge modeling for better interoperability. However, although these studies address the use of KE practices in the domains and some of them followed a uniform approach towards the development of knowledge bases, few of them can provide ontology-based knowledge management and reasoning services. As a result, a major limitation of the previous work is the lack of reusability and interoperability for common services. This challenge could be addressed if knowledge modeling were unified, formalized and enriched by employing ontological principles and semantics. Ontology and ontology-based computational services will be able to provide new kinds of knowledge management and reasoning services that facilitate the sharing and reuse of data and knowledge across various phases of system development. The current research focus is in developing formal ontologies with emerging semantic methods such as Process Specification Language (PSL), Web Ontology Language (OWL) and resource description framework (RDF), in support of these integration scenarios. This work will advance the research on ontology-based knowledge service, and is a step towards formalizing support system as a knowledge intensive system.

Topics and related issues of artificial intelligence, soft computing, and integrated intelligent information systems include but are not limited to the following:

1. Foundations and principles of data, information, and knowledge models
2. Methodologies for IIIS analysis, design, implementation, validation, maintenance and evolution
3. User models, intelligent and cooperative query languages and interfaces
4. Knowledge representation and ontologies, integration, fusion, interchange and evolution
5. Intelligent databases, object-oriented, extended-relational, logic-based, active databases, and constraint management
6. Intelligent information retrieval, digital libraries, and networked information retrieval

7. Distributed multimedia and hypermedia information space design, implementation and navigation
8. Visual interfaces, visual query languages, and visual expressiveness of IIIS
9. Machine learning, knowledge discovery, and data mining
10. Soft computing (including neural nets, fuzzy logic, evolutionary computing, probabilistic reasoning, and rough set theory) and hybrid intelligent systems
11. Uncertainty management and reasoning under uncertainty
12. Intelligent integration of information, information and knowledge repository
13. Distributed intelligent information systems, cooperative information systems, agent architectures and systems (including multi-agent scenarios)
14. Information and knowledge grid, grid computing, grid services for distributed systems integration
15. Ubiquitous computing, ambient intelligence, heterogeneous intelligent information systems interoperability
16. Industrial informatics, i.e., applications and case studies in novel applications, e.g., scientific databases, e-commerce, e-logistics, engineering design and manufacturing, product life cycle management and knowledge management, healthcare, education, etc.

The Overall Objective of the Book

There is a need for an edited collection of articles to reflect emerging intelligent technologies and their applications in areas: business, engineering, health care, management, and science, etc. The great breadth and expanding significance of AI and integrated intelligent information systems (IIIS) fields on the international scene require a major reference work for an adequately substantive treatment of the subject. This book aims to collect the relevant original works on the emerging technologies of artificial intelligence and integrated intelligent information systems and their applications in those areas above. The goal is to take a snapshot of the progress in the research and to disseminate recent developments and applications in different domains. The book provides relevant theoretical foundations, methodologies, frameworks and latest research findings in the areas for professionals who want to improve their understanding of the strategic role of artificial intelligence (AI) and integrated intelligent information systems (IIIS) at different levels of the information, knowledge and intelligence society, that is, trusts at the levels of the global economy, of networks and organizations, of teams and work groups, of information systems and, finally, of individuals as actors in the integrated (networked) environments. It brings together leading authoritative authors to address arguably most pressing challenge in the field-how to create and develop integrated intelligent information systems to serve our future needs.

