Chapter 11
Security and Privacy of Educational Computational Intelligence

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ABSTRACT

In today's technological era, educators need to safeguard the security and privacy of their data by employing Computational Intelligence (CI). CI is an aspect of Artificial Intelligence (AI) that concentrates on developing algorithms and systems capable of solving tough societal problems. Several methodologies informed by biological systems and natural events used in CI include Artificial Neural Networks (ANN), fuzzy systems, evolutionary computation, and swarm intelligence. Therefore, CI systems learn and adapt over time, improving performance through experience and interaction with their environment. This versatility and durability render CI valuable for various applications, including data analysis, pattern identification, control systems, and decision-making processes. Confidentiality is critical for securing sensitive information. CI uses sophisticated computational techniques to improve learning experiences, instructional practices, and educational outcomes.
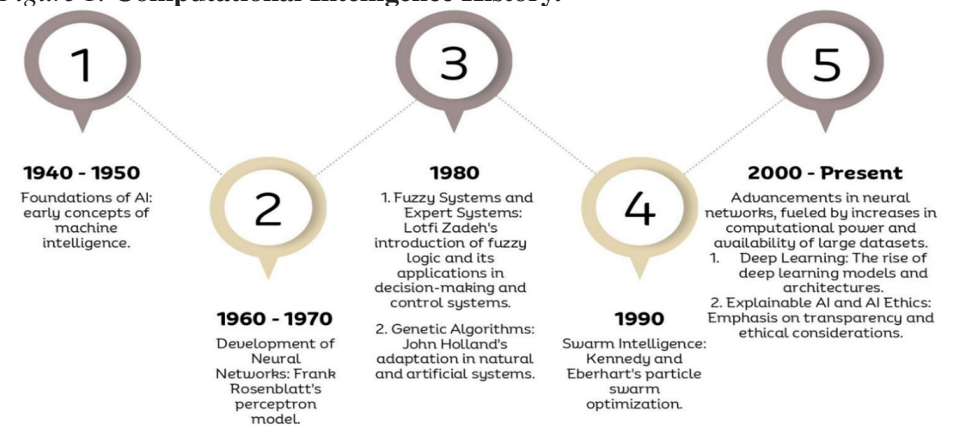
1. INTRODUCTION

CI is a subclass of AI where algorithms have been devised to imitate human information processing and reasoning mechanisms for processing complex and uncertain data sources. CI techniques form a set of nature-inspired computational methodologies and techniques developed to address complex real-world data-driven issues for which mathematical and traditional modeling cannot work due to processes' high complexity, uncertainty, and stochastic nature. Fuzzy Logic (FL) and Artificial Neural Networks (ANN) form the core CI approaches developed to handle this growing class of real-world problems (Iqbal et al., 2020).

1.1 Computational Intelligence History

CI refers to a collection of techniques employed to imitate human thinking—the power to deal with complex problems of the real world (Kumar, Jain, & Singh, 2021). CI continues to evolve, driven by advances in machine learning (ML), data availability, and computational power. Its interdisciplinary nature and ability to solve complex problems make it a critical area of research and application across various domains. Figure 1 illustrates the history of CI from 1940 to the present.

Figure 1. **Computational Intelligence History.**

1940 - 1950
Foundations of AI: early concepts of machine intelligence.

1960 - 1970
Development of Neural Networks: Frank Rosenblatt's perceptron model.

1980
1. Fuzzy Systems and Expert Systems: Lotfi Zadeh's introduction of fuzzy logic and its applications in decision-making and control systems.

2. Genetic Algorithms: John Holland's adaptation in natural and artificial systems.

1990
Swarm Intelligence: Kennedy and Eberhart's particle swarm optimization.

2000 - Present
Advancements in neural networks, fueled by increases in computational power and availability of large datasets.
1. Deep Learning: The rise of deep learning models and architectures.
2. Explainable AI and AI Ethics: Emphasis on transparency and ethical considerations.

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