Machine Learning & Deep Learning Applications

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**Abstract**

Making robots intelligent in the same way as the human brain is known as artificial intelligence (AI). In computer engineering, artificial intelligence (AI) is the study of "expert systems," which are machines that are aware of their environment and take actions to improve their chances of success. "Artificial intelligence" is the term used to describe a system that is capable of performing tasks that people associate with other human minds, such as "learning" and "problem-solving." Machines must be capable of learning. Machine learning is therefore a subset of AI. As a result, expectations for machines are raised. This strategy is demonstrated via deep learning. It includes the subfield of machine learning.

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

1. **INTRODCUTION**

**Machine Learning**

A subset of artificial intelligence called machine learning employs methods (like 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 information into an algorithm. (During this step, you can provide the model more data by performing feature extraction, for instance.)

* To train a model, use the data below.
* To deploy and test the model.

Utilize the deployed model to carry out a prediction task automatically. (Or, call the deployed model and utilize it to get the predictions it has returned.)

**Deep Learning**

A branch of machine learning called "deep learning" uses artificial neural networks as its foundation. Because artificial neural networks have various input, output, and hidden layers, the learning process is complex. Each layer has components that convert the incoming data into knowledge that the following layer can utilize to perform a specific predicted task. This structure enables a machine to learn by processing its own data.

**Artificial Intelligence**

A method called artificial intelligence (AI) enables computers to simulate human intelligence. There is machine learning in it.

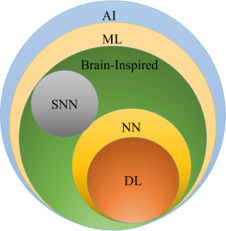


Figure 1. Shows the correlation between artificial intelligence (AL), machine learning (ML), and deep learning (DL) [[5]](https://www.sciencedirect.com/science/article/pii/S2666285X21000042" \l "bib0034).

You can create computer programmes and systems that do activities that are frequently attributed to human intellect by utilizing machine learning and deep learning approaches. These include language translation, speech recognition, and picture and image recognition.

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

Let's compare machine learning and deep learning now that you have an idea of both methodologies. In machine learning, it is necessary to instruct the algorithm on how to produce correct predictions by consuming additional data (for example, by performing feature extraction). Because artificial neural networks are built for deep learning, the algorithm may learn how to produce a precise forecast by digesting its own data [2].

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| --- | --- | --- |
| **Base** | Machine Learning | Deep Learning |
| **Number of data points** | Can create predictions using a small amount of data. | Needs to generate predictions using a lot of training data. |
| **Hardware dependencies** | Can operate on low-end computers. It doesn't require a lot of processing power. | Depends on sophisticated equipment. It already does many matrix multiplication operations. These operations can be effectively optimized using a GPU. |
| **Featurization process** | Demands that users accurately identify and build features. | Develops new features on its own while learning high-level features from the data. |
| **Learning approach** | Divides learning into more manageable steps. The outcomes of each phase are then combined to create one output. | Moves through the learning process by working through the issue from beginning to end. |
| **Execution time** | Training just requires a little amount of time, from a few seconds to a few hours. | Due to the several layers of a deep learning system, training typically takes a long time. |
| **Output** | Typically, the result is a number, such as a score or a classification. | The output might 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**

Three categorization types are 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 calls for outside assistance. Training and testing datasets are created using the input database that is provided. The training database is used to predict or categories the output variable. During database training, algorithms attempt to learn a few shapes, and they then apply these new patterns to the testing database to produce results in estimation [4].

**Unsupervised Learning**

A machine learning approach called unsupervised learning picks up on some properties of the incoming data. Following the provision of a fresh database, it makes use of 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 outcomes at the intended outcome or favorable situation. The learner, however, lacks any prior knowledge of the data. It learns to select the appropriate course of action after being presented with the situation. The learner's choice, or the action taken, has an impact on the circumstance now and in the future. Only two conditions—delayed outcome and trial-and-error search—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 for machine learning.

Figure 3: Applications of machine learning

**Image Recognition**

One of the most popular uses of machine learning is image recognition. It is used to identify things like digital photos, people, places, and items. Automatic buddy tagging suggestion is a common use for face and image recognition.

Facebook offers us an automatic buddy tagging recommendation option. The face identification and recognition technique used in machine learning is what gives us an automatic tagging recommendation with names whenever we submit a photo of one of our Facebook friends.

It is based on the "Deep Facial" technology from Facebook, which handles face recognition and human identification in photos.

**Speech Recognition**

When using Google, we have the option to "Search by voice," which falls under speech recognition and is a well-known machine learning application. Speech recognition, often known as "Speech to text" or "Computer speech recognition," is the process of turning 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 carry out voice commands.

**Traffic prediction**

When we wish to travel to a new location, Google Maps comes in handy because it offers us the best route and anticipates traffic conditions. It uses two methods to forecast traffic conditions, such as whether it will be clear, moving slowly, or jam-packed:

* The vehicle's real-time location as determined by sensors and the Google Maps app
* It took an average amount of time on similar days in the past.