The Organization of the Book

The focus of this book is on the integrated & hybrid intelligent methodologies, techniques, frameworks and systems. The chapters provide an integrated, holistic perspective on this complex set of challenges, combined with practice experiences of leading figures in industry. Some of the chapters provide rigorous research results, while others are in-depth reports from the field. All chapters are rigorously reviewed and carefully edited. There is a logical flow through this book, starting with emerging intelligent systems and soft computing then continuing hybrid intelligent systems and innovative computing, information and control followed by modeling and development of intelligent information systems and their applications for product design and development. The treatment of the subject in the book can be described as:

1. Examines emerging technologies and recent research results on AI and integrated intelligent information systems (IIS), including integrated intelligent systems, hybrid intelligent systems, soft computing, distributed artificial intelligence (DAI), computer-integrated information systems (CIIS), intelligent computer-aided development systems, etc.
2. Presents theoretical fundamentals and implementation technology, as well as industrial applications.
3. Introduces new knowledge-intensive problem-solving strategies and their implementations based on AI and integrated and hybrid intelligent systems techniques.
4. Explores a few applications and case studies, including electro-mechanical systems, systems design, robot controller design, process control system, embedded and mechatronic systems design.

This book consists of the following distinctly titled and well integrated chapters. The contents of the book are organized into five parts consisting of 20 chapters. Each part has 4 chapters. A brief description of each of the chapters is provided.

Section I

Section I, *Emerging Intelligent Technologies and Applications*, addresses several emerging intelligent systems (such as agent-based ambient intelligence, parallelized ant colony algorithm, immunization systems, and knowledge grid-based approach) and their applications. The basic question is how accumulated data and expertise from business or medical operations can be abstracted into useful knowledge, and how such knowledge can be applied to on-going operations or services. The wide range of areas represented includes traveling salesman problem, human modeling, health care, data fusion and decision making.

Chapter I describes an agent-based ambient intelligence architecture able to deliver services on the basis of physical and emotional user status captured from a set of biometric features. Abstract representation and management is achieved thanks to two markup languages,

H2ML and FML, able to model behavioral as well as fuzzy control activities and to exploit distribution and concurrent computation in order to gain real-time performances.

Chapter II presents the work that parallelizes the ant colony systems and introduces the communication strategies so as to reduce the computation time and reach better solution for traveling salesman problem. The chapter also discusses a data clustering process using the constrained ant colony optimization (CACO). The CACO algorithm can resolve the problems of clusters with arbitrary shapes, clusters with outliers and bridges between clusters.

Chapter III reports the problem of spreading the normal state (rather than spreading of the abnormal state) that is formalized as cleaning a contaminated network by mutual copying. Repairing by copying is the “double edged sword” that could spread contamination when properly used. The chapter also introduces a framework for controlling copying involving a spatial prisoner’s dilemma.

Chapter IV describes a grid-based method for data fusion with interactions among decision makers. This method takes advantages of observation of other decision makers’ opinions and then modifies the result. The method simulates the process of human decision making. It involves decision making, decision fusion, discussion, and remaking, refuse. It can improve the reliability and flexibility of the fusion system.

Section II

Section II, *Hybrid Intelligent Systems and Applications*, explores hybrid intelligent systems of neural networks, fuzzy theory, and genetic algorithms and their applications in such areas as hierarchical fuzzy logic systems, text mining, classification system, and process control.

Chapter V presents an investigation into the design and development of a hierarchical fuzzy logic system. A new method using genetic algorithms for design of hierarchical fuzzy logic systems is proposed. This research study is unique in the way applied to design and development of hierarchical fuzzy logic systems. The proposed method is then applied to financial modeling and prediction. A hierarchical fuzzy logic system is developed to predict quarterly interest rates in Australia.

Chapter VI introduces a novel evolutionary model for intelligent text mining. The model deals with issues concerning shallow text representation and processing for mining purposes in an integrated way, and aims to look for interesting explanatory knowledge across text documents. The approach uses Natural-Language technology and genetic algorithms to produce explanatory novel hidden patterns. The proposed approach involves a mixture of different techniques from evolutionary computation and other kinds of text mining methods. Accordingly, new kinds of genetic operations suitable for text mining are proposed.

