Review

A Comprehensive Survey on Machine Learning of Artificial Intelligence

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Abstract: Machine Learning of Artificial Intelligence explains the definition, concept, significance and main strategy of machine learning as well as the basic structure of machine learning system. By combining several basic ideas of main strategies, great effort is laid on introducing several machine learning methods, such as Rote learning, Explanation-based learning, Learning from instruction, Learning by deduction, Learning by analogy and Inductive learning, etc. Machine learning is a fundamental way that enable the computer to have the intelligence; its application which had been used mainly the method of induction and the synthesis rather than the deduction has already reached many fields of Artificial Intelligence.

Keywords: Machine Learning, Artificial Intelligence, ML Methods.

1. Introduction

The general focus of machine learning is there presentation of the input data and generalization of the learnt patterns for use on future unseen data. The goodness of the data representation has a large impact on the performance of machine learners on the data. A poor data representation is likely to reduce the performance of even an advanced, complex machine learner, while a good data representation can lead to high performance for a relatively simpler machine learner. Thus, feature engineering, which

focuses on constructing features and data representations from raw data, is an important element of machine learning.

Feature engineering consumes a large portion of the effort in a machine learning task, and is typically quite domain specific and involves considerable. Human input. For example, the Histogram of Oriented Gradients (HOG) and Scale Invariant Feature Transform (SIFT) are popular feature engineering algorithms developed specifically for the computer vision domain. Performing feature engineering in a more automated and general fashion would be a major breakthrough in machine learning as this would allow practitioners to automatically extract such features without direct human input.

Along with the development of Internet technology and multimedia, the study of Artificial Intelligence (AI) has emerged a number of new issues. AI has attracted the attention in many disciplines, which is used to simulate human thought. Scientists who in many different professional backgrounds get some new thoughts and new methods in the fields of AI. As a branch of computer science, these systems are showing a human intelligence and behavior characteristics. As a subject of computer science, AI has entered a stage of practical application in various departments on the many aspects of social life to play a role and continue moving in the direction of in-depth development.

2. Machine Learning

As humans, we are intuitively familiar with learning. We learn continuously, informally or formally, as we go about our lives. Learning involves the acquisition and integration of new knowledge. Learning implies that one's performance is improved in some way by new understanding gained through learning, enabling superior decision making or the exercise of new skills. Learning may be accomplished by instruction, where an external expert or source imparts knowledge, or by study, where one gathers knowledge through observation, experimentation, or experience. Learning underlies our ability to adapt to new or changing circumstances. "Machine learning" generally adheres to the same principles as human learning, but usually and explicitly within a particular problem domain and with foundational mathematical rigor rarely present in the mental picture we have of human learning [1].

However, the end result is the same: a program constructed applying machine learning principles improves the quality of its output (according to metrics of importance to the application) with training, exposure to past data, or through trial-and-error. Machine learning is useful when we have a set of data that is characterized by some unknown function (if there is no underlying order, however obscure, or if the data is random, then there is nothing to discover and learn).

If we want to decode Big Data and keep up with its exponential growth, we need to teach computers to think more like humans. Learning involves the acquisition and integration of new knowledge. Learning underlies our ability to adapt to new or changing circumstances. Means of

predicting correct function outputs when presented with new, previously unseen data. Aside from experiments specifically designed to model human learning to better understand our own brains and biological mechanisms, machine learning might be employed any time we want self-customizing programs that adapt to data sets or over time.

Machine learning can also accomplish tasks that would be difficult to program explicitly due to data complexity and difficult-to-enumerate processing procedures. Big Data can come from sensors and sources of almost any and all types, from text to video, raw or organized, and many challenges associated with mining such complex aggregations of data are well-suited to machine learning. The kinds of undirected association and classification tasks we want to perform to extract knowledge and meaning from the flood of Big Data are strengths of machine learning algorithms.

3. The Evolution of Machine Learning

Artificial Intelligence (AI), a concept that came into existence in the 1990s, is fast gaining popularity across industries. Deep Blue (the chess-playing computer developed by IBM), Watson (the artificially intelligent computer system specifically developed to answer questions on the quiz show Jeopardy!), and Google Chauffeur (the software powering Google's driverless car) are some landmarks in the field of AI, where computer programs have surpassed the capabilities of the human mind.

Machine Learning is a part of AI that continuously observes a series of actions performed over a period of time, and puts this knowledge to use by devising ways to perform similar processes better, in a new environment. In 1959, Arthur Samuel defined Machine Learning as the field of study that gave computers the ability to learn without being explicitly programmed. From initial efforts to explore whether computers could play games and mimic the human brain, this study has now grown into a broad discipline with the ability to produce statistical and computational theories of learning processes.