Everyone who uses Google Map contributes to its improvement. In order to boost performance, it receives data from the user and delivers it back to its database.

**Product recommendations**

### Amazon, Netflix, and other e-commerce and entertainment businesses frequently utilize machine learning to recommend products to users. Because of machine learning, whenever we look for a product on Amazon, we begin to see advertisements for the same product while using the same browser to browse the internet. Google uses a variety of machine learning algorithms to assess user interests and makes product recommendations based on those interests.

Similar to how we get recommendations for entertainment series, movies, etc. when we use Netflix, this is likewise accomplished with the aid of machine learning.

### **Self-driving cars**

### Self-driving automobiles are one of the most intriguing uses of machine learning. Self-driving cars heavily rely on machine learning. The most well-known automaker, Tesla, is developing a self-driving vehicle. In order to train the car models 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 important sign in our inbox and spam emails in our spam box. Here are a few spam filters that Gmail employs:

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

For email spam filtering and virus identification, some machine learning methods are utilized, including Multi-Layer Perceptron, Decision tree, and Nave Bayes classifier.

**Virtual Personal Assistant**

We have a variety of virtual personal assistants, including Siri, Cortana, Alexa, and Google Assistant. They assist us in discovering the information using our voice commands, as the name says. Our voice commands to these assistants, such as "Play music," "Call someone," "Open an email," and "Schedule an appointment," among others, can support us in a variety of ways.

Machine learning algorithms are a key component of these virtual assistants. These assistants capture our voice commands, transmit them via a cloud server, decode those using ML algorithms, and then respond as necessary.

### **Online Fraud Detection**

### Through the detection of fraud transactions, machine learning makes online transactions safe and secure. When we conduct an online transaction, a fraudulent transaction may occur in a number of ways, including the use of fictitious accounts and identification documents and the theft of money in the middle of a transaction. As a result, Feed Forward Neural Network assists us in identifying this by determining if the transaction is legitimate or fraudulent.

### For each legitimate transaction, the output is transformed into a set of hash values, which are then used as the input for the subsequent round. Every legitimate transaction has a unique pattern that changes when a fraud transaction occurs; as a result, it may be identified and our online transactions are made safer.

### **Stock Market trading**

### Trading on the stock market frequently makes use of machine learning. Since there is always a chance that share prices may go up and down, machine learning's long short term memory neural network is utilized to predict stock market patterns.

### **Medical Diagnosis**

### Machine learning is utilized in medical science to diagnose disorders. As a result, medical technology is developing quickly and is now able to create 3D models that can pinpoint the precise location of brain lesions.

### It makes it easier to discover brain tumors and other conditions related to the brain.

### **Automatic Language Translation**

### These days, it is not an issue at all if we travel to a new location where we are unfamiliar with the language because machine learning also assists us in this by translating the text into our native tongues. This function is offered by Google's GNMT (Google Neural Machine Translation), which uses neural machine learning to automatically translate the text into our native tongue.

# A sequence to sequence learning method, used in conjunction with picture recognition and text translation from one language to another, is the technology underpinning automatic translation.

# **APPLICATIONS OF DEEP LEARNING**

Deep learning is a subset of machine learning. It is a massive neural network with numerous layers and settings. The majority of deep learning methods rely on neural network designs. It is also referred to as deep neural networks as a result. The following examples highlight some of the most cutting-edge deep learning application innovations:

**Self-Driving Cars:**

In self-driving cars, analyzing a vast quantity of data allows them to take in the visuals of their surroundings. They then decide whether to turn left, right, or halt. As a result, it will decide what steps to take to further reduce the incidents that occur each year.

**Voice Controlled Assistance**

Siri is the first thing that comes to mind when we discuss voice control help. Siri will look for and present whatever you want it to do for you, so you can tell it to do anything.

**Automatic Image Caption Generation**

The algorithm will operate in such a way that it will generate a caption for each image you supply. If you type "blue colored eye," an image of a blue eye will appear, along with a caption at the bottom.

**Automatic Machine Translation**

We can translate one language into another with the aid of automatic machine translation and deep learning.

Deep learning is suitable for extending applications mostly 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 upgraded processor [1].

1. **DISCUSSION**

There are several 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 characteristics from given data, known as feature engineering, sets it apart from ML. As a result, deep learning is starting to take on new applications in a variety of fields. "There are several projects in precision agriculture, consumer finance, and medical, where deep learning has a tremendous impact and grows rapidly," writes Andrew Ng in a Quora post.

1. **CONCLUSION**

A set of algorithms is used in machine learning to analyses and interpret data, learn from it, and then make the best decisions possible 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 examined. Nowadays, machine learning is used by everyone, whether directly or indirectly. From receiving product recommendations when shopping online to updating the images on social networking sites. It also elaborates on the history of machine learning and deep learning as well as their main characteristics, shared traits, and differences. This indicates that deep learning has a new range of applications and has the potential to yield outstanding outcomes in the future. A new architecture may develop as a result of the ongoing nature of research.

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