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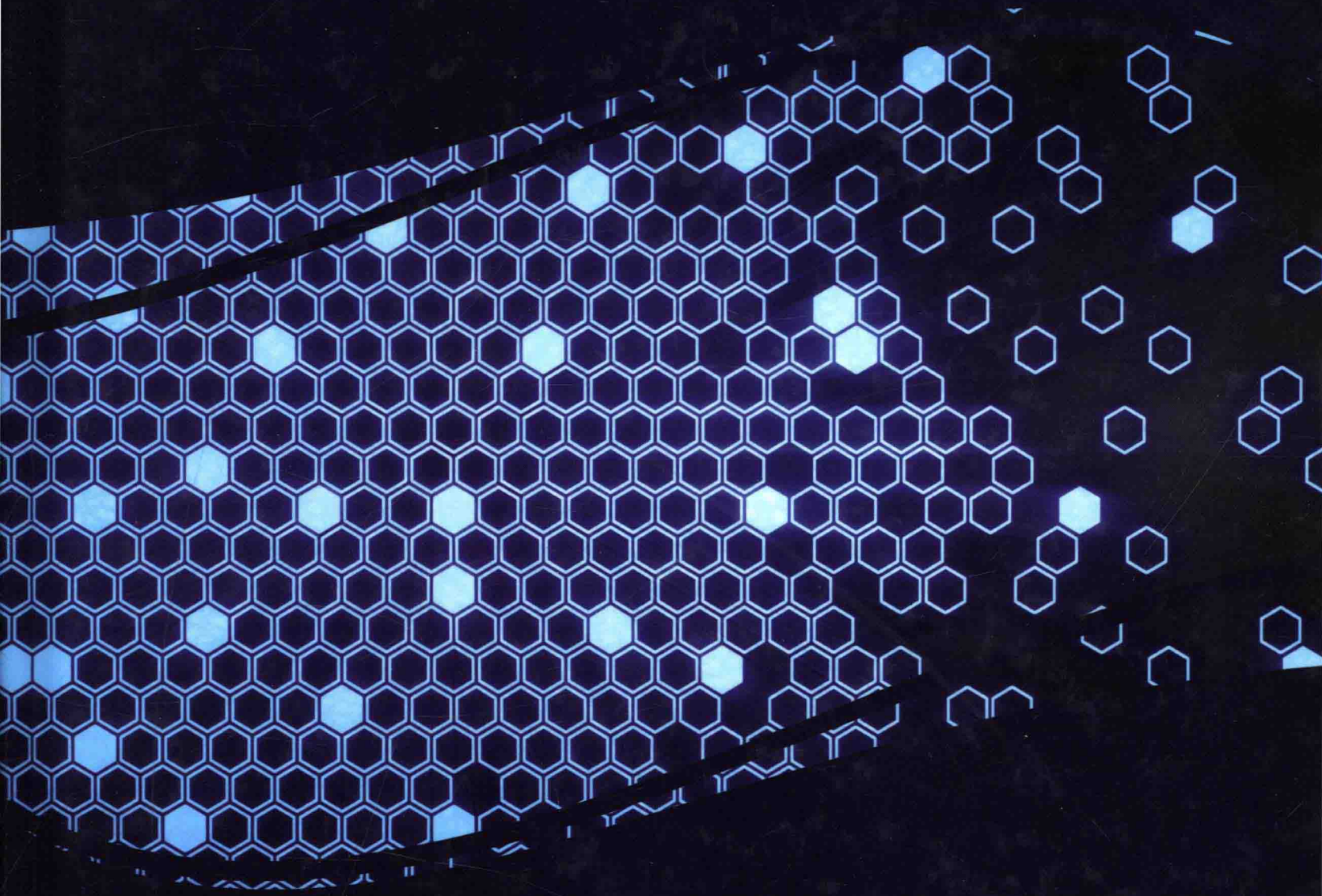
Nature-Inspired Computing

Concepts, Methodologies, Tools, and Applications



Information Resources Management Association

IGI GLOBAL
DISSEMINATOR OF KNOWLEDGE

Volume II

Nature-Inspired Computing

Concepts, Methodologies, Tools, and Applications

As technology continues to become more sophisticated, mimicking natural processes and phenomena also becomes more of a reality. Continued research in the field of natural computing enables an understanding of the world around us, in addition to opportunities for man-made computing to mirror the natural processes and systems that have existed for centuries.

