

A Brief Review of Machine Learning and its Application

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Abstract—With the popularization of information and the establishment of the databases in great number, and how to extract data from the useful information is the urgent problem to be solved. Machine learning is the core issue of artificial intelligence research, this paper introduces the definition of machine learning and its basic structure, and describes a variety of machine learning methods, including rote learning, inductive learning, analogy learning, explained learning, learning based on neural network and knowledge discovery and so on. This paper also brings forward the objectives of machine learning, and points out the development trend of machine learning.

Keywords—machine learning; intelligence; methods; application

I. INTRODUCTION

Learning is the main hallmark of human intelligence and the basic means to obtain knowledge. Machine learning is the fundamental way to make the computer intelligent. R.Shank has said: "If a computer can not learn, it will not be called intelligent." Since learning is an integrative mental activity with memory, thinking, perception, feeling, and other mental activities closely related. So, researchers from different fields give a different interpretation with different disciplines respectively, and give some different points of view.

II. MACHINE LEARNING

Machine learning is a subject that studies how to use computers to simulate human learning activities, and to study self-improvement methods of computers that to obtain new knowledge and new skills, identify existing knowledge, and continuously improve the performance and achievement.

Compared with human learning, machine learning learns faster, the accumulation of knowledge is more facilitate the results of learning spread easier. So, any progress of human in the field of machine learning, will enhance the capability of computers, thus have an impact on human society.

III. THE BASIC MODEL OF MACHINE LEARNING

Take the definition of learning from H•Simon [1] as the starting point, and establish the basic model shown in Fig. 1. In the process of machine learning, the quality of information that external environment provides to the system is the primary factor. The external environment is outside information set that delivers itself in some form, it represents sources of outside information; Learning is the process that processes the outside information to knowledge, first it obtains the information of outside environment and then processes the information to knowledge, and puts these knowledge into the repository; Repository stores many general principles that guide a part of the implementation action, due to environment provides all kinds of information for learning system, the quality of information impacts directly on learning realization whether easy or disorderly.

Repository is the second factor that impacts the design of learning system. The expression of knowledge is varied, such as, eigenvector, logic statements of the first order, production rules, semantic networks and frameworks and so on, these fashions of expression each has its strong point.

Take into account four aspects when to choose: strong in expression, easy to infer, easy to modify repository, the knowledge is easy to expand. The implementation is the process that uses the knowledge of repository to complete a certain task, and to feed back the information which obtained in the progress of completing the task to the learning, and to guide further study.

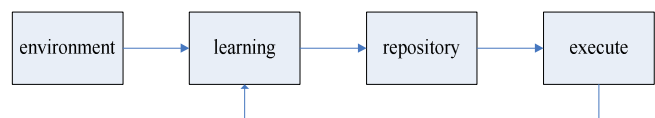


Figure 1. Basic model of machine learning

IV. THE METHODS OF MACHINE LEARNING

A. Rote Learning

Rote learning is a memory [2], that is to store the new knowledge and call for it when necessary. Calculation and reasoning learning system needn't remember any of their knowledge to access to. In the rote learning system, knowledge accessing is in a more stable and directing way. The system does not require too much processing. The implementation part of learning system can be considered abstractly as a function. Since the function receives the input of the variables (X_1, X_2, \dots, X_n) , then calculates and outputs the value of functions (Y_1, Y_2, \dots, Y_n) , rote learning memorizes the simple storage of $((X_1, X_2, \dots, X_n), (Y_1, Y_2, \dots, Y_n))$. When need $F(X_1, X_2, \dots, X_n)$, the implementation part simply searches the (Y_1, Y_2, \dots, Y_n) from the memory rather than re-calculates it. Learning model is as following:

$$\begin{array}{c} (X_1, X_2, \dots, X_n) \rightarrow (Y_1, Y_2, \dots, Y_n) \\ \xrightarrow{\text{storing}} \end{array} ((X_1, X_2, \dots, X_n) \rightarrow (Y_1, Y_2, \dots, Y_n))$$

Figure 2. Learning model

Attention: use appropriate storage way, make the rate of research as quickly as possible, ensure that the information stored can adapt to the changing needs of external environment, cannot reduce the efficiency of the system.

