

# Machine Learning in Automation

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## ABSTRACT

*Machine learning (ML) refers to the automated detection of meaningful patterns in a given data. It can appear in many guises. It involves programming computers to perform tasks using example data or past experience. It is capable of accelerating the pace of automation. As tasks are offloaded to automation, humans can address other challenges. This paper briefly presents machine learning techniques for the use in automation.*

**Key words:** Automation, Artificial intelligence, Machine learning.

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## 1. INTRODUCTION

Scientists and engineers need intelligent tools to assist them with problems such as design, monitoring, control, and analysis. Machine learning techniques hold promise for assisting in solutions to many of these problems. Machine learning is concerned with enabling computer programs to automatically improve their performance through experience. Automation is designed to streamline tasks and speed workflows. It is solely fixed on repetitive, instructive tasks. Automation saves time and allows workers to focus on higher-priority initiatives. Its prime objective is to successfully operate on its own without human assistance.

Machine learning takes the repetitive tasks and layers them in an element of prediction.

There is an abundance of data in many domains and a need for automatic algorithms to analyze them for prediction or better understanding [1]. It is clear that machine learning is a “general purpose technology,” like steam engine or electricity. It is a process that uses statistical methods to make machines think independently and take decisions.

## 2. MACHINE LEARNING TECHNIQUES

Machine learning (ML) may be regarded as a subset of artificial intelligence (AI). AI is the theory and development of computer systems that can perform tasks that normally require human intelligence. ML is a type of AI that provides computers with the ability to learn without being explicitly programmed. “Learning” denotes gaining of knowledge and understanding from instruction or experience.

Machine learning is an emerging technology that can facilitate discovery of rules and patterns in a data set. It uses algorithms to parse data, learn from it, and draw conclusions without human intervention. Many industries have realized the great benefits from using machine learning to increase reliability, productivity, and the safer operations of their machines.

ML has intelligence built in it. ML techniques often result from the need for intelligent solutions to practical tasks such as classification, regression or clustering. ML algorithms can be broken down into five types: supervised, unsupervised, semi-supervised, active, and reinforcement. Various ML algorithms can be applied to automation. A classification of the major ML techniques is shown in Figure 1 [2].

### 3. APPLICATIONS

Machine learning techniques are transforming many fields including computer science, engineering, mathematics, physics, neuroscience, and cognitive science [3]. ML has several applications including the manufacturing industry, the medical industry, the financial industry, customer service, healthcare, genomics, navigation of the self-driving car, and transportation, to name just a few. The following are typical common applications of ML in automation.

- *Manufacturing:* This is a field where the application of machine learning can be very fruitful. The manufacturing industry today is facing an increasing volume of data which compromise a variety of different formats, semantics, and quality. ML techniques have been successfully utilized in various process optimization, monitoring and control applications in manufacturing [4]. Thus, ML can be used to increase productivity. For this reason, manufacturers have started to integrate ML into their automation processes. This is helping them gain a foothold in the 21st century's Industry 4.0 revolution. ML can be beneficial in all aspects of industrial automation. Leading manufacturing companies such as GE and Siemens are developing their own ML industrial automation operating software.
- *Self-driving cars:* Self-driving (or autonomous) cars represent a development and application of ML. Manufacturers of automated cars keep adding automated systems such as adaptive cruise control, airbags, lane-departure warnings, collision warnings, cameras, and other aids. Autonomous driving is now seen as possible in spite of the unpredictability of the open road. Due to some factors, self-driving cars can be both distant and just-around-the-corner [5].
- *Recognition tasks:* Over the years, skills have been developed to recognize patterns like handwriting, speech recognition, facial expression, etc. The need for computer programs that make computer learn these skills led to machine learning. Machine learning can be used in automatic speech recognition for home automation or space exploration [6]. Many security applications use face recognition as one its components.
- *Automated planning:* Automated planners (AP) require an accurate description of the planning task. However, the definition of accurate models for planning is still is a bottleneck. Machine learning has been useful in overcoming the knowledge acquisition problems of AP [7].