Today, although the field of Machine Learning is still nascent, it has found its way into daily user experience through applications like Google Maps that present accurate geographical data from satellite view to street view, and Netflix, which simulates the user experience through patterns of movie viewing habits. Other examples include applications used for speech and gesture recognition (Kinect), natural language processing (Siri), facial recognition (iPhoto), web search, spam filters, ad placement, credit scoring, fraud detection, stock trading, and drug design.

The technologies like Big Data, with capacity to process large volumes of data, is accelerating the growth of Machine Learning applications. Apache Mahout, a machine learning library for Hadoop, has a collection of scalable Machine Learning algorithms, executed in quick cycles with the innovative 'MapReduce' technology. These algorithms are remarkable in their ability to bring out hidden relationships among data sets and make predictions.

4. Concept and Significance of Machine Learning

The Concept of Machine Learning Machine learning (ML) is, studying how the computer to simulate or to realize the study behavior of human being. The aim is to obtain the new knowledge or the skill, organize the knowledge structure, which can make progressive improvement of its own performance. It is a fundamental way that enable the computer to have the intelligence. The ML research establishes the computation model or the understanding model, according to the study mechanism of humanity through the physiology, the science, which develops each kind of study theory and the study method, studies the general algorithm and carries on the theoretically analysis.

The Significance of Machine Learning Research is whether machine is able to surpass the human's or not, the main argument of the people is that, the machine is man-made, its performance and the movement are completely stipulated by the designer, therefore its ability cannot surpass designer in any case. This is right for the machines which do not have study ability, but is worth considering for the learning capability machine. Because the ability of this kind of machine can be increased constantly in the application, after period of time, even the designer would not know the level of its ability. The ML has the extremely important status in the AI research. Its application has been throughout the various branches of AI, such as expert systems, automated reasoning, natural language understanding, pattern recognition, computer vision, intelligent robots and other fields. Specific applications such as search engines, medical diagnosis, detection of credit card fraud, stock market analysis, DNA sequencing sequences, voice and handwriting recognition, strategy games and the use of robots.

5. Basic Structure of Machine Learning System

The diagram in figure 1 is the basic structure of ML. The environment provides certain information to the learning part of system, and the learning part revisions knowledge library by using this information. In the environment of concrete application, the knowledge library and the execution part have decided the concrete work content the learning part which needed to solve the problem to be determined completely by the above three parts. We are going to narrate the impact of these three parts to design the learning system separately as follows: The most important factor which affects to learn system design is the information which is provided to the system by the environment, specifically, or the information quality. Knowledge stored in guiding the implementation of part of the general principles of action. However, the environment and to the learning system is provided by a variety of information. If the information quality is higher and the difference of the general principle of equality is smaller, then the learning part is quite easy to deal with.
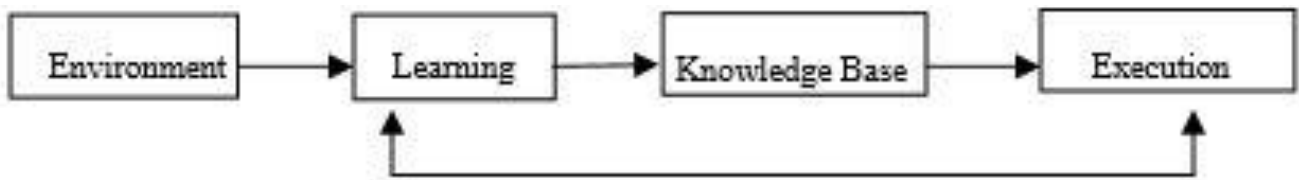
Figure 1. The Basic Structure

If learning system to provide guidance and disorderly implementation of specific action specific information, the learning system deletes of the unnecessary details after gaining sufficient data, sums up the promotion, to form the general principles of guiding the action, and puts it into the knowledge base. Then the task of learning some of is heavier, the design is more difficult. Because the information obtained from the learning system is often incomplete, reasoning is not entirely reliable which is carried out by reasoning. The rules summed up by reason is correct possibly, or not. This must be tested through the implementation of the effect [3]. The correct rules make the system efficiency improve, it should be retained; the incorrect rules should be modified or be deleted from the database. The knowledge base is the second factor which affects to the learning system design.