Chapter VII proposes a probabilistic learning technique, known as gated mixture of experts (MEs), made more adaptive by employing a customized genetic algorithm based on the concepts of hierarchical mixed encoding and hybrid training. The chapter outlines the main steps behind such novel hybrid intelligent system, focusing on its application to the nontrivial task of nonlinear time-series forecasting. Experiment results are reported with respect to three benchmarking time-series problems, and confirmed our expectation that the new integrated approach is capable to outperform, both in terms of accuracy and generalization, other conventional approaches, such as single neural networks and non-adaptive, handcrafted gated MEs.

Chapter VIII presents the applications of artificial intelligence (AI) in the process control of electro chemical discharge machining (ECDM). The aim of the study is to investigate the most suitable pulse classification architecture which provides the better classification accuracy with the minimum calculation time. A neural network pulse classification system (NNPCS), a fuzzy logic pulse classification system (FLPCS) and a neuro fuzzy pulse classification system (NFPCS) were developed for the pulse classification of the ECDM process. The NNPCS was selected as the most suitable pulse classification system for the ECDM process control system.

Section III

Section III, *Innovative Intelligent Computing, Information Processing and Control*, addresses the important question of how hybrid intelligent systems are applied in computing, information processing and control. Case studies examine a wide variety of application areas including vision-based intelligent systems, robot control, surveillance systems, sensor network design, and face detection and recognition.

Chapter IX describes a novel system that can track and recognize faces in real time using neural networks and genetic algorithms. The main feature of this system is a 3D facemask that combined with a neural network based face detector and adaptive template matching using genetic algorithms, is capable of detecting and recognizing faces in real time. Neural network learning and template matching enable size and pose invariant face detection and recognition while the genetic algorithm optimizes the searching algorithms enabling real time usage of the system.

Chapter X addresses the problem of combining color and geometric invariants for object description by proposing a novel colored invariant local feature descriptor. The proposed approach uses scale-space theory to detect the most geometrically robust features in a physical-based color invariant space. Building a geometrical invariant feature descriptor in a color invariant space grants the built descriptor the stability to both geometric and color variations. The proposed approach is applicable in any vision-based intelligent system that requires object recognition/retrieval.

Chapter XI discusses the need for automated detection and tracking for visual surveillance systems and proposes a solution using the capabilities of sensors network and the intelligence of multi-agent systems. This chapter introduces object detection and tracking system based on the multi-agent approach. Object detection is performed by means of the background subtraction techniques. After detection, a multi-agent tracking system tracks and follows the movement of each detected object. The proposed approach uses two types of agents: region agents and object agents. The region agents function as an arbiter between object agents. Object agents are responsible for keeping records of each detected object.

Chapter XII discusses probabilistic neural network (PNN) learning from information rich voice commands for controlling a robot. First, new concepts of fuzzy coach-player system and sub-coach for robot control with natural language commands are proposed. Then, the characteristics of subjective human decision making process and learning from such decisions are discussed. Finally, an experiment conducted with a PA-10 redundant manipulator in order to establish the proposed concept is described.

Section IV

Section IV, *Modeling and Development of Intelligent Information Systems*, considers application areas as modeling of mobile agent systems using a multi-level Petri net formalisms, formal approach for the modeling and verification of intelligent information systems using colored Petri nets, artificial intelligence approach to improve the efficiency of design pattern selection in developing object-oriented software, and the development of intelligent remote monitoring and maintenance systems.

Chapter XIII deals with the modeling of mobile agent systems evolving within structured environments using a multi-level Petri net based formalism, called n-LNS. In a n-LNS model the tokens of a net can be symbols or other nets allowing representing the behavior of mobile entities. The chapter introduces the formal definition of n-LNS and its application to the modeling of various kinds of discrete event systems, namely batch manufacturing systems, mobile robot communities, urban traffic micro-simulation, and software agents for e-commerce.

Chapter XIV presents an artificial intelligence approach to improve the efficiency of design pattern selection used in the development of object-oriented software. A prototype expert system was developed in order to automate this process of selecting suitable patterns to be applied to the design problem under consideration. The prototype system also provides the capabilities to browse patterns, view the relationship between patterns, and generate code based on the pattern selected. The routine application of such a system is viewed as a means to improve the productivity of software development by increasing the use of accepted design patterns.