### 4. BENEFITS AND CHALLENGES

Machine learning systems can predict outcomes of events in a number of ways. They can be used to discover valuable patterns in data. They can also be used to monitor and control complex processed. A program with ML capabilities can identity concepts and problems without the biases humans impose on solutions. However, before ML becomes a robust tool for solving a wide range of engineering problem and is capable of improving automatic processes, a number of engineering-specific challenges must be addressed [8]. These include knowledge presentation, extraction of experience, and exploitation of learned knowledge.

With the proliferation of ML tools today, it is a challenging task for a scientist wishing to apply ML to a problem. It is impossible to offer one technique as a general solution.

Most ML techniques can handle only data with continuous and nominal values. It will be of great interest to develop algorithms that can learn regularities in other types of data such as text and images [2]. Another problem is that ML remains a relatively 'hard' problem because the science of advancing machine learning algorithms through research is difficult. ML is basically a complex debugging tool.

Although autonomous systems promise being able to act alone, most of them still interact with humans as supervisory controllers. The ability of human operators to interact with autonomous systems when needed poses a challenge [9].

### 5. CONCLUSION

Machine learning is a research field in artificial intelligence and statistics that develops computational methods that can be used to learn from data and to predict with new data.

The success of ML in a wide range of applications has resulted in an increasing demand for off-the-shelf ML systems by non-experts.

Automation helps in reducing time-consumption, and human-effort that are required to performing tasks manually. In recent times, machine learning is sought-after for helping in automating many real-world manual tasks. Although machine learning is still in its infancy, it is going mainstream. In the near future, ML algorithms will interact with computers/machines to enhance productivity.

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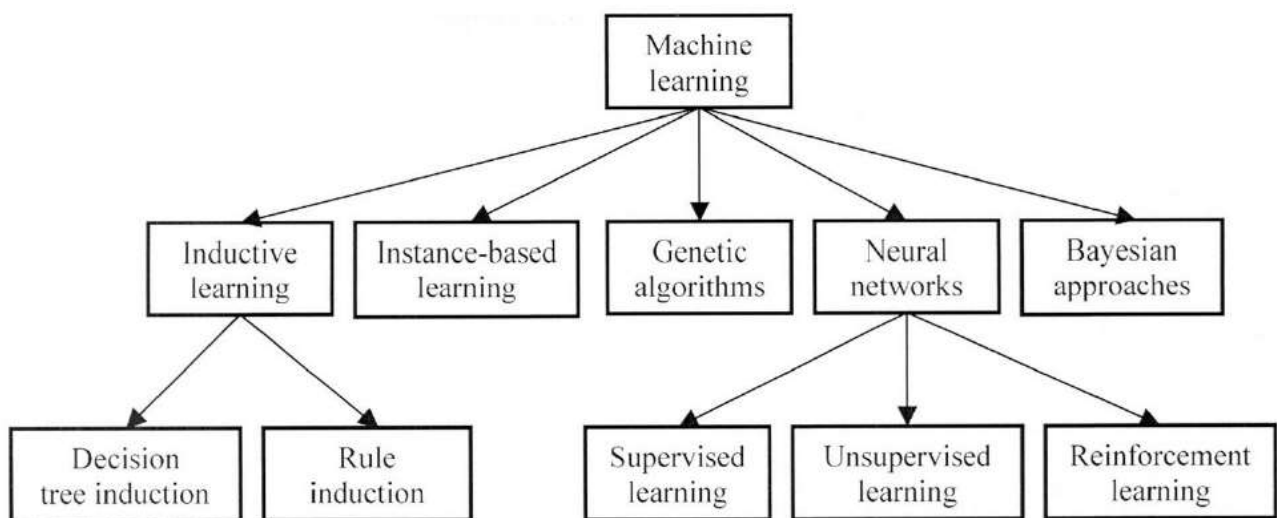
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**Figure 1 A classification of the main ML techniques [2].**