Nature-Inspired Computing: Concepts, Methodologies, Tools, and Applications takes an interdisciplinary approach to the topic of natural computing, including emerging technologies being developed for the purpose of simulating natural phenomena, applications across industries, and the future outlook of biologically and nature-inspired technologies. Emphasizing critical research in a comprehensive multi-volume set, this publication is designed for use by IT professionals, researchers, and graduate students studying intelligent computing.

Topics Covered:

- Artificial Life
- Evolutionary Algorithms
- Genetic Algorithms
- Molecular Computing
- Neural Networks
- Quantum Computing
- Swarm Intelligence

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Preface

The constantly changing landscape of Nature-Inspired Computing makes it challenging for experts and practitioners to stay informed of the field's most up-to-date research. That is why Information Science Reference is pleased to offer this three-volume reference collection that will empower students, researchers, and academicians with a strong understanding of critical issues within Nature-Inspired Computing by providing both broad and detailed perspectives on cutting-edge theories and developments. This reference is designed to act as a single reference source on conceptual, methodological, technical, and managerial issues, as well as provide insight into emerging trends and future opportunities within the discipline.

Nature-Inspired Computing: Concepts, Methodologies, Tools and Applications is organized into six distinct sections that provide comprehensive coverage of important topics. The sections are:

1. Fundamental Concepts and Theories;
2. Development and Design Methodologies;
3. Tools and Technologies;
4. Utilization and Application;
5. Issues and Challenges; and
6. Emerging Trends.

The following paragraphs provide a summary of what to expect from this invaluable reference tool.

Section 1, "Fundamental Concepts and Theories," serves as a foundation for this extensive reference tool by addressing crucial theories essential to the understanding of Nature-Inspired Computing. Introducing the book is *A Theoretical Framework for Parallel Implementation of Deep Higher Order Neural Networks* by Shuxiang Xu and Yunling Liu; a great foundation laying the groundwork for the basic concepts and theories that will be discussed throughout the rest of the book. Section 1 concludes, and leads into the following portion of the book with a nice segue chapter, *On Mutual Relations amongst Evolutionary Algorithm Dynamics and Its Hidden Complex Network Structures: An Overview and Recent Advances* by Ivan Zelinka.

Section 2, "Development and Design Methodologies," presents in-depth coverage of the conceptual design and architecture of Nature-Inspired Computing. Opening the section is *Artificial Higher Order Neural Network Models* by Ming Zhang. Through case studies, this section lays excellent groundwork for later sections that will get into present and future applications for Nature-Inspired Computing. The section concludes with an excellent work by Niccolò Gordini, titled *Genetic Algorithms for Small Enterprises Default Prediction: Empirical Evidence from Italy*.

Section 3, "Tools and Technologies," presents extensive coverage of the various tools and technologies used in the implementation of Nature-Inspired Computing. Section 3 begins where Section 2 left off,

though this section describes more concrete tools at place in the modeling, planning, and applications of Nature-Inspired Computing. The first chapter, *Quantum Computing Based Technique for Cancer Disease Detection System* by Setu Kumar Chaturvedi and Milan Jain, lays a framework for the types of works that can be found in this section. The section concludes with *Navigation Control of a Mobile Robot under Time Constraint using Genetic Algorithms, CSP Techniques, and Fuzzy Logic* by Tlijani Hayet, Tlijani Hatem, and Knani Jilani. Where Section 3 described specific tools and technologies at the disposal of practitioners, Section 4 describes the use and applications of the tools and frameworks discussed in previous sections.

