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General Theory About the Traditional Methods and Algorithms of Machine Learning

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Abstract: In the current age of the Fourth Industrial Revolution, the digital world has a wealth of data, such as Internet of Things (IoT) data, cybersecurity data, mobile data, business data, social media data, health data, etc. To intelligently analyze these data and develop the corresponding smart and automated applications, the knowledge of artificial intelligence (AI), particularly, machine learning (ML) is the key. Various types of machine learning algorithms such as supervised, unsupervised, semi-supervised, and reinforcement learning exist in the area. Besides, the deep learning, which is part of a broader family of machine learning methods, can intelligently analyze the data on a large scale. In this paper, we present a comprehensive view on these machine learning algorithms that can be applied to enhance the intelligence and the capabilities of an application. Thus, this study's key contribution is explaining the principles of different machine learning techniques and their applicability in various real-world application domains, such as cybersecurity systems, smart cities, healthcare, e-commerce, agriculture, and many more. We also highlight the challenges and potential research directions based on our study. Overall, this paper aims to serve as a reference point for both academia and industry professionals as well as for decision-makers in various real-world situations and application areas, particularly from the technical point of view.

Keywords: Machine learning, AI, List of machine learning algorithms, Linear regression, KNN, Unsupervised Learning.

Machine learning (machine learning) - the practice and theory of creating programs that one learns, a large part of artificial intelligence. Programmers teach their algorithms to determine common laws in private cases. As a result, the computer makes decisions based on its own personal competence, and not on the commands that a person has previously specified. Too many methods of such training can be attributed to data mining. The first tariff on machine learning was given in 1959 by the American informatist Arthur Samuel. He is the creator of a checker game with artificial intelligence elements, the first self-taught program in theworld.

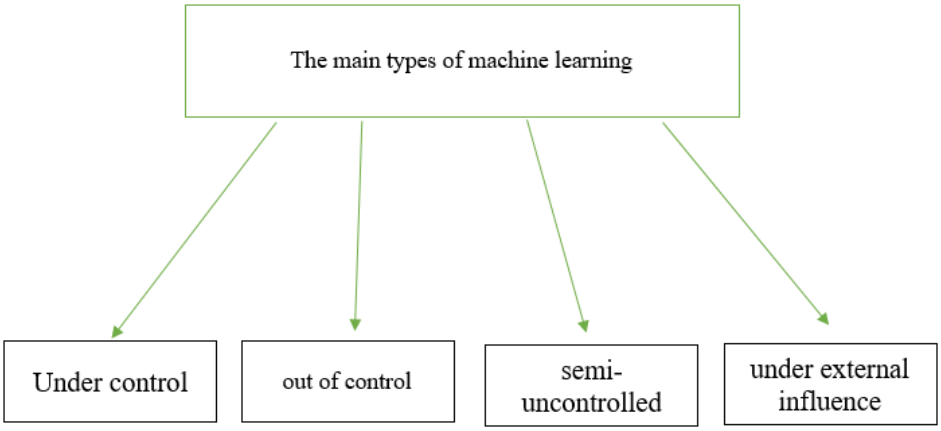

Figure 1. Technical types of machine learning and required information.

Machine learning is a class of artificial intelligence methods, the characteristic feature of which is not a direct solution to the problem, but education in the process of applying solutions to many similar problems. To build such methods, various methods of working with mathematical statistics, numerical methods, optimization methods, probability theory, Graph Theory, data in numerical form are used

There are 3 main types of machine learning algorithm:

Supervised learning (Supervised Learning)

Uncontrolled learning (Unsupervised Learning)

Compulsive learning (Reinforcement Learning)

