Chapter 1
Deep Learning and Intelligent Robots in Government

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ABSTRACT

Deep learning algorithms have witnessed considerable advances in different sectors. Consequently, these techniques have been commonly deployed for government, mainly to support robotic and autonomous systems. They make intelligent robots, which can replace humans in danger zones or production processes and look and react like humans. The purpose of this chapter is to review the deep learning concept and particularly its applications in governments' working systems. In addition, the authors introduce the robotic field with its importance for governments. Finally, they illustrate this work by two simulated examples of robotic motions based on deep learning algorithms.

INTRODUCTION

A remarkable advance in research and development work in artificial intelligence (AI) has recently been recorded. It can replace men by ensuring intelligent tasks, which were once absolutely or relatively unreachable to the human mind .Besides, it can solve the most-complex problems, with an inclusive use in all the governmental sectors in order to achieve much better services and change them for the better. Hence, governments and public sectors elsewhere plan to invest in AI for cost reductions and efficiency benefits. However, still the majority of them have not applied it, yet.

AI is an umbrella term including a wide range of programming constraints, algorithms, optimizers, and machine learning (ML). However, deep learning (DL) is a specialized subset of ML. It is one of the main intelligent approaches with a big neural net, which have been proven very efficient in providing faster, and more accurate data gathering and processing. It is applied to almost every domain, such

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as virtual Assistants, Image classification and segmentation, Natural language processing, automated predictions, healthcare, entertainment and robotics.

Currently, Applying DL to robotics is a significant area of focus. It is a remarkable step for smart robot creation, which can replace humans in either manufacturing tasks or hazardous missions (Francis 2018), (Donald 2018). Robots may appear, act and possess a level of intelligence like humans. It is a new trend that governments invest in robotics in the sense of diversification and essentially the establishment of robot technologies; investment in new robot technologies has become larger and larger. Additionally, DL is more general than any other learning algorithm. Furthermore, it has been proven that deep networks are capable of thinking and abstracting at a high level, which makes it a perfect solution for robotics in an unregulated environment.

This chapter is organized as follows: in the first section, the authors review deep learning approaches and its applications to governments' necessities. In the second section, the authors introduce the robotic field and show its importance to governments. For illustrative reasons, two simulated examples of robotic motions based on Deep learning algorithms are shown. Finally, the chapter ends with a brief summary of the main points and their discussion.

DEEP LEARNING

1. From Artificial Intelligence to Deep Learning

Man is not the only creature who is intelligent. Even in nature, there are different cases of intelligence. Any system, which gives an adaptable response to its environment, is considered to be intelligent, too (Felten, 2019). In fact, the idea began with the question "Do computers think?" (Bunge1956). In the 1950s, John McCarthy used the term artificial intelligence to indicate a machine, which is able to reproduce human behavior with a particular level of consciousness (*Kruse, 2013)*. The fruit of understanding certain natural processes linked to intelligence in line with progress in research in the basic sciences have evolved enormously in the last decade in various sectors. Furthermore, AI has become a trending concept and a controversial subject within the community of professionals and experts. This magic, so to speak, concept has induced the scientific and technical sphere to infiltrate philosophical, economic and societal debates among the public. Generally, the field of AI is global since it covers numerous techniques such as ML, which is a computational methods based on experience to correct performance or to produce accurate predictions. Tom Dietterich defines ML as "The goal of ML is to build computer systems that can adapt and learn .from their experience." (*Shalev-Shwartz, 2014).* ML is derived from many disciplines such as statistics, optimization, algorithms, or signal processing. It is a constantly changing field of study.

ML is a program, which signifies the ability to learn without any programming process (Arthur Samuel 1959). Hence, ML is based on two fundamental pillars: the first is the data, which is learned by the algorithm; and the second is the learning algorithm, which is the procedure of data training to produce a model. Training is actually the fact of running a learning algorithm on a data set (*HaykinS)*.

Nevertheless, DL is an intelligent method coming from ML (*John 2019)*. It is an advanced system with large neural network models inspired from the human brain. This network is made up of interconnected neural networks, which are capable of memorizing information, comparing any problems or situations with past similar situations, analyzing solutions and solving problems in the best possible way.