Machine Learning

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Introduction

Artificial Intelligence (AI) is the simulation of human intelligence by machines. This is a special branch in Computer Science (CS). Machine Learning (ML) is closely related to AI. It allows to a specific machine to learn itself automatically without any human interaction. Basically, in machine learning, there are specific algorithms that can get data, processing data (Mainly by using statistically accepted methods) and predict the output in acceptable range.

There are many fields in computer science that machine learning is used. Gaming, Data mining, pattern identification… are few of them.

Key features in Machine Learning Algorithms

There are many Machine Learning Algorithms are available in modern Computer Science. But all should have three key features.

- **Evaluation**-This means, how to evaluate user hypotheses. In such evaluation, we can see there are many key features like accuracy, predictions …etc.
- **Representation**- This means, how to represent the knowledge. In modern Computer Science, there are various ways to do this. For instance, data structures, neural networks, decision trees…etc.
- **Optimization**- This means, the way of user's program generates the knowledge. For instance, Combinatorial Optimization, Convex Optimization...etc.

Machine Learning Concepts.

Machine learning is closely related to computational statistics. It means that many machine learning algorithms are based on statistical concepts. There are three main categories in Machine Learning. In machine learning, there are various categories that based on various

aspects. At the first level, ML is completely depended on its algorithms. Those algorithms can be divided into three classes.

1. **Supervised Learning**

First class is supervised learning algorithms. Such algorithms are required human support both in training with predefined conditions with known data sets. This learning process iterates until the model achieves acceptable level. Then, the model can be applied with new data set.

There are two subsets in supervised learning;

- **Regression problems**- If the output variable is a continues value (for instance weight, height…etc.), we can say that supervised learning belongs to Regression problems.
- **Classification problems**- If the output variable is a discrete value (for instance male, female…etc.), we can say that supervised learning belongs to Classification problems.

1.2 Semi Supervised Learning

This includes training data sets as above. But, it is smaller than above mentioned Supervised Learning. Nevertheless, it is used a large data set after training. There are many applications in data mining for Semi Supervised Learning.

2. Unsupervised Learning

But in contrast, for unsupervised algorithms it is not required any human support in training and applying new data sets. Such algorithms are automatically review the provided data set and will work on desired data set. Such deep learning algorithms can be applied to more complicated tasks.

Unsupervised Learning has two sub sets;

- **Cluster Analysis-** In such problem, it is group the given data upon various conditions. Such analysis in used in education field to cluster students.
- **Association -** In such problems, it will discover relationships in the given data set.

3. **Reinforcement Learning**

In this Machine Learning type, the machine is trained to act given an observation or make specific decisions. This likes trial and error learning. The machine takes its actions based on its past experience and new choices. The new knowledge that gained in past actions is used to make accurate new decisions.

Prerequisite for Machine Learning

The main pre-request for machine Learning is data analysis. In data analysis, you need statistics, calculus, Algebra. Not only that you need a good knowledge in programming. There are various programming languages that can be used in Statistics. A good example is R programming.

Not only that, it is better to have a good knowledge in spreadsheet software like Microsoft Excel (You can use Visual Basic programming in Excel).

Real life application in Machine Learning

1. Internet Search Engines – Many search engines use Machine Learning to get better results in cyber searching. A good example is Google. This well-known search engine uses Machine Learning to achieve better individual search results.

2. Weather forecast – Modern weather forecasting is used Machine learning heavily. By using Machine Learning, the accuracy of the prediction can be increased.

3. Gaming - Using Machine Learning, gamers can gain a good experience in playing.

4. Anti-Malware software – Today malicious activities are spreading in large scale. Therefore, it is difficult to react millions of such activities. The Machine Learning can be applied in such occasions to react for such cases efficiently.

5. Face detection/Recognition - The human face can have various moods. Therefore, Machine learning can be used to detect/identify the same face various moods.

6. Speech detection/Recognition – Machine Learning can be used to detect human voices efficiently.

7. Clustering- Clustering is used in various fields to identify the pattern, groups…etc. For instance, in Genetics and Education clustering is used to group data sets.

Breakthrough has occurred in the field of machine learning in the last 5-10 years

There are many major leaps in Machine learning last 5-10 years. It is listed major leaps as follows.

- **Speech Detection** – This is a major victory in Machine Learning. Because, usage of any natural language is different from person to person. To identify person's speech even sometimes difficult to us also. To identify the correct word of a natural language speech is a major victory in Machine Learning.
- **Optical Character Recognition –** If your writing is on an image, you cannot edit with word processor like Microsoft Word. But using OCR ability, your computer can extract words from the image and publish to the word processor. This is a very difficult task, when it is come across with Asian Languages like Sinhala. Because, such languages have characters that can be appeared as very similar to each other.
- **3 D Space –** There are many 3D things we meet every day. 3D drawings, 3D games, 3D animations…etc. To accomplish better 3D space in various fields is a major victory in Machine Learning.
- **Clustering –** Working with big data and grouping them correctly is a major victory in Machine Learning. In such analysis researchers and scientists can identify the nature of big data sets and use them in decision making.

- **Self-drive Vehicles –** Many researchers and scientists are working on self-drive vehicles. There are many developments in this field. Researchers and scientists are able to develop cars, trucks, SUVs that can drive without drivers. Google cars are good example for this.

Challenges remain in the field of machine learning

Today, Machine Learning has been developing rapidly in day by day. But there are few challenges, which are still facing by researchers and scientists in Machine Learning.

- **Big Data** – Today, it is essential to work with big data. Especially in services like financial, educational fields, there are many big data sets. By carful analyzing such data, it is easy to reveal particulars from big data sets. But still identification of proper and accurate data patterns is still challenge for Machine Learning. However, researchers are working on this challenge to identify data patterns efficiently.
- **Optical Character Recognition –** OCR is one of great breakthrough of Machine Learning. But identifying handwritten characters of Asian natural languages like Sinhala, Sanskrit…etc. are still a big challenge in Machine Learning.
- **Biomedical Image Analysis** - Biomedical Image Analysis is a rapidly advancing field in Machine Learning. It is required, Machine Learning modeling techniques to deeply analyze such images. But it is still a challenge to use with low level visual contents for these techniques.
- **Cybersecurity –** Today, Machine Learning plays big role in cyber security. But hackers are changing their strategies constantly. To work against automatically for changing strategies is a big challenge in Machine Learning.
- **E Learning** – E learning is a big business today. But AI based E learning systems are still developing today. There are many challenges in such systems. For instance,

precisely identifying of a student and his learning pattern is a big challenge in Machine Learning.

- **Cyber Searching** – Today, Machine Learning is using Cyber searching in large scale. Search Engines like Google use Machine Learning to identify user's real requirements. But still there are many challenges in using different languages. Because, especially in Asian Languages, some words have different meaning in place to place. Therefore, still it is developing Machine Learning techniques to identify the correct requirements of the user in cyber searching.

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