Exploring the basics of Machine Learning in Artificial Intelligence

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Abstract: *The recent extraordinary growth of artificial intelligence and its applications has been paralleled by a surge of interest in machine learning, a field concerned with the developing computational theories of learning processes and building learning machines. Because the ability to learn is clearly fundamental to any intelligent behavior. The concern and goals of machine learning are central to the progress of artificial intelligence. The basic idea behind the paper is to explore the basics of Machine Learning in Artificial Intelligence. Artificial Intelligence (AI) is "The study and design of Intelligent System". In simple words Artificial Intelligence can be defined as the process of "Generating Intelligence in Machines". In order to have intelligence in machines, the machine must have planning, Diagnosis, Speech Recognition, Vision Recognition, Game Playing, NLP (Natural Language Processing) and Prediction for each to work and give efficient result the backbone is Machine Learning. Learning may play a role to develop new systems or make changes in already established systems. Machine Learning has a very important role in Artificial Intelligence, the paper tries to explore the importance of Machine Learning thus to know the role it plays in it. The role of Machine Learning touch both the Psychological aspects and as well as the Technical aspects. The paper touches the topics like types of machine learning methods. At the end an attempt has been made to have a look at the aspects of machine learning. Machine learning has a great future. Recent advances in the field of machine learning method along with successful applications across a wide variety of field such as Bioinformatics, promise powerful new tools for practicing scientist. This viewpoint highlights some useful characteristics of modern machine learning methods and their relevance to scientific applications. We conclude with some speculations on near term progress in promising directions.*

Keywords: Artificial Intelligence, Information Technology, Machine Language, Bio-informatics

I. Introduction

Artificial Intelligence (AI) is the branch of Computer Science that deals with the ability of machines to adapt and react to different situations as human do i.e. Artificial intelligence (AI) is " The study and design of intelligent System". In simple words Artificial Intelligence can be defined as the process of "Generating Intelligence in Machines". In order to achieve artificial intelligence, we must first understand the nature of intelligence. Intelligence can be simply defined as a set of properties of the

mind. These properties include the ability to plan, solve problems, and in general, reason. A simpler definition could be that intelligence is the ability to make the right decision given a set of inputs and a variety of possible actions. Using this simple definition of intelligence (making the right decision), we can apply this not only to humans, but also to animals that exhibit rational behavior. But the intelligence that is exhibited by human beings is much more complex than that of animals. For example, humans have the ability to communicate with language, but so do some animals. Humans can also solve problems, but the same can be said of some animals. One difference then is that humans embody many aspects of intelligence (the ability to communicate, solve problems, learn and adapt) where animals typically have a small number of intelligent characteristics, and usually at a much lower level than humans.

II. Areas of AI

Artificial Intelligence is currently being used in the following areas:

1. Banks and other financial institutions rely on intelligent software, which provide accurate analysis of the data and helps make predictions based upon that data.
2. Stocks and commodities are being traded without any human interference- all thanks to the intelligent systems.
3. Artificial intelligence is used for weather forecasting.
4. It is used by airlines to keep a check on its system.
5. Robotics is the greatest success story, in the field of artificial intelligence. Spacecrafts are send by NASA and other space organizations into space, which are completely manned by robots. Even some manufacturing processes are now being completely undertaken by robots. Robots are being used industrial processes, that are dangerous to human beings, such as in nuclear power plants.
6. Usage of artificial intelligence is being used largely in various speech recognition system, such as IBM via Voice software and Windows Vista.

III. Machine Learning

Human intelligence is a behavior that incorporates a sense of purpose in actions and decisions. Intelligent behavior is not a static procedure. What ever may be the level of intelligence it is created through learning and as in this case the learning is done by machines so it should be better referred to as "Machine Learning". Learning can be defined as behavioral changes over time that better fulfill an intelligent being's sense of purpose, and is a fundamental aspect of intelligence. An understanding be replicated of intelligent behavior will be realized when either intelligence is replicated using machines, or conversely when we prove why human intelligence cannot be replicated.