Section 4, "Utilization and Application," describes how the broad range of Nature-Inspired Computing efforts has been utilized and offers insight on and important lessons for their applications and impact. The first chapter in the section is titled *A Survey on Swarm Robotics* written by Ying Tan. This section includes the widest range of topics because it describes case studies, research, methodologies, frameworks, architectures, theory, analysis, and guides for implementation. The breadth of topics covered in the chapter is also reflected in the diversity of its authors, from countries all over the globe. The section concludes with *Application of Genetic Algorithm and Back Propagation Neural Network for Effective Personalize Web Search-Based on Clustered Query Sessions* by Suruchi Chawla, a great transition chapter into the next section.

Section 5, "Critical Issues," presents coverage of academic and research perspectives on Nature-Inspired Computing tools and applications. The section begins with *Role of Consumer Engagement and Swarm Intelligence in Management of a Brand at Social Media* by Rajshree Singh. Chapters in this section will look into theoretical approaches and offer alternatives to crucial questions on the subject of Nature-Inspired Computing. The section concludes with *Determination of Bearing Capacity of Shallow Foundation Using Soft Computing* by Jagan J., Swaptik Chowdhury, Pratik Goyal, Pijush Samui, and Yıldırım Dalkiliç.

Section 6, "Emerging Trends," highlights areas for future research within the field of Nature-Inspired Computing, opening with *Green Computing and Its Impact* by Shailendra Singh and Sunita Gond. This section contains chapters that look at what might happen in the coming years that can extend the already staggering amount of applications for Nature-Inspired Computing. The final chapter of the book looks at an emerging field within Nature-Inspired Computing, in the excellent contribution, *Improving Performance of Higher Order Neural Network using Artificial Chemical Reaction Optimization: A Case Study on Stock Market Forecasting* by Sarat Chandra Nayak, Bijan Bihari Misra, and Himansu Sekhar Behera.

Although the primary organization of the contents in this multi-volume work is based on its six sections, offering a progression of coverage of the important concepts, methodologies, technologies, applications, social issues, and emerging trends, the reader can also identify specific contents by utilizing the extensive indexing system listed at the end of each volume. As a comprehensive collection of research on the latest findings related to using technology to providing various services, *Nature-Inspired Computing: Concepts, Methodologies, Tools and Applications*, provides researchers, administrators and all audiences with a complete understanding of the development of applications and concepts in Nature-Inspired Computing. Given the vast number of issues concerning usage, failure, success, policies, strategies, and applications of Nature-Inspired Computing in countries around the world, *Nature-Inspired Computing: Concepts, Methodologies, Tools and Applications* addresses the demand for a resource that encompasses the most pertinent research in technologies being employed to globally bolster the knowledge and applications of Nature-Inspired Computing.

List of Contributors

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Section 2
Development and Design Methodologies

This section provides in-depth coverage of conceptual architecture frameworks to provide the reader with a comprehensive understanding of the emerging developments within the field of Nature-Inspired Computing. Research fundamentals imperative to the understanding of developmental processes within Nature-Inspired Computing are offered. From broad examinations to specific discussions on methodology, the research found within this section spans the discipline while offering detailed, specific discussions. From basic designs to abstract development, these chapters serve to expand the reaches of development and design technologies within the Nature-Inspired Computing community. This section includes 12 contributions from researchers throughout the world on the topic of Nature-Inspired Computing.

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Section 3
Tools and Technologies

This section presents an extensive coverage of various tools and technologies available in the field of Nature-Inspired Computing that practitioners and academicians alike can utilize to develop different techniques. These chapters enlighten readers about fundamental research on the many tools facilitating the burgeoning field of Nature-Inspired Computing. It is through these rigorously researched chapters that the reader is provided with countless examples of the up-and-coming tools and technologies emerging from the field of Nature-Inspired Computing. With 12 chapters, this section offers a broad treatment of some of the many tools and technologies within the Nature-Inspired Computing field.