Machine Learning & Deep Learning Applications

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**Abstract**

The intelligent construction robots similar to the human brain are known as artificial intelligence (AI In computer engineering, artificial intelligence (AI) is the learning of "expert systems", which are machines that are aware of their environment and take action to improve their chances of success. "Artificial intelligence" is a term used to describe a system that is capable of performing tasks that people associate with other human brains, such as "learning" and "problem-solving". Machines must be capable of learning. Therefore machine learning is a subset of AI. As a result, the expectations of the machines increase. This strategy is demonstrated through deep learning. It includes the subfield of machine learning.

**Keywords:** Deep learning, Machine Learning, Artificial Intelligence

1. **INTRODCUTION**

**Machine Learning**

A subset of artificial intelligence called machine learning employs methods (such as deep learning) that allow machines to learn from experience and become better at completing tasks. The following steps form the foundation of the learning process:

Put the information in an algorithm. (During this step, for example, you can provide more data to the model by performing feature extraction.)

To train the model, use the data below.

* Deploying and testing the model.

Use a deployed model to automatically perform a prediction task. (Or, call the deployed model and use it to get the predictions that are returned from it.)

**Deep Learning**

A branch of machine learning called "deep learning" uses artificial neural networks as its foundation. Since artificial neural networks have different inputs, outputs and hidden layers, the learning process is complex. Each layer has components that convert the incoming data into knowledge that the lower layer can use to perform a specific predictive task. This structure enables the machine to learn by processing its own data.

**Artificial Intelligence**

A method called artificial intelligence (AI) enables computers to emulate human intelligence. It has machine learning.

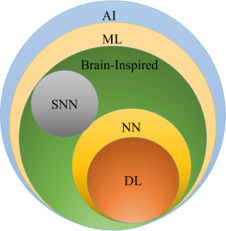


Figure 1. Shows the relationship between Artificial Intelligence (AL), Machine Learning (ML) and Deep Learning (DL) [[5]](https://www.sciencedirect.com/science/article/pii/S2666285X21000042#bib0034).

You can create computer programs and systems that use machine learning and deep learning approaches to perform activities that are often attributable to human intelligence. These include language translation, speech recognition, and picture and image recognition.

1. **TECHNIQUES OF MACHINE LEARNING VS. DEEP LEARNING**

Let us now compare Machine Learning and Deep Learning once you have an idea of ​​both the methods. In machine learning, it is necessary to instruct an algorithm to produce correct predictions by consuming additional data (for example, by performing feature extraction). Since artificial neural networks are built for deep learning, algorithms can learn how to make accurate predictions by digesting their own data. [2].

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| --- | --- | --- |
| **Base** | Machine Learning | Deep Learning |
| **Number of data points** | Can make predictions using a small amount of data. | There is a need to generate predictions using a lot of training data. |
| **Hardware dependencies** | Can work on low-end computers. It does not require a lot of processing power. | Depends on sophisticated equipment. It already performs many matrix multiplication operations. These operations can be effectively optimized using the GPU. |
| **Featurization process** | Demands that users accurately identify and build features. | Develops new features automatically, learning higher-level features from data. |
| **Learning approach** | Divides learning into more manageable stages. The results of each step are then combined to form an output. | One moves through the learning process by working through the problem from start to finish. |
| **Execution time** | Training requires a short amount of time, ranging from just a few seconds to a few hours. | Due to the many layers of deep learning systems, training usually takes a long time. |
| **Output** | Typically, the result is a number, such as a score or classification. | Output can come in a variety of media, such as text, music or sound. |

Table 1: Techniques of Machine Learning Vs. Deep Learning

1. **APPROACHES IN MACHINE LEARNING**

There are three classification types used in ML algorithms: supervised, unsupervised, and reinforcement learning.