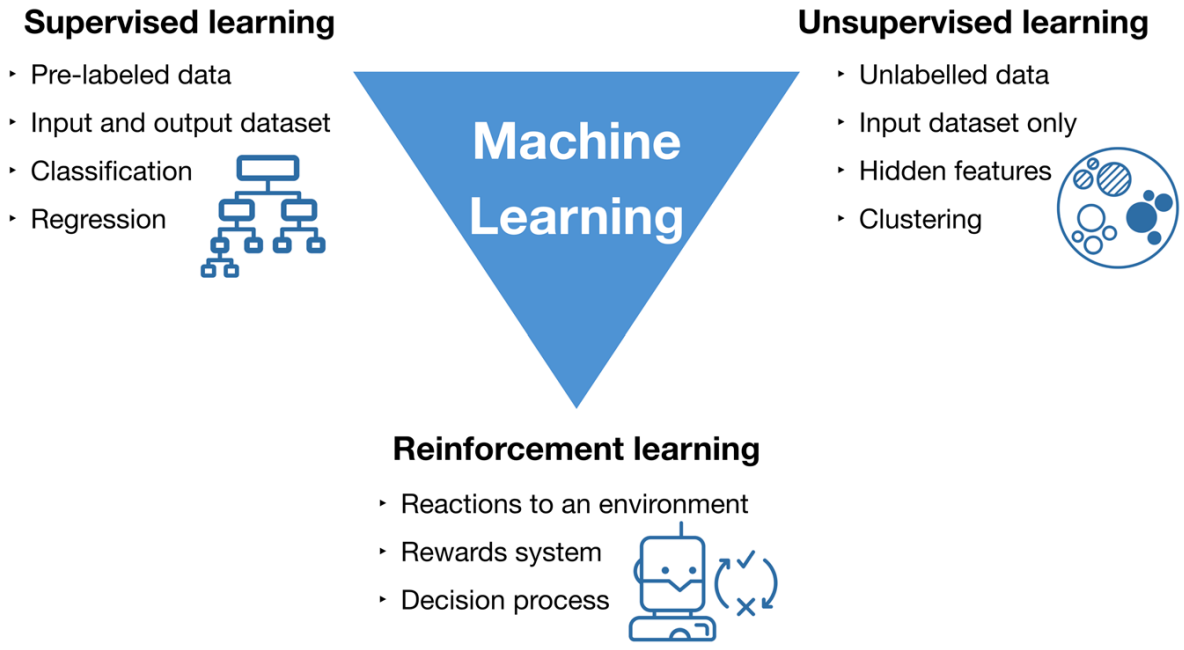

Figure 2. Basic technical types of machine learning.

Supervised learning - this algorithm consists of a result variable (dependent variable) that is biased to some goal and must be approximated from a given set of predictors (independent variables). Using this set of variables, we generate a function that adjusts the input to the desired results. The learning process continues until the model reaches the desired level of accuracy in terms of training data.

Unsupervised Learning – In this algorithm, there is no result variable that we can predict. It is used to cluster a population in different groups, which is widely used to divide buyers into different groups for a given intervention

Reinforcement Learning - With this algorithm, the machine is trained to make specific decisions. It works like this: the machine constantly affects the environment in which it trains itself using tests and errors. This machine studies past experience and tries to obtain the best possible knowledge to make specific decisions.

List of machine learning algorithms - Here is a list of machine learning algorithms commonly used. These algorithms can be applied to almost any reference problem:

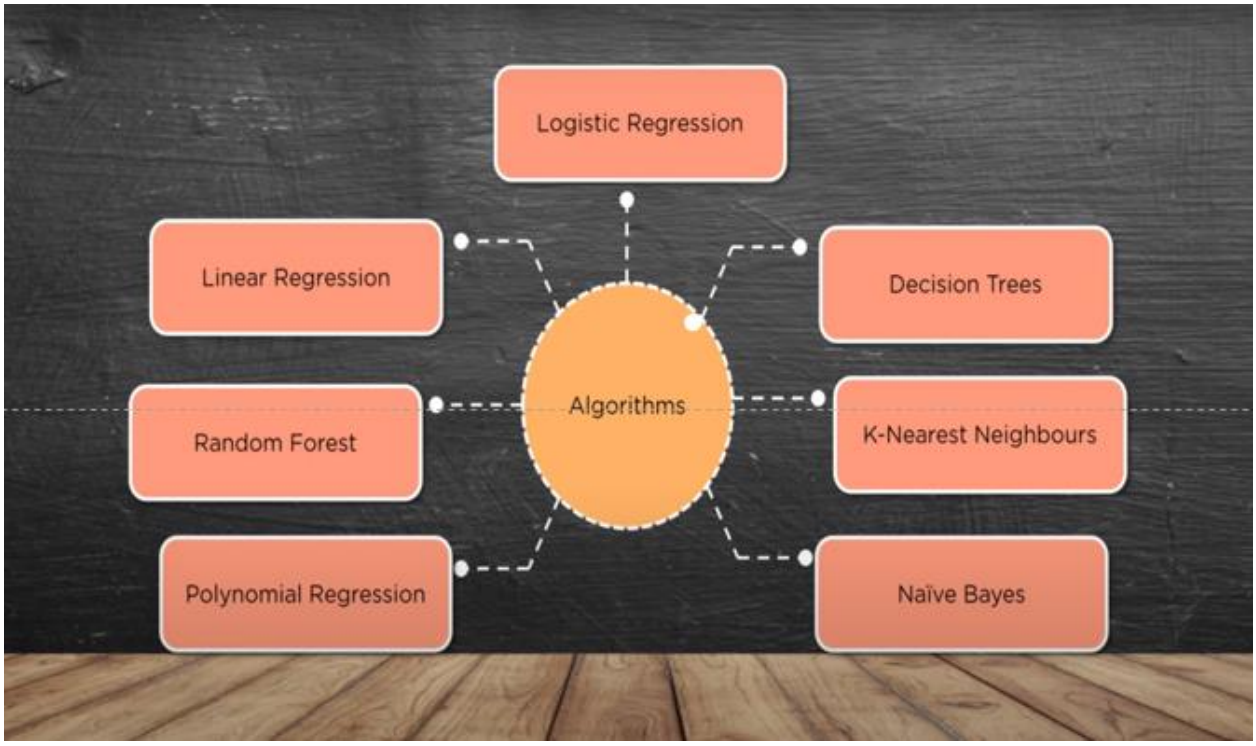

Figure 3. types of machine learning algorithms.

