Chapter 5
A Journey From Neural Networks to Deep Networks: Comprehensive Understanding for Deep Learning

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ABSTRACT

The chapter is about deep learning fundaments and its recent trends. The chapter mentions many advanced applications and deep learning models and networks to easily solve those applications in a very smart way. Discussion of some techniques for computer vision problem and how to solve with deep learning approach are included. After taking fundamental knowledge of the background theory, one can create or solve applications. The current state-of-the-art of deep learning for education, healthcare, agriculture, industrial, organizations, and research and development applications are very fast growing. The chapter is about types of learning in a deep learning approach, what kind of data set one can be required, and what kind of hardware facility is required for the particular complex problem. For unsupervised learning problems, Deep learning algorithms have been designed, but in the same way Deep learning is also solving the supervised learning problems for a wide variety of tasks.

INTRODUCTION

DL is a subclass of ML and ML is a sub-branch of AI. Capabilities of deep learning diverge in many key respects from ancient machine learning. Deep learning acquiesces to computers to resolve a number of complex, advanced and novel issues that have been not somewhat be tackled by Ancient machine

DOI: 10.4018/978-1-6684-2408-7.ch005

learning approaches (Arel, I. et al, 2010; LeCun et al, 2015; Schmidhuber, J., 2015). These issues are that swathes of issues in the real world are not a good fit for such simple models means some advanced and high configuration models, techniques, and approach is required. A handwritten number recognizing is one of the examples of these complex real- world problem. To resolve such problem one needs to gather a huge dataset related to handwritten numbers also the computer system should handle such data. Every digit between 0 and 9 can be written in numerous ways also the size and exact shape of each handwritten digit can be very different depending on whose writing and in what circumstance. So to manage the diversity of these multiple feature set and to further communication between them is where deep learning and deep neural networks become very beneficial as compare to Ancient learning. Neural networks are mathematical models whose construction of the network is broadly inspired by the human brain. Each neuron of the network is a mathematical function which receives data through an input layer and, transforms that input data into a more responsible form, and then it will spit it out through an output layer. You can think of neurons in a neural network as being arranged in layers, as shown below (Adamczak et al, 2004; Buduma et al, 2017; Goodfellow et al,2016; LeCun et al, 2015). The terms like Deep Belief Nets, Convolutional Nets, Backpropagation, non-linearity, Image recognition, and so on or maybe across the big Deep Learning researchers like Geoff Hinton, Andrew Ng, Yann LeCun, Andrej Karpathy, Yoshua Bengio.If we follow and see the news of technology we may have even heard about Deep Learning in big companies NVidia and its GPUs, Apple and its self-driving Car, Google buying DeepMind for 400 million dollars, and Toyota's billion dollars AI research investment(Arel et al, 2010).

Deep Learning is About Neural Networks

The neural system's structures and any other simple network's structures are the same structure. Nodes of webs are interconnected with each other. Nodes are called neurons and we called edges to those joints which are used to join node to node. The main function of neural networks is to collect or receive a set of inputs, do some complex and progressively calculate some process and end up with some useful information called the output of the problem (Adamczak et al, 2004; Buduma et al, 2017; LeCun et al, 2015Schmidhuber et al, 2015).

Figure 1. Neural Network