Figure 2: Machine learning approaches [[4]](https://www.sciencedirect.com/science/article/pii/S2666285X21000042" \l "bib0004)

**Supervised Learning**

A supervised learning employs an algorithm that solicits external assistance. The training and test datasets are created using the provided input database. The training database is used to predict or categorize the output variables. During database training, algorithms attempt to learn certain shapes, and then they apply these new patterns to the test database to produce results in inference [4].

**Unsupervised Learning**

The machine learning approach called unsupervised learning selects certain properties of the incoming data. After provisioning of a new database, it uses previously discovered traits to identify the data class. It is mostly preferred for both clustering and feature reduction.

**Reinforcement Learning**

Action based decision concept learning is known as reinforcement learning. In this learning, decisions are followed by actions to increase the value of the results in the desired outcome or favorable situation. However, the learner lacks any prior knowledge of the data. It learns to choose the appropriate course of action after being presented with the situation. The learner's choice, or action taken, has an impact on the situation now and in the future. Only two conditions—delayed outcome and trial-and-error finding—are used in reinforcement learning [5].

1. **APPLICATIONS OF MACHINE LEARNING**

Computer vision, forecasting, text analytics, natural language processing and information extraction are just a few of the many application domains of machine learning.

Figure 3: Applications of machine learning

**Image Recognition**

The most popular use of machine learning is image recognition. It is used to identify things like digital photos, people, places and objects. Automated friend tagging suggestions are a common use for face and image recognition.

Facebook provides us with the automatic friend tagging recommendation option The facial recognition and recognition technology used in machine learning is what gives us an automatic tagging recommendation with names whenever we submit a picture of one of our Facebook friends.

It is based on Facebook's "Deep Facial" technology, which uses facial recognition and human recognition in photos.

**Speech Recognition**

When using Google, we have the option of "Search by Voice", which comes under Speech Recognition and is a well known machine learning application. Speech recognition, often referred to as "text-to-speech" or "computer speech recognition", is the process of converting spoken commands into text. Speech recognition applications currently use machine learning algorithms extensively. Speech recognition technology is used by Alexa, Google Assistant, Siri, Cortana and Microsoft Cortana to execute voice commands.

**Traffic prediction**

When we want to travel to a new place, Google Maps comes handy as it provides us with the best route and predicts the traffic conditions. It uses two methods to forecast traffic conditions, such as whether it will be clear, slow, or clogged:

* Real-time location of the vehicle determined by sensors and the Google Maps app
* In the past it took an average of time on the same days.

Everyone who uses Google Maps contributes to its improvement. To boost performance, it receives data from the user and distributes it back to its database.

**Product recommendations**

### Amazon, Netflix and other e-commerce and entertainment businesses often use machine learning to recommend products to users. Due to machine learning, whenever we look for a product on Amazon, we end up seeing ads for the same product when using the same browser to browse the internet. Google uses a variety of machine learning algorithms to assess user interests and make product recommendations based on those interests.

### The way we get recommendations for entertainment series, movies, etc while using Netflix, this is accomplished with the help of machine learning.

### **Self-driving cars**

### Self-driving automobiles are one of the most interesting uses of machine learning. Self-driving cars rely heavily on machine learning. The best-known automaker, Tesla, is developing a self-driving vehicle. To train the model of the car to recognize people and objects while driving, unsupervised learning was used.

### **Email Spam and Malware Filtering**

Every new email that we get is immediately classified as essential, common, or spam. Machine learning is the technology that enables us to consistently receive essential emails marked with the key sign in our inboxes and spam emails in our spam boxes. Here are some of the spam filters that Gmail uses:

* Content Filter
* Header filter
* General blacklists filter
* Rules-based filters
* Permission filters

For email spam filtering and virus identification, some machine learning methods are used, including multi-layer perceptions, decision trees, and the Nave Bayes classifier.