B. Inductive Learning

Inductive consequence applies inductive methods to summarize general knowledge from sufficient specific examples, and to distill general law of things. It is a consequence from individual to general. Inductive learning is a learning method which applies inductive consequence. According to the learning whether has the guidance of teachers, inductive learning can be divided into learning of examples and learning of observed. The former is the learning with teacher; the latter is the learning without teacher. The model of learning system is shown in Fig. 3:

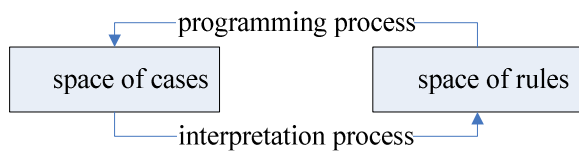


Figure 3. The model of learning system

The programming process chooses the examples through searching the space of cases, and submits the selected active examples to the interpretation process.

The programming process transforms the examples properly, and changes the active examples to some concept of the space of rules, to guide the search of the space of rules.

1) The Learning of Examples

The learning of examples concludes the learning methods of general concept through the examples related with a concept in the environment. Take a group of animals as an example, and tell the learning system which animal is "Ma", and which

is not. When the sample is enough, the learning system can conclude the conceptual model about "Ma", so it can identify "Ma", and can distinguish "Ma" from other animals.

2) The Learning of Observed

The learning of observed is also known as the descriptive summary, its goal is to identify general description of a law or a theory, depict observation set, and specify the nature of certain objects.

C. Analog Learning

Analogy can describe the similarity between objects clearly and concisely. Analogy learning carries out learning by comparing similar things. For example, when a professor wants to teach a new concept which is more difficult to understand to students, he or she always uses figure of speech between some of the examples that students have mastered and similar to the new concept, to enable students to have deep understanding by the analogy. Analogy learning includes four major processes:

1) Input a group of known conditions and a group of conditions without fully determined ;

2) For the two conditions inputted, according to its description, search the corresponding relation between each by a similar definition.

3) According to the method of similar transformation, mapped the concept, characters, methods and relations to a new issue, to get new knowledge needed to solve new problems.

4) Verify the new knowledge gained from the analogy of the new problems, and put the correct knowledge into repository. The knowledge unable verified is put in repository only as referenced knowledge.

The key to analog learning is the method of similar definition and similar transformation. The object based on similar definition changes with the purpose of the analog learning. If the purpose of learning is to gain some attributes of new issues, then the definition should be based on the similar attributes between new and old issues; if the goal of learning is to solve new problems, then analog should be based on the relationship between the state of new issues and the old problems.

D. Explained Learning

The learning based on the interpretation is called explained learning. Explained learning analyses and answers the current instances by the knowledge contained in the field and the concept knowledge is learning on, educe a cause and effect explanation tree which delegates the process of answering the instance. In the process of acquiring new knowledge, it learns new knowledge by explaining nature, phenomenon of token and internal relations and so on. The generalized process based on interpretation is shown in Fig. 4:

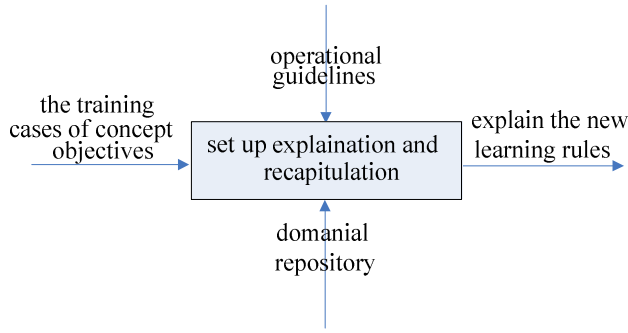


Figure 4. The generalized process based on interpretation

When the system is learning, first to find the reason why training examples are the proof of the target concept by domain knowledge, and then to extend the proof by the operational rules, last to get the universality description of the target concept, then you can use general knowledge expression formalization.

