

Chapter 7

Deep Learning: Architectures and Applications

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ABSTRACT

Deep learning is a subset of machine learning. As the name suggests, deep learning means more and more layers. Deep learning basically works on the principle of neurons. With the increase in big data or large quantities of data, deep learning methods and techniques have been widely used to extract the useful information. Deep learning can be applied to computer vision, bioinformatics, and speech recognition or on natural language processing. This chapter covers the basics of deep learning, different architectures of deep learning like artificial neural network, feed forward neural network, CNN, recurrent neural network, deep Boltzmann machine, and their comparison. This chapter also summarizes the applications of deep learning in different areas.

INTRODUCTION

Deep Learning has been emerged as new concept of Machine Learning since 2006. Deep learning is a part of machine learning algorithm that tries to get the details from multiple based on abstraction level. In other it can be also defined as machine learning sub-field where there be better understanding of underlying layers based on their features and characteristics. Here, higher level concepts have been defined from lower level representations and these lower level concepts are useful in defining other higher level concepts. One example to denote is an image. Image is higher level representation whereas group of pixels denotes the lower levels. Following sections elaborates how data has been emerged in huge amount.

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Deep Learning

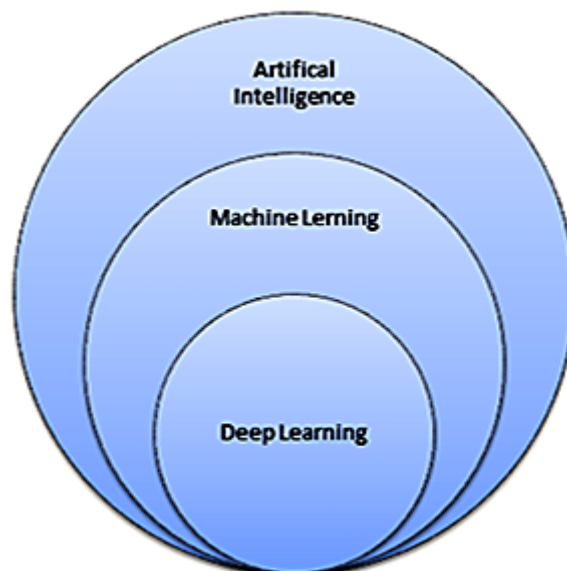
Figure 1 shows the relationship between artificial intelligence, machine learning and deep learning. Artificial intelligence is referred as machine that tends to perform the tasks which requires human intelligence. It provides a machine a capability to behave like a human. While machine learning is using algorithms to process the data, analyze from the data and then make the prediction about related things. The machine is trained using large amounts of data and procedures provide them ability to perform the new task. Deep learning has been defined from machine learning. It was inspired by human neurons. It contains basically multiple layers of information. In each layer, more and more features or information extracted.

Rise of Huge Amount of Data

In today's world, the rise of data is due to development of newly created devices that generates different kind of data. Nowadays each and every user is connected with a smartphone to make life smarter. Each operation with smartphone generates data. Applications in the smartphone like temperate and humidity too generates data in large size.

Another factor for development of huge amount of data is IOT. Internet of Things connects your physical device to make it smarter and faster. Smart ACs, Smart TVs, Smart Car are example of IOT. Let us take simple example of Smart ACs. Smart ACs controls temperature of the room from the details room temperature, surrounding temperature and from global data as well. To accumulate this data, it has get details of temperature from sensors which provides room and surrounding temperature. Based on this data, Smart ACs set the temperature of room. In another example of smart car, Sensors attached to the smart car measures whatever the obstacle is, size of obstacle and speed of the obstacle. After analyzing huge amount of data, smart car can run. There are so many applications which processing and generating huge amount of data every day.

Figure 1. AI vs machine learning vs deep learning



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