Chapter 3
Computational Intelligence Foundations and Principles

Murugan Sethuraman Sethuraman
Wolkite University Ethiopia, India

ABSTRACT

AI has been defined in different ways, including the abilities for abstract thought, understanding, communication, reasoning, learning, retaining, planning, and solving. Intelligence is most widely studied in humans, but has also been observed in animals and plants. AI is the intelligence of machines or the simulation of intelligence in machines. AI is both the intelligence of machines and the branch of Computer Science which aims to create it, through the study and design of intelligent agents or rational agents, where an intelligent agent is a system that perceives its environment and takes actions which maximize its chances of success. Achievements include constrained and well-defined problems such as games, crossword-solving and optical character recognition. Among the traits that researchers hope machines will exhibit are reasoning, knowledge, planning, learning, communication, perception, and the ability to move and manipulate objects. In the field of AI there is no consensus on how closely the brain should be simulated.

DOI: 10.4018/978-1-5225-2423-6.ch003

INTRODUCTION

Computational Intelligence is the study of the design of intelligent agents. An intelligent agent is a system that acts intelligently, it is flexible to changing environments and changing goals, it learns from experience, and it makes appropriate choices given perceptual limitations and finite computation.

Bezdek defined Computational Intelligence (CI) is when it: deals with only numerical data, has pattern recognition components does not use knowledge in the artificial intelligence sense. It shows:

- Computational adaptively.
- Computational fault tolerance.
- Speed approaching human-like turnaround.
- Error rates that approximate human performance.

In the intelligence intrusion detection field, supervised learning usually produces classifiers for misuse detection from class-labeled training datasets. Classifiers are basically viewed as a function mapping data samples to corresponding class labels. Unsupervised learning distinguishes itself from supervised learning by the fact that no class-labeled data is available in the training phase. It groups data points based upon their similarities. Unsupervised learning satisfies the requirement of anomaly detection hence it is usually employed in anomaly detection.

Artificial Intelligence(AI) techniques like as data mining, artificial neural networks, fuzzy logic and expert systems can be integrated with traditional procedural and statistical methods to analyze the collected data by sensors, recognize reconnaissance patterns, filter and correlate events to support security event management and prevention of intrusions. These techniques improve the ability of security management systems to correlate events generated by a diversified suite of modern tools used for network management and security monitoring (Hentea, 2005a). Statistical methods have been used for building intrusion and fault detection models (Manikopoulos & Papavassiliou, 2002), but these models lack the capability to learn and adapt in time.

Expert systems are the most common form of AI applied today in manufacturing, telecommunications, business and other areas. The systems which are based on expert system and inference techniques are not well-organized and accessible because they mainly rely on human expertise, known facts and statistics implemented in rules for a specific host or network and their capability is limited. However the expert systems evolved to a new trend of integration with the traditional information processing such that in the early nineties, the expert systems merged to a new infrastructure based on knowledge based technology.