OVERVIEW OF MACHINE LEARNING METHODS AND ITS APPLICATIONS

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ABSTRACT:
With the popularization of information and the establishment of the databases in great number, the urgent problem to be solved is how to extract useful data from the information. Machine learning is the core issue of artificial intelligence research. This paper introduces the definition of machine learning and its basic structure. It describes a variety of machine learning methods such as Supervised Learning, Unsupervised Learning, and Reinforcement Learning, including Statistics, Data Science and Artificial Intelligence Robotics. Our review of study not only suggests that these techniques are competitive with traditional estimators on one data set but also illustrate that these methods are sensitive to the data on which they are trained.

Keywords – Machine Learning, Algorithms, Statistics, Data Science, Robotics and AI.

[1] INTRODUCTION

Machine learning (ML) is a branch of Artificial Intelligence that pushes forward the idea that, by giving access to the right data, machines can learn by themselves how to solve a specific problem. Additionally, Machine learning is a paradigm that may refer to learning from past experience (which in this case is previous data) to improve future performance. The sole focus of this field is automatic learning methods. Learning refers to modification or improvement of algorithm based on past “experiences” automatically without any external assistance from human. While designing a machine (a software system), the programmer always has a specific purpose in mind.

Section 2, provides an overview of some of the most popular machine learning algorithms that are commonly classified as Supervised Learning, Unsupervised Learning and Reinforcement Learning. ML algorithms have been successfully applied to a wide variety of problems. Traditional machine learning algorithms have been applied in many application areas. Researchers have put many efforts to improve the accuracy of the machine learning algorithms. The main advantage of using machine learning is that, once an algorithm learns
what to do with data, it can do its work automatically. Section 3 deals with Machine Learning, Statistics, Data Science, Robotics, and AI. In Section 4, we discuss the main motivations behind the application of Machine Learning. Section 5, concludes the paper.


Over the past years, an enormous number of ML algorithms were introduced. Only some of them were able to solve the problem so they were replaced by another one. There are three ML algorithms for example Unsupervised Learning, Supervised Learning and Reinforcement Learning.

![Fig 2.1. Types of Machine Learning Algorithms]

**Supervised Learning**

- Supervised learning uses labeled training data to learn the mapping function that turns input variables \((X)\) into the output variable \((Y)\). In other words, it solves for \(f\) in the following equation:

\[
Y = f(X)
\]

- This allows us to accurately generate outputs when given new inputs.

![Fig 2.2 Supervised Learning]
Supervised learning is used in a variety of applications, such as speech recognition, spam detection and object recognition.

Examples of Supervised Learning: Classification and Regression.

Classification: It is used to predict the outcome of a given sample when the output variable is in the form of categories.

Regression: It is used to predict the outcome of a given sample when the output variable is in the form of real values. For example, a regression model might process input data to predict the amount of rainfall, the height of a person, etc.

Unsupervised Learning

“The outcome or output for the given inputs is unknown.”. Here input data is given and the model is run on it. The images or the inputs given are grouped together and insights on the inputs can be found here (which is the most of the real world data available).
• Social network analysis, genes clustering and market research are among the most successful applications of unsupervised learning methods.

• Examples of Unsupervised Learning: Clustering.

• **Clustering:** Clustering is used to group samples such that objects within the same cluster are more similar to each other than to the objects from another cluster.

• The big difference between the Supervised Learning and Unsupervised Learning is that supervised learning uses labeled data exclusively, while unsupervised learning feeds on unlabeled data.

**Reinforcement Learning**

Reinforcement Learning covers more area of *Artificial Intelligence* which allows machines to interact with their dynamic environment in order to reach their goals. With this, machines and software agents are able to evaluate the ideal behavior in a specific context. With the help of this reward feedback, agents are able to learn the behavior and improve it in the longer run. This simple feedback reward is known as a reinforcement signal.
The agent in the environment is required to take actions that are based on the current state. This type of learning is different from Supervised Learning in the sense that the training data in the former has output mapping provided such that the model is capable of learning the correct answer. Whereas, in the case of reinforcement learning, there is no answer key provided to the agent when they have to perform a particular task. When there is no training dataset, it learns from its own experience.

Example of Reinforcement Learning: Google’s Active Query Answering (AQA) System makes use of reinforcement learning.


Machine learning is closely related to the fields of statistics and data science, which provide a range of tools and methods for data analysis and inference from data. It is also related to robotics and intelligent automation. These fields help shape the context in which people relate to many machine learning applications, and inform the opportunities and challenges associated with it. Machine learning also supports progress in these fields, as an underlying technology for both AI and data science.

Data Science And Statistics

At its most basic level, machine learning involves computers processing a large amount of data to predict outcomes. This process of data handling and prediction has strong links to the overlapping fields of data science and statistics, which seek to extract insights from data.

Statistical approaches can inform how machine learning systems deal with probabilities or uncertainty in decision-making, while processing and analysis techniques from data science feed into machine learning. However, both of these disciplines also include areas of study which are not concerned with creating algorithms that can learn from data to make predictions or decisions. While many core concepts in machine learning have their roots in data science and statistics, some of its advanced analytical capabilities do not naturally overlap with these disciplines.

Artificial Intelligence
The term ‘Artificial Intelligence’ lacks a broadly agreed definition, but has variously been described as:

- “Activities that we associate with human thinking, activities such as decision-making, problem solving, learning…”

- “The branch of computer science that is concerned with the automation of intelligent behavior.”

