

# Chapter 1

# Introduction to Machine Learning and Its Implementation Techniques

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## **ABSTRACT**

*Machine learning (ML) is one of the exciting sub-fields of artificial intelligence (AI). The term machine learning is generally stated as the ability to learn without being explicitly programmed. In recent years, machine learning has become one of the thrust areas of research across various business verticals. The technical advancements in the field of big data have provided the ability to gain access over large volumes of diversified data at ease. This massive amount of data can be processed at high speeds in a reasonable amount of time with the help of emerging hardware capabilities. Hence the machine learning algorithms have been the most effective at leveraging all of big data to provide near real-time solutions even for the complex business problems. This chapter aims in giving a solid introduction to various widely adopted machine learning techniques and its applications categorized into supervised, unsupervised, and reinforcement and will serve a simplified guide for the aspiring data and machine learning enthusiasts.*

## **INTRODUCTION**

In the past decade there has been a rapid paradigm shift in the field of computer science due to apex achievements in artificial intelligence. Machine learning which is a sub field of artificial intelligence has taken the capabilities of imparting the intelligence across various disciplines beyond the horizon. In 1959, Arthur Samuel defined machine learning as a “Field of study that gives computers the ability to learn without being explicitly programmed” (Samuel 1959). The machine learning algorithms works on the fact that the learning happens persistently from the training data or with the past experience and

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can enhance their performance by synthesizing the underlying relationships among data and the given problem without any human intervention. In contrast with the optimization problems, the machine learning algorithms generally encompasses a well-defined function that can be optimized through learning. This optimization of the decision-making processes based on learning has led to rapid rise in employing automation in innumerable areas like Healthcare, Finance, Retail, E-governance etc. However, machine learning has been considered as the giant step forward in the AI revolution the development in neural networks has taken the AI to a completely new level. Deep learning which a subset of machine learning is incorporates neural networks as their building blocks have remarkable advances in natural language and image processing.

With big data landscape being able to store massive amount of data that is generated every day by various businesses and users the machine learning algorithms can harvest the exponentially growing data in deriving accurate predictions. The complexity raised in maintaining a large computational on primes infrastructure to ensure successful learning has been efficiently addressed through cloud computing by eliminating the need to maintain expensive computing hardware, software and dedicated space. The businesses have started adopting Machine Learning as a service (MLaaS) into their technology stacks since they offer machine learning as a part of their service, as the name suggests. The major attraction is that these services offer data modeling APIs, machine learning algorithms, data transformations and predictive analytics without having to install software or provision their own servers, just like any other cloud service. Moreover MLaaS can help manage big data better by collecting huge amounts of data to get insights by correlating the data, crunching numbers and understanding patterns of the data to helps business take quick decisions. As data sources proliferate along with the computing power to process them, going straight to the data is one of the most straightforward ways to quickly gain insights and make predictions. The combination of these two mainstream technologies yields beneficial outcome for the organizations. Machine learning is heavily recommended for the problems that involve complex learning. However, it is essential to remember that Machine learning is not always an optimal solution to every type of problem. There are certain problems where robust solutions can be developed without using Machine-learning techniques.

This chapter will explore the end-to-end process of investigating data through a machine-learning lens from how to extract and identify useful features from the data; some of the most commonly used machine-learning algorithms, to identifying and evaluating the performance of the machine learning algorithms. Section 2 introduces steps for developing suitable machine learning model and various paradigms of machine learning techniques such as supervised, unsupervised and reinforcement learning. Section 3 discusses about various applications of machine learning in various fields and then concludes whole chapter with research insights.

## **DEVELOPING A MACHINE LEARNING MODEL**

As discussed, machine Learning is the field where an agent is said to learn from the experience with respect to some class of tasks and the performance measure  $P$ . The task could be answering exams in a particular subject or it could be of diagnosing patients of a specific illness. As shown in the figure 1 given below, it is the subset of Artificial intelligence (AI) where it contains artificial neurons and reacts to the given stimuli whereas machine learning uses statistical techniques for knowledge discovery. Deep learning is the subset of machine learning where it uses artificial neural networks for learning process.

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