


## Chapter 2

# Review and Applications of Machine Learning and Artificial Intelligence in Engineering: Overview for Machine Learning and AI

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### **ABSTRACT**

*This chapter presents a summary review of the development of artificial intelligence (AI). The chapter provides definitions of AI, together with its basic features, and illustrates the development process of AI and machine learning. Further, the authors outline the developments of applications from the past to today and the use of AI in different categories. Finally, they describe prediction applications using artificial neural networks for engineering applications. The outcomes of this review show that the usage of AI methods to predict optimum results is the current trend and will be more important in the future.*

### **ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING**

Alongside generally related to computer sciences and engineering disciplines, artificial intelligence (AI) pertains to science and technology, and benefits many fields, such as biology and genetics, psychology, language learning and comprehension, and mathematics.

DOI: 10.4018/978-1-6684-6291-1.ch002

## ***Review and Applications of Machine Learning and Artificial Intelligence in Engineering***

As AI is accepted as a branch of a science, being considered as a field of research and technology at the same time, its various definitions are from many different sources. Some of these are as follows:

1. This approach, which is human-oriented, should be an experimental science that includes hypothesis and experiences within (Russell & Norvig, 1995).
2. AI can be defined as an effort for developing computer operations, which will ensure to find out the similarities of this structure, via an understanding of the human thinking structure (Uygunoğlu & Yurtçu, 2006).
3. McCarthy (2007) remarked that of AI is a science and engineering discipline, which is generated by intelligent machines, especially computer programming, too.
4. Luger (2009) defined AI as a computer science branch that is related to automation of intelligent behaviors.
5. AI is an expert system to understand intelligent beings, and establish and make the process of decision-making productive, rapid, and simple (Patil et al., 2017).

Based on these different definitions, AI is a technology, which is made of computers, which function similarly to humans' intelligent structure and thinking behaviors, intelligently thinking software or computer-controlled robots.

However, although this technology is a case, which is related to using computers in order to understand human intelligence, it should not be limited to methods that are measurable only according to biological factors (McCarthy, 2007). On the other hand, in recent times, the main reason of importantly advancing of AI technology consists in developments in computer functions, which are integrated with human intelligence, such as reasoning, nominated ability of discernment, learning, and solving problems.

Machine learning, which is seen as a subfield of AI, is a technology related to designing and developing algorithms and techniques, which ensure devices to learn, such as computers (Olivas, Guerrero, Sober, Benedito, & López, 2009). In this respect, the concept of machine learning expresses the generated changes in systems by tasks, which include the actions which are realized with AI, such as recognition, robot-controlling, detection/identification, and prediction. Also, with occurring changes, previously generated systems are developed or new systems are synthesized. Figure 1 shows the structure of a typical AI tool, which illustrates this case more clearly.

This tool senses information coming from its surrounding and realizes a suitable modelling. Actions are calculated based on the possible effects from the models being predicted. Conversely, changes, which can occur in any of AI components Figure 1 shows, may be regarded as learning. Also, different learning mechanisms may be run, based on the change of subsystems.

The definition of learning in the dictionary is gain of knowledge and success through study, understanding or experience, become skillful and changes that occurred via experience in behavioral tendencies (Nilsson, 1998). Consequently, learning happens in a long and iterative process, and generates alterations, which ensure certain attainments and experiences as a result of this process, too. The development of many technological devices (e.g., computer) and becoming like humans are unavoidable when various activities are carried out. In this case, machine learning is considered as gain of experience or information of machines, such as computers, as a result of a variety of events (e.g., developing various decision-making mechanisms and foreknowing similar states) which may be lived in the future.

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