Informally, these definitions relate to systems that think like humans, act like humans, think rationally, or act rationally.

Machine learning is a method that can help achieve ‘narrow AI’, in the sense that many machine learning systems can learn to carry out specific functions ‘intelligently’. However, these specific competencies do not match the broad suite of capabilities demonstrated by people.

AI is often assumed to signify intelligence with fully human capabilities. Such human-level intelligence – or artificial general intelligence – receives significant media attention but this is still some time from being delivered and it is not clear when this will be possible.

**Robotics**

The term ‘robot’ usually conjures the idea of something that lives in the physical world. It covers a range of different applications, whose software sophistication ranges from zero, in the case of automata, to high, when representing intelligent systems. In the context of machine learning and AI, a ‘robot’ typically refers to the embodied form of AI. Robots are physical agents that act in the real world. These physical manifestations might have sensory inputs and abilities powered by machine learning.

The field of robotics has also made advances in recent years, as a result of improvements in sensor technologies and materials. As a result, and combined with advances in machine learning, robotic systems contribute to applications such as autonomous vehicles and drones. Potential applications can also be found in areas such as assisted living or city management. These further advances will draw from capabilities created by machine learning, such as computer vision, language processing, and human-machine interaction.

A further development in the field of machine learning relates to the increased use of virtual agents, or ‘bots’. The term ‘bot’ is sometimes used to refer to an autonomous agent deployed in software. Such agents may not have a physical manifestation, but may operate autonomously in the virtual world of the internet.

[4] Applications
A majority of real current Artificial Intelligence success stories relate to the application of Machine Learning only. A majority of current Machine Learning success stories relate to Image & Speech processing and use this to detect patterns and make predictions.

Such systems are used in a range of online retail environments, including Amazon and Netflix. They can also be used to promote particular types of content to social media users, such as news stories that correspond to a user’s areas of interest.

**Organizing Information**

Search engines and spam filtering Machine learning also helps provide the results of queries entered in internet search engines, such as Google. These systems take the words entered as part of a search, find words and phrases that have the same or highly similar meanings, and use this information to predict the right web pages to respond to that query. Spam detection systems can also use machine learning to filter emails. In this application, the system is trained using a sample of documents, which are classified as spam and non-spam, to distinguish between emails and direct them to the correct folders. In this training process, the system can learn how the presence of specific words, or the names of different senders, and other characteristics, relate to whether or not the email is spam. When deployed in the live system, it uses this learning to classify new emails, refining its training when users identify incorrect classifications.

**Voice Recognition And Response**

Virtual Personal Assistants Natural Language Processing and Speech Recognition systems can match the patterns of sounds produced in human speech to words or phrases they have already encountered, by distinguishing between the different audio-footprints of these sounds. Having identified the words used, they can then translate this to text, or carry out commands.

Until recently, voice recognition systems suffered from low levels of accuracy, which made them difficult to use in many cases. Recent advances mean that these systems can now recognize speech much more accurately, translating the data patterns encoded within sound waves to text, and carrying out the commands contained therein. As a result, many smart phones and other devices now come equipped with virtual Personal Assistants; applications such as Alexa, Cortana, Google Assistant, or Siri, which respond to voice commands or answer questions.

**Computer Vision (Tagging Photos And Recognizing Handwriting)**

Machine learning can support advanced image recognition systems and computer vision. Such vision requires computers to be able to detect and analyze visual images, and to associate numerical or symbolic information with those images.

In social media applications, image recognition can be used to tag objects or people in photos that have been uploaded to a website. Similar image recognition systems can also be used to
recognize scanned handwritten material, for example to recognize the addresses on letters or the digits on cheques. Gaming systems, which detect movements or gestures made by users as part of their play, also use machine learning via computer vision. The system is trained to detect what a ‘body’ looks like, and then uses this training to interact with its users.

**Machine Translation (Translating Text Into Different Languages)**

Using machine translation, computer systems are able to automatically convert text or speech from one language into another. Efforts in this field date back to at least the early 1950s, but, again, it is recent advances in the field that have made these techniques more broadly useful. There now exists a range of approaches to this task, including statistical, rule-based, and neural network-based techniques. Today, machine translation is used in specific translation apps for mobile phones, social and traditional media, and in international organizations that need to reproduce documents in a large number of languages.

**Detecting Patterns (Unusual Financial Activity)**

As a result of its ability to analyze large datasets, machine learning can be used to identify patterns in data which might not be picked up by human analysts. A common application of its pattern recognition abilities is in the fraud detection systems associated with credit card use or other payment systems. Using the normal transaction data from a large number of users, algorithms are trained to recognize typical patterns of spending. Using this data for each user, it can also learn what makes a transaction more or less likely to be fraudulent, such as the location, magnitude or timing of spending activity. Then, if a user displays an unusual pattern of spending, the system can raise a flag and the activity can be queried with the user.

**[5] SUMMARY**

Machine Learning methods and algorithms have been reviewed in this paper. This paper also reviewed algorithms describing the various types of machine learning techniques, algorithms and methodology. Various applications of Machine Learning and many tools needed for processing are also being reviewed. In the literature review section we studied various machine learning algorithms implemented in past years in different areas in combination with the tradition methods and studied how they outperformed the previous models.

**REFERENCES**