E. Learning Based on Neural Network

The nature of neural network depends on two main factors: the topology structure of network, right values and work rules of network. Combining of the two can form the main characters of a network. Learning problem of neural network is the problem of adjustment of network values.

There are two ways to determine the value of neural network: one is determined through the design calculations; another is determined by the study of network through certain rules. Most neural network uses the second method to determine the value of its network. The well-known network model and learning algorithm contains the back propagation arithmetic, Hopfield network and so on.

F. Knowledge Discovery

Knowledge discovery of repository is a senior managed process to identify effective, novel, potential, useful and understanding model from large amounts of data, the discovery process of knowledge is shown in Fig. 5:

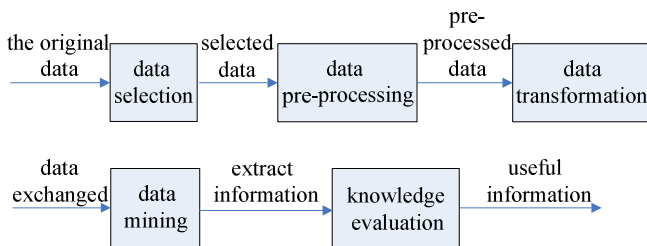


Figure 5. The discovery process of knowledge

Data selection extracts relevant data from database based on the needs of users. Data pre-processing gives data further processing, checks data's integrity and consistency, processes the noisy data, fills up the loss of data by statistical methods, and forms explored database. Data transformation chooses data from explored database, the methods of transformation mainly using discrimination analysis and clustering analysis. Data mining identifies the goal of what type of knowledge is to

discover based on user's requirements, then selects knowledge discovery algorithm by the selected knowledge, and extracts knowledge which users needed from database. Knowledge evaluation mainly valuates the acquired rules, then determine whether putting the rules into basic knowledge database. Knowledge discovery process can be generalized to three steps. That is, pretreatment of data mining, data mining, post-treatment of data mining. Knowledge discovery has been successfully applied in the banking, insurance, retail, health care, engineering and manufacturing, scientific research, satellite observation and entertainment industries and so on. It has provided a great help in people's scientific decision-making.

V. THE APPLICATION OF MACHINE LEARNING

Research shows that machine learning technology has been widely used in marketing, finance, telecommunications and network analysis.

In the field of marketing, machine learning technology is more widely used in the area of tasks classification-and-related; in the field of finance, machine learning technology is more widely used in tasks of forecasts; in the field of network analysis, machine learning technology is used in the relating tasks; in the field of telecommunications, machine learning technology is widely used in the tasks of classification, prediction and spy. In addition, machine learning is also applied in the field of data mining combination with other applications, the typical methods are based on the neural network initialization, the application of evolutionary computation in machine learning research, the study of level classification of machine learning, and machine learning based on rough set and so on [3,4,5,6].

VI. CONCLUSION

This paper introduces the concept of machine learning, the basic model and its application in many fields. Although there have gained some preliminary research results in the application of machine learning, yet the research is still immature, many issues need to be further studied and solved [7]. First of all, learning algorithm is only chosen from several classic algorithms, it lacks comparative analysis and design of new algorithm between these algorithms. In addition, current studies are mostly based on all of the collected data and rarely consider the sampling problem, if data sets are too large, there will need more time to collect and deal with these data. Furthermore, existing methods to identify the application types are very limited and rough, and they couldn't meet the needs of specific applications. So, in my opinion, the study of optimal recognition algorithms and combination methods [8] should be paid more attention in the future research.

VII. OUTLOOK

The research and application of machine learning has come into a new period of development, in the future, machine learning will develop new research in areas of theoretical concepts [9], computer rationale, integrated technology and promotion of the use [10,11,12] and so on. Therefore, the development of the structural model, theory, algorithms and hybrid learning is particularly important.

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