Chapter XV presents a formal agent based approach for the modeling and verification of intelligent information systems using colored Petri nets. The use of a formal method allows analysis techniques such as automatic simulation and verification, increasing the confidence on the system behavior. The agent based modeling allows separating distribution, integration and intelligent features of the system, improving model reuse, flexibility and maintenance.

Chapter XVI presents methodologies and techniques for the development of an Internet server controller based intelligent remote monitoring and maintenance system. The discussion also involves on how to develop products and manufacturing systems using Internet-based intelligent technologies and how to ensure product quality, coordinate activities, reduce costs and change maintenance practice from the breakdown reaction to prevention. A hybrid intelligent approach using hardware and software agents (watchdog agent) is adopted. The server controller is web-enabled and its core is an embedded network model. The software agent is implemented through a package of smart prognostics algorithms.

Section V

Section V, *Integrated Intelligent Product Design and Development*, discusses applications of IIIS in product design and development, such areas intelligent design, feature-based semantic modeling, distributed CAD, new product innovation and development, intelligent knowledge management, and recommendation service in e-commerce.

Chapter XVII proposes a novel integrated intelligent framework for virtual engineering design and development based on the soft computing and hybrid intelligent techniques. An evolutionary neuro-fuzzy (EFNN) model is developed and used for supporting modeling, analysis and evaluation, and optimization tasks in the design process, which combines fuzzy logic with neural networks and genetic algorithms. The developed system HIDS-EFNN provides a unified integrated intelligent environment for virtual engineering design and simulation. The focus of this chapter is to present a hybrid intelligent approach with evolutionary neuro-fuzzy modeling and its applications in virtual product design, customization and simulation (product performance prediction).

Chapter XVIII presents a new feature-based modeling mechanism, document-driven design, to enable batch mode geometry construction for distributed CAD systems. A semantic feature model is developed to represent informative and communicative design intent. Feature semantics is explicitly captured as trinary relation, which provides good extensibility and prevents semantics loss. Data interoperability between domains is enhanced by schema mapping and multi-resolution semantics.

Chapter XIX proposes a design process for deploying intelligent recommendation services in existing e-markets, in order to reduce the complexity of such kind of software development. To demonstrate the applicability of this approach, the proposed process is applied for the integration of a wine recommendation service in a Greek e-market with agricultural products.

Chapter XX provides an analytical tool to assist organizations in their implementations of intelligent knowledge management systems (IKMS) along the new product development (NPD) process. The proposed framework outlines the technological and organizational path that organizations have to follow to integrate and manage knowledge effectively along their new product development processes. The framework is illustrated through an analysis of several case studies.

There are over 48 coauthors of this notable work and they come from 19 countries. The chapters are clearly written, self-contained, readable and comprehensive with helpful guides including introduction, summary, extensive figures and examples and future trends in the domain with comprehensive reference lists.

The discussions in these parts and chapters provide a wealth of practical ideas intended to foster innovation in thought and consequently, in the further development of technology. Together, they comprise a significant and uniquely comprehensive reference source for research workers, practitioners, computer scientists, academics, students, and others on the international scene for years to come.

The Target Audience

The contributors to this book clearly reveal the effectiveness and great significance of the AI and IIS techniques and, with further development, the essential role that they will play in the future. Professionals and researchers working in the field of artificial intelligence, intelligent systems, information and knowledge management, in various disciplines, e.g., information and communication sciences, administrative sciences and management, education, computer science, information technology, engineering design, product development.

Moreover, the book provides insights and support executives concerned with the management of expertise, knowledge, information and organizational development in different types of work communities and environments. I hope that practitioners, research workers, students, computer scientists, and others on the international scene will find this volume to be unique and significant reference source for years to come.

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