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Applications of Computational Intelligence

[Intelligent Systems: Emerging Trends and Challenges in Deep Neuro-Fuzzy Models and Explainable Artificial Intelligence](#) • Book Chapter • 2026 • DOI: 10.1201/9781003540298-6 

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Abstract

The chapter Applications of Computational Intelligence examines how Computational Intelligence (CI) techniques emulate human reasoning and decision-making to address complex, real-world challenges. Techniques like Neural Networks, Fuzzy Logic, and Genetic Algorithms provide adaptive, data-driven solutions for optimizing processes, fault detection, and predictive maintenance. These methods enable systems to detect anomalies, isolate faults, and make informed decisions, enhancing efficiency and reliability in diverse domains. CI applications are transformative across industries. In manufacturing, CI optimizes production, ensures quality control, and enables predictive maintenance, reducing costs and improving productivity. The aerospace sector relies on CI for fault diagnosis, route optimization, and autonomous systems, enhancing safety and operational efficiency. In finance, CI powers fraud detection, algorithmic trading, and credit risk assessment, while in healthcare, it improves diagnostics, personalized medicine, and medical imaging, revolutionizing patient care. Despite significant progress, CI faces challenges such as high computational demands, limited model interpretability, and dependence on high-quality data. Addressing these requires enhancing transparency, integrating CI with emerging technologies like IoT and quantum computing, and tackling ethical concerns like bias and data privacy. This chapter underscores the vast potential of CI to drive innovation, improve system reliability, and address critical challenges across industries. © 2026 selection and editorial matter, Siddhartha Roy, Soumya Sen, and Agostino Cortesi; individual chapters, the contributors.

Indexed keywords

Engineering controlled terms

Computer privacy; Data privacy; Decision making; Diagnosis; Efficiency; Ethical technology; Fault detection; Medical imaging; Personalized medicine; Predictive maintenance; Reliability

Engineering uncontrolled terms

Computational intelligence techniques; Data driven; Decisions makings; Fuzzy - genetic algorithms; Fuzzy logic algorithms; Human decisions; Human reasoning; Neural-networks; Predictive maintenance; Real-world

Engineering main heading

Artificial intelligence

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Abstract

Indexed keywords

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