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Computational Intelligence

Editors:
Sushil Chandra Dimri, Graphic Era (Deemed to be) University, Dehradun, India.
Lata Nautiyal, University of Roehampton, London
Akshay Kumar, Graphic Era Hill University, India
Richa Indu, Himalayan Institute of Technology, Asthal Campus, Dehradun, India

This book presents key computational intelligence approaches applied across diverse areas of computer science, demonstrating their effectiveness in solving real-world problems. It highlights how nature-inspired methods are shaping the future of intelligent systems and offering powerful, efficient, and elegant solutions to complex challenges.

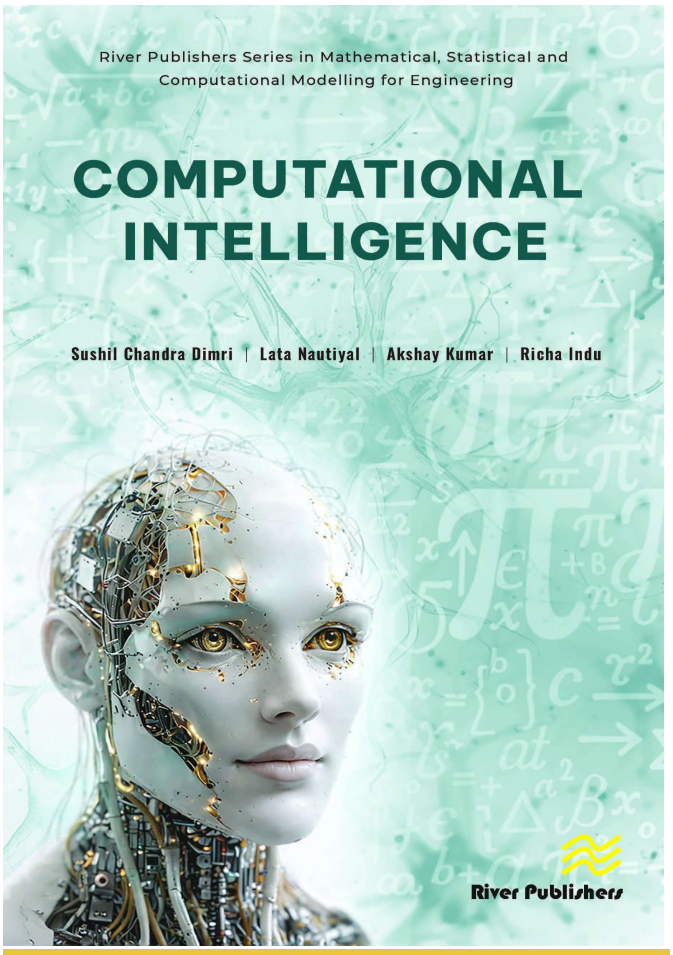
Computational intelligence (CI) extends far beyond the optimization of complex computations. It provides robust, generic, and adaptable mechanisms for addressing challenging problems across science and technology where traditional mathematical reasoning encounters uncertainty, nonlinearity, and complexity.

In computer science, CI strongly influences algorithm design, system architectures, and optimization schemes. Unlike classical artificial intelligence, which is largely rule- and logic-based, computational intelligence relies on nature-inspired methodologies that model learning, adaptation, and evolution.

Traditionally, CI has been built upon three foundational paradigms: Neural networks, fuzzy systems, and evolutionary computation. Neural networks emulate the structure and learning behavior of the human brain; fuzzy systems incorporate linguistic reasoning to manage uncertainty and imprecise data; and evolutionary computation draws inspiration from biological evolution, incorporating mechanisms such as selection, mutation, and reproduction.

Today, CI has expanded to include machine learning methods, swarm intelligence, support vector machines, and chaotic systems. These techniques enable faster, more accurate, and less complex decision-making across a wide range of computational problems.
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