Chapter 8
Introduction to Machine Learning

ABSTRACT

A machine learning system works by using data to identify patterns, make decisions, and learn from them. Machine learning is based on the idea that systems can learn from data. In the traditional problem-solving approach, data is paired with a human-created program to generate answers to a problem. In machine learning, the data and answers are used to unravel the rules that create a problem. During a learning process, machines experiment with different rules and learn what works and does not work, hence the name machine learning. This chapter explores the history of machine learning, various machine learning techniques, and their comparisons.

WHAT IS MACHINE LEARNING?

Machine learning has become a powerful tool to convert information into knowledge because of the exponential growth of raw data over the last few years. As John Naisbitt pointed out "We are drowning in information and starving for knowledge". Data is useless unless it is analyzed, and hidden patterns are identified. Machine learning techniques are used to discover the hidden patterns within complex data. This would help to predict future events and perform all kinds of complex decision-making. To put it simply, machine learning algorithms identify patterns in data that facilitate better decisions and predictions. Several industries have seen an increase in the use of machine

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learning algorithms, including medicine, email filtering, speech recognition, computer vision, recommending songs or movies, and gaining insights into their customers' purchasing habits. A branch of artificial intelligence, it is based on the idea that systems can learn from data, identify patterns, and make accurate decisions with minimal human effort.

HISTORY OF MACHINE LEARNING

The first attempt to automate data processing was made by Pascal, who created a mechanical adder that used gears and wheels. A machine he devised could divide and multiply directly by adding and subtracting two numbers. On the calculator, metal wheels showed the numbers from 0 to 9 all-around their circumference. Joseph Marie Jacquard invented weaving looms that used metal cards with holes punched into them to position threads. Jacquard's loom, equipped with an interchangeable punch card system, enabled automatic reproduction of any pattern. These punched cards were used by both Charles Babbage, an inventor of the analytical engine, to feed data into his machine, and by Herman Hollerith, an American statistician to feed information into his census machine. By using Boolean operators (AND, OR, NOR), the binary values of yes and no would be represented as true, false, and binary values as 1 or 0. Herman Hollerith developed a system of mechanical calculations and punch cards to calculate statistics gathered from millions of people. An electromechanical device known as a tabulating machine was used to combine information stored on punched cards. English mathematician Alan Turing developed the Turing Test to determine whether machines are intelligent in the 1940s and 1950s (Fradkov, 2020; Kononenko, 2001; Plasek, 2016). The Fig.1 depicts the history of machine learning

In 1952, Arthur Samuel created a checkers game to teach computers to play. A supervised training model was used to study which moves to lead to winning strategies, and the software was updated to implement those. A perceptron is a type of neural network designed by Frank Rosenblatt. Neurons in the brain are connected in a network, and a neural network is like the brain. As part of the larger program, decisions are made that help solve complex problems. Students at Stanford University invented the Stanford Cart, which is capable of navigating obstacles by itself in a room. Computer software enabled the Cart to navigate crowded spaces on its own, entirely relying on images broadcast via an onboard TV system for all its knowledge. A journal article by Gerald Dejong in 1981 introduced explanation-based learning (EBL)

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