The knowledge expressed in various forms, for instance, characteristic vector, step logic sentence, production pattern rule, semantic network and frame and so on. These expressions have their characters respectively, when you choose any one of these expressions, you must take into four aspects account: (1) Ability to express strong (2) Easy reasoning (3) It is easy to modify Knowledge Base (4) Knowledge Representation is easy to expand. A question finally needs to explain which regarding the knowledge library is studies the system not to be able not to completely have in any knowledge situation the baseless knowledge acquisition, each learning system all requests to have certain knowledge to understand the environment provides the information, the analysis comparison, makes the supposition, examines and revises these suppositions. Therefore, to be exactly, the learning system is to the existing knowledge expansion and the improvement

The execution part is core of the entire learning system, because operative part of the action is aimed at improving learning action. With the implementation of some related three issues are: complexity, feedback and transparency.

6. Common Learning Method Based on Learning Strategy

The learning strategy is a reasoning strategy which is used in the process of learning system. The learning system is always composed by two parts, the learning and the environment. It has divided into the following five basic types:

6.1. Rote Learning

The rote learning is the simplest machine learning method. The rote learning is the memory. That is, the new knowledge is stored, the supply and demand wants when retrieves transfers, but does not need to calculate and the inference. When the rote learning system operative to solve problems, the system remembers these questions and the solutions. We can regard the learning system execution part as some function abstractly, before calculating and outputting the function value (y1, y2,…, yp), this function obtains the independent variable input value (x1, x2,…, xn). The rote learning makes a simple memory storage in the memory ((x1, x2,…, xn), (y1, y2,…,yp)). When it needs f(x1, x2,…, xn), but the execution part on (y1, y2,…, yp) retrieves from the memory rather than recalculation. This kind of simple learning pattern is as follows: (x1,x2,…x n) f   (y1,y2,… yp) store   ((x1,x2,…x n), (y1,y2,…yp))

6.2. Explanation-based Learning

The goal concept, a concept example, the domain theory which provides according to the teacher and operational guidelines. First, a structure explanation showed satisfies the goal concept for the assorted this example. Then, explained the promotion satisfies for target concept may operate the criterion the sufficient condition. EBL has been widely applied in the knowledge base refinement and the improvement of the system performance.

6.3. Learning from Instruction

The student (teachers or other information sources such as textbooks and so on) gains the information from the environment, transforms the knowledge into the expression form which the interior may use, and combines the new knowledge with the original knowledge organically. Therefore, the student is required to have certain degree inference ability. However, the environment still have to do a lot of work. The teacher proposes and organizes knowledge by some form, to increase the knowledge which the student has continuously. This learning method is similar with human society's school teaching way. The learning duty is to establish a system that enables it to accept the guidance and the suggestion, stores and applies the learning knowledge effectively. At present, many expert systems use this method to realize the knowledge gain when they established the knowledge base.

6.4. Learning by Deduction

The deductive reasoning is used by the student the reasoning embarks from the axiom, infers the conclusion after the logical transformation. This kind of reasoning is a process that is from" fidelity" transform to specialize (specialization), the student can obtain the useful knowledge in the reasoning

process. This learning method contains macro-operation learning, the knowledge edition and the Chunking technology. The inverse process of deductive reasoning is inductive reasoning.

6.5. Learning by Analogy

Analogy is one kind of useful and effective inference method, it can succinctly describe similarity clearly between the objects; at the same time, it also (either teacher) shifts certain test similar nature duty from the orator to the listener (or student). Through the analogy, using the similarity between two different domains (source territory, goal territory) of the knowledge, (including similar characteristic and other nature) infers the goal territory from the source territory knowledge the corresponding knowledge, we can learn from it. The analogy learning needs more reasoning than the three kinds of learning ways above. It requests (source territory) to retrieve the available knowledge generally from the knowledge source, then transforms it into the new form, apply it to the new condition (goal territory). The analogy learning is playing the vital role in the human science and technology history, many scientific discoveries are obtained by the analogy.

6.6. Inductive Learning

The inductive learning is the most widely as a symbol learning methods. It expressed conceives the supposition from the example the process. The teacher or the environment provides some examples or the counterexample in some concept, lets the student obtain the general description in this concept through the inductive reasoning. This kind of learning reasoning work load is heavier than the demonstration learning and the deduct learning, because the environment does not provide the general concept description (for example axiom). To some extent, the number of induction learning reasoning is heavier than the analogy learning, because there is no one similar concept can be used as " source concept ". The inductive learning is the most basic method, its development is a mature learning method as well, it has been used to research and apply widely in the artificial intelligence domain.

7. Conclusion

AI science is the only way that raises the machine intelligence level. Only improve the machine-learning function continuously, can we make the machine close to or surpasses the humanity's intelligent level. To the ML discussion and the ML research progress, will certainly make the artificial intelligence and the entire science and technology further development.

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