**Virtual Personal Assistant**

We have a variety of virtual personal assistants, including Siri, Cortana, Alexa, and Google Assistant As the name suggests, they help us to search for information using our voice commands. Our voice commands to these assistants, such as "play music," "call someone," "open an email," and "schedule an appointment," can support us in a variety of ways, among others. These assistants capture our voice commands, transmit them through cloud servers, decode those using ML algorithms, and then respond as needed.

**Online Fraud Detection**

Machine learning makes online transactions safe and secure through fraudulent transaction detection. When we conduct an online transaction, fraudulent transactions can occur in a number of ways, including the use of fake accounts and identification documents, and theft of money in between transactions. As a result, the feed forward neural network helps us determine whether a transaction is legitimate or fraudulent.

For each valid transaction, the output is converted into a set of hash values, which are then used as input for subsequent rounds. Each legitimate transaction has a unique pattern that changes when a fraudulent transaction occurs; As a result, it can be identified and our online transactions can be made secure.

**Stock Market trading**

Machine learning is often used in trading in the stock market. Since there is always a chance that share prices may move up and down, machine learning's Long Term Memory Neural Networks are used to predict stock market patterns. **Medical Diagnosis**

Machine learning is used in medical science to diagnose disorders. As a result, medical technology is developing rapidly and is now capable of producing 3D models that can pinpoint the precise location of brain lesions. This makes it easier to search for brain tumors and other brain-related conditions.

**Automatic Language Translation**

These days, it is not a problem if we travel to a new place where we are unfamiliar with the language as machine learning also helps us in this by translating the text into our native languages. This function is offered by Google's GNMT (Google Neural Machine Translation), which uses neural machine learning to automatically translate text in our native language. A sequence learning method, used in conjunction with picture recognition and text translation from one language to another, is a technology underpinning automatic translation.

1. **APPLICATIONS OF DEEP LEARNING**

Deep learning is a subset of machine learning. It is a huge neural network consisting of many layers and settings. Most deep learning methods rely on neural network design. As a result it is also known as deep neural network. The following examples highlight some of the most cutting-edge deep learning application innovations:

**Self-Driving Cars:**

In self-driving cars, analyzing large amounts of data enables them to take in the scenery around them. They then decide whether to turn left, turn right or stop. As a result, it will decide what steps should be taken to further reduce the incidence of each year.

**Voice Controlled Assistance**

Siri is the first thing that comes to mind when we discuss voice control assistance. Siri will find and offer whatever it wants to do for you, so you can ask it to do anything.

**Automatic Image Caption Generation**

The algorithm will work in such a way that it will generate a caption for each image you provide If you type "blue eye", an image of the blue eye will appear, along with a caption below.

**Automatic Machine Translation**

We can translate one language into another with the help of automatic machine translation and deep learning. Deep learning is mostly suitable for scaling applications due to data requirements, GPU hardware and feature engineering. Data-dependent deep learning techniques are those that work well with lots of data and are referred to as such. The term "GPU" stands for "Graphics Processing Unit" and describes an advanced processor [1].

1. **DISCUSSION**

There are many applications including computer vision, natural language processing, semantic analysis, machine learning prediction fields, and deep learning techniques. The ability of DL to extract high-level features from given data, known as feature engineering, differentiates it from ML. As a result, deep learning is opening up for new applications in various fields. "There are many projects in precision agriculture, consumer finance and medicine, where deep learning has a tremendous impact and grows rapidly," writes Andrew Ng in the Quora post.

1. **CONCLUSION**

Machine learning uses a set of algorithms to analyze and interpret data, learn from it, and then make the best decisions based on those learnings. Deep learning uses layers of artificial neural networks as its foundation Deep learning and machine learning are studied in depth, and their applications are investigated. Nowadays, machine learning is directly or indirectly used by everyone. From getting product recommendation while shopping online to updating images on social networking sites. It also explains the history of machine learning and deep learning, along with their main features, shared traits, and differences. This indicates that deep learning has a new range of applications and has the potential to produce excellent results in the future. The ongoing nature of the research may result in the development of a new architecture.

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