Learning may play a role develop new systems or to make changes in already established systems. In an attempt to gain insight into intelligence, researchers have identified three processes that comprise of intelligence: searching, knowledge representation, and knowledge acquisition. The field of AI can be broken down into various smaller

components, each of which relies on these three processes to be performed properly. They are: game playing, expert systems, neural networks, natural language processing, and robotics programming, Planning, Diagnosis, Speech Recognition, and Vision Recognition. For each to work and give efficient result the **backbone is Machine Learning.**

Machine learning refers to a system capable of the autonomous acquisition and integration of knowledge. This capacity to learn from experience, analytical observation, and other means, results in a system that can improve its own speed of performance, i.e., its efficiency and effectiveness. The question here arises is that "What machines can do as intelligent machines"- Philosophers have been trying for over two thousand years to understand and resolve two big questions of the universe: how does a human mind work, and can non- humans have minds? However, these questions are still unanswered. Some philosophers have picked up the computational approach originated by computer scientists and accepted the idea that machines can do everything that humans can do. Others have openly opposed this idea, claiming that such highly sophisticated behavior as love, creative discovery and moral choice will always be beyond the scope of any machine. The nature of philosophy allows for disagreements to remain unresolved. In fact, engineers and scientists have already built machines that we can call 'intelligent'. So what does the word 'intelligence' mean? Let us look at a dictionary definition:

1. Someone's intelligence is their ability to understand and learn things.
2. Intelligence is the ability to think and understand instead of doing things by instinct or automatically.

The first point focus on intelligence as the "Quality possessed by humans". But the second definition suggests a completely different approach and gives some flexibility; it does not specify whether it is someone or something that has the ability to think and understand. Now we should discover what thinking means. Let us consult our dictionary again. Thinking is the activity of using your brain to consider a problem or to create an idea. So, in order to thin, someone or something has to have a brain, or in other words, an organ that enables someone or something to learn and understand things, to solve problems and make decisions. We can define intelligence as 'the ability to learn and understand, to solve problem and to make decisions'.

Now going through the various application areas of Artificial Intelligence may also us to know what level of Intelligence is required.

- **Game playing**

You can buy machines that can play master level chess for a few hundred dollars. There is some AI in them, but they play well against people mainly through brute force computation-looking at hundreds of thousands of positions.

To beat a world champion by brute force and known reliable heuristics requires being able to look at 200 million positions per second.

- **Speech Recognition**

In the 1990s, computer speech recognition reached a practical level for limited purpose. Thus, United Airlines has replaced its keyboard tree for flight information by system using speech recognition of flight numbers and city names. It is quite convenient. On the other hand, while it is possible to instruct some computers using speech, most users have gone back to the keyboard and mouse as still more convenient.

- **Understanding Natural Language**

Just getting a sequence of words into a computer is not enough. Parsing sentences is not enough either. The computer has to be provided with an understanding of the domain the text is about, and this is presently possible only for very limited domains.

- **Computer Vision**

The world is composed of three-dimensional objects, but the inputs to the human eye and computers' TV cameras are two dimensional. Some useful programs can work solely in two dimensions, but full computer vision requires partial three-dimensional information that is not just a set of two-dimensional views. At present there are only limited ways of representing three-dimensional information directly, and they are not as good as what humans evidently use.

- **Expert Systems**

A "Knowledge engineer" interviews experts in a certain domain and tries to embody their knowledge in a computer program for carrying out some task. How well this works depends on whether the intellectual mechanisms required for the task are within the present state of A.I. when this turned out not to be so, there were many disappointing results. One of the first expert systems was MYCIN in 1974, which diagnosed bacterial infections of the blood and suggested treatments. It did better than medical students or practicing doctors, provided its limitations were observed. Namely, its ontology included bacteria, symptoms, and treatments and did not include patients, doctors, hospitals, death, recovery, and events occurring in time. Its interactions depended on a single patient being considered. Since the experts consulted by the knowledge engineers knew about patients, doctors, recovery, etc. it is clear that the knowledge engineers forced what the experts told them into a predetermined framework. In the present state of AI, this has to be true. The usefulness of current expert systems depends on their users having common sense.

- **Heuristic classification**

One of the most feasible kinds of expert system given the present knowledge of AI is to put some information in one of a fixed set of categories using several sources of information. An example is advising whether to accept a proposed credit card purchase. Information is available about the owner of the credit card, his record of payment and also about the item he is buying and about the establishment from which he is buying it (e.g., about whether there have been previous credit card frauds at this establishment). The above brief study of the various areas of Artificial Intelligence give a great hind regarding what level of intelligence is required in machines and a last what level of learning capabilities will be required to gain

knowledge thus for better efficiency and enhancement. Going back to Machine Learning introduction it can be defined as the technique **"To create self-improving software".**

IV. Types of Machine Learning

The machine learning is of two main types.

