Chapter 13
Machine and Deep Learning Techniques in IoT and Cloud

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ABSTRACT

For centuries, the concept of a smart, autonomous learning machine has fascinated people. The machine learning philosophy is to automate the development of analytical models so that algorithms can learn continually with the assistance of accessible information. Machine learning (ML) and deep learning (DL) methods are implemented to further improve an application's intelligence and capacities as the quantity of the gathered information rises. Because IoT will be one of the main sources of information, data science will make a significant contribution to making IoT apps smarter. There is a rapid development of both technologies, cloud computing and the internet of things, considering the field of wireless communication. This chapter answers the questions: How can IoT intelligent information be applied to ML and DL algorithms? What is the taxonomy of IoT's ML and DL and profound learning algorithms? And what are real-world IoT data features that require data analytics?

INTRODUCTION

Machine learning is a technique of data analysis that automates analytical model construction(Smola & Vishwanathan, 2008). It is a crucial sub-area of artificial intelligence, allowing machines without specific programming to enter a self-learning mode. When exposed to new knowledge, these computer

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programmers are allowed to learn, evolve, develop and alter on their own. Identify trends and make decisions based on the idea that systems can learn from knowledge with limited human intervention.

The significance of machine learning is that data processing has always historically been characterized by trial and error, an approach that becomes difficult when information sets are broad and heterogeneous. By providing intelligent solutions to analyze massive amounts of knowledge, machine learning emerges as a solution to all of this. By developing fast and efficient algorithms and data-driven models for real-time data processing(Mahdavinejad et al., 2018; Tanskanen, n.d.), machine learning is able to produce accurate results and analysis.

Rapid advances in hardware, software and communication techniques have facilitated the development of sensory instruments connected to the Internet that provide physical world observations and information measurements. Internet-connected device technology, known as the Internet of Things (IoT), continues to expand the existing Internet by offering connectivity and interactions between physical and cyber worlds. The key to developing intelligent IoT apps is intelligent processing and evaluation of big data. The key contribution is the taxonomy of machine learning algorithms explaining how different techniques are applied to the data in order to extract higher level information.

To understand which machine learning algorithm is more appropriate for processing and decision making on smart data generated from the things in IoT, it is essential to consider the following three concepts. First is the IoT application, second is the IoT data characteristic and third is the data-driven vision of machine learning algorithms. These machine learning algorithms are categorized according to their structural similarities, types of data that can handle, and the amount of data that can process in a reasonable time.

Machine learning becomes more affordable through the use of cloud platforms(Katzir, 2019; Michalski, n.d.), is that the technology will be misapplied. Cloud providers promote machine learning is having a wide value. Many open-source and proprietary machine-learning systems support the types of predictions. Cloud-based machine learning solutions(Bankole & Ajila, n.d.; Jamshidi et al., 2014) from the three public cloud providers: Google, AWS, and Microsoft which are very different from each other. Public clouds also provide cheap data storage. Finally, they all provide software developer kits (SDK) and API that allow embedded machine-learning functionality directly into applications and they support most programming languages. The real value of machine learning technology is the use from within applications because the types of predictions that are made are operational and transaction focused.

Popular methods of machine learning are supervised learning, unsupervised learning, semi - supervised learning and reinforcement learning. Supervised learning maps an input to an output pairs are known as labelled data. Supervised Learning has two sub classes: Classification and Regression. A task is considered as a classification task if the output is categorical and a regression task if the output is a continuous value. A data that does not have a label then it comes under unsupervised learning which is mostly used for finding relationships in datasets, reducing dimensionality or identifying anomalies. Semi-supervised learning is a mixture of supervised and unsupervised learning which typically works with a small amount of labelled data and a large amount of unlabelled data. Reinforcement Learning deals with how an agent takes actions in an environment to maximize a reward.

A wider family of machine learning strategies focused on artificial neural networks is deep learning. In deep learning, a computer model learns directly from images, text, or sound to perform classification tasks. Deep learning models, may achieve state-of-the-art precision, often exceeding human-level efficiency. By using a wide collection of labeled data and neural network architectures that include several layers, models are trained. On the other hand, uses advanced computing power and special types of neural

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