Linear regression is used to calculate real values based on continuous variables (house prices, total sales, etc. We define the best line and establish relationships between independent and non-independent variables. Of this, the best and corresponding line is called the regression line, and y = a * x + b described by.

By the following example, where we define the linear equation y = 0.28111x + 13.9 we determined the best line equal to. Now, using this equation, we find out the height of a person and find out the weight.

Linear regression consists mainly of two types: simple linear regression and a few linear regression. Simple linear regression is characterized by one independent variable. And multiple linear regression is characterized by several (more than 1) independent variables. When finding the line that best fits, you can adjust to polynomial or curvature regression.

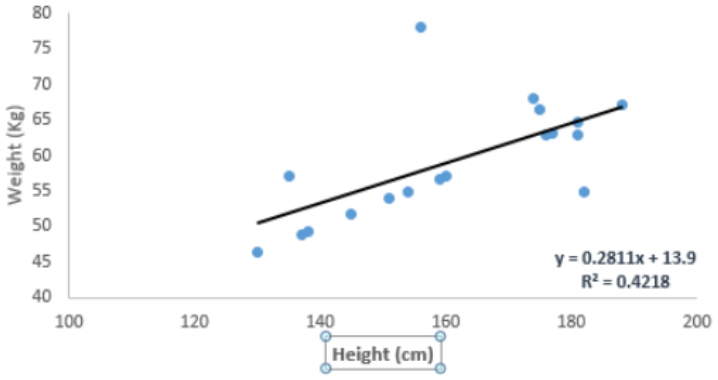

Figure 4. An example of linear regression.

KNN (k – Nearest Neighbors) - it can be used to classify and solve regression problems. However, classification problems in this area are common. K close neighbors is a simple algorithm that preserves all existing states and classifies new states by the majority vote of K neighbors. These remote functions can be Euclidean, Manhattan, Minkowski, and Hamming distance. The first three functions are calculated for category variables through a continuous function and one of the above four. KNN can be easily imitated by us in our real life. For example, gar if you want to know about a person who does not have any information, you can get information about his close friends and circle and have information about him!

Things to consider before choosing Knn:

Cost per KNN calculation, Variables must be normalized, from which other range variables can affect this, More processing at the finishing processing stage and before going to KNN, such as noise removal, Methods of obtaining knowledge. The acquisition of knowledge from the Expert(Specialist)of the knowledge engineer is carried out in three modes: Protocol Analysis, interview and playful immitation of professional activities. The knowledge gained in the protocol analysis consists of marking. In the interview mode, the knowledge engineer conducts active communication with the expert, directing him in the desired direction. In a playful immutation, the expert falls into a state similar to the one in which his professional career takes place. Following his actions in various cases, the knowledge engineer then forms his own vision of expert knowledge, which is deepened by the expert in the interview mode. The principles of playful imitation have found their place in various work Games, special trainers.

If information refers to being as a word or Numbers, or messages that are generated with the sensory organs of a person or technique, then it is possible to express the concepts and knowledge of being that arise from a logical connection based on information with the word information. In our subsequent lectures, we look at the “unprocessed”of the initial concepts for the perception of being as information (Information) and processed as information (Data). Therefore, information is also understood as information given by others. In Uzbek-language sources of knowledge in the field of ICT, the concept of “database of the given” is consistent with the concept of “database” in content. Information, on the other hand, are the initial signs of being, being – subject, or process, or phenomena. If information refers to being as a word or Numbers, or messages that are generated with the sensory organs of a person or technique, then it is possible to express the concepts and knowledge of being that arise from a logical connection based on information with the word information. In our subsequent lectures, we look at the “unprocessed”of the initial concepts for the perception of being as information (Information) and processed as information (Data). Therefore, information is also understood as information given by others. In Uzbek-language sources of knowledge in the field of ICT, the concept of “database of the given” is consistent with the concept of “database” in content. Information, on the other hand, are the initial signs of being, being – subject, or process, or phenomena. It is necessary to study the flow of information and information in a large cell so that we can imagine or realize the existence. The concept of large-scale data processing for perception of existence using algorithms of large-scale data flow learning methods after the creation of computers, i.e. electronic computing machines, gave rise to the concept of machine learning (MO’).

CONCLUSION

That is, humans have developed large-scale data processing techniques to provide the machine with real-time analytical and logical hulosaging allorhythms of large-scale information and/or data flow. With this, it was possible and developed to make high-volume data flow Moor fast decisions. The initial perception of being through information is called a crocodile (Crocodile, object). The perception of those early visions – known as the perception of logos-developed as a distinct area of data science. On the other hand, was the first research-oriented discipline in Data Science and also relied on crocodile perception techniques.Information entry and performance. In this area, issues such as handling manuscript checks, identifying signatures, fingerprints and voices, and introducing economic and tax documents into the computer are addressed. Example:

Flex Read series packages for automatic entry and realization of payment documents and tax returns.

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