a) **Supervised Learning**
b) **Unsupervised Learning**

a) Supervised Learning

The machine learning is done from supervised training data. The training data consist of a set of training examples. In supervised learning, each example is a pair consisting of an input object and a desired output value. A supervised learning algorithm analyzes the training data and produces an inferred function, which is called a classifier also called as a regression function. The inferred function should predict the correct output value for any valid input object. This requires the learning algorithm to generalize from the training data to unseen situations in a "reasonable" way. The parallel task in human and animal psychology is often referred to as concept learning. The purpose of the supervised learning algorithm is to create prediction function the training data. The following steps are used as guide lines supervised learning-

1. Determine the type of training examples.
2. Gather a training set. The training set needs to be representative of the real-world use of the function. A set of input objects is gathered and corresponding outputs are also gathered, either from human experts or from measurements.
3. Determine the input feature representation of the learned function. The accuracy of the learned function depends strongly on how the input object is represented. Typically, the input object is transformed into a feature vector, which contains a number of feature should not be too large, because of the curse of dimensionality; but should contain enough information to accurately predict the output.
4. Determine the structure of the learned function and corresponding learning algorithm. For example, the engineer may choose to use support vector machines or decision trees.
5. Complete the design. Run the learning algorithm on the gathered training set. Some supervised learning algorithms require the user to determine certain control parameters. These parameters may be adjusted by optimizing performance on a subset of the training set, or via cross- validation.
6. Evaluate the accuracy of the learned function. After parameter adjustment and learning, the performance of the resulting function should be measured on a test set that is separate from the training set.

b) Unsupervised Learning

Unsupervised machine learning gives the AI program the freedom to experiment, determining the most effective methods to achieve the intended result. Unsupervised learning is generally used to classify items into groups or choose appropriate actions. Unsupervised learning involves the sorting of groups of items that fit into a particular category. By comparing data, the AI program is able to find similarities among each data set. This allows the program to sort the entries into groups as needed by the programmers.

Gathering data, and sorting it in this fashion, is particularly helpful to business intelligence efforts, which add value to a business through categorizing and analyzing patterns in data. Unsupervised learning is used to find patterns in the data. This allows the data to be reduced and segmented into its representative classes. Comparing the two types it is found that unsupervised learning has some advantage over supervised learning that is unsupervised learning allows the AI program to determine the best, most efficient or most effective means of solving a puzzle, reaching conclusions, or even playing a game, without the limitations of human error or prejudice.

V. Methods of Machine Learning

- Statistical classification
- Association rule learning
- Hierarchical clustering
- Partition clustering
- Reinforcement learning

VI. Future Prospects

After going through the various types of machine learning now the interest shifts towards seeing its future prospects. Machine learning methods play a key role in the world of computer science, within an important and growing niche. While there will remain software application where machine learning may never be useful, the niche where it will be used is growing rapidly as applications grow in complexity, as the demand grows for self-customizing software, as computers gain access to more data, and as we develop, machine learning algorithms. Beyond its obvious role as a method for software development, machine learning is also likely to help reshape our view of computer science more generally. By shifting the question from "how to program computers" to" how to allow them to program themselves," machine learning emphasizes the design of self-monitoring systems that self-diagnose and self-repair, and on approaches that model their users, and the task advantage of the steady stream of data flowing through the program rather than simply processing it. Similarly, Machine Learning will help reshape the field of statistics, by bringing a computational perspective to the fore and rising issues such as never- ending learning. Of course both computer science and statistics will also help shape Machine Learning as they progress and provide new ideas to change the way we view learning.

It is expected that in the future, such machines will be developed having basic common sense, similar to human beings, although pertaining to specific areas only. It is also expected that the human mind functions, such as learning by experience, learning by rehearsal, cognition and perception will also be performed by future intelligent machines. In fact, research and experiment are being conducted to recreate the human brain. Cortex, a project by Artificial Development Inc., California, and Swiss government's IBM sponsored Blue Brain Projects, are two main ventures, whose goal is to simulate the human brain. Whether this brain will have human consciousness incorporated in it- there is still no answer for that. In addition to these some questions that add to the research in the area of machine learning are-

1. Can we build never – ending learners?
2 Can machine learning theories and algorithms help explain human learning?
3. Can we design programming languages containing machine learning primitives?

4. Will computer perception merge with machine learning?

At the end exploration of the field of machine learning has given birth to a number of new questions and ideas to get implemented in future with having a thorough undertaking of the concept. So the study continues to explore many more aspects at last to start our research work.

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