

Deep Learning Vs Machine Learning: What's The Difference?

Introduction

Deep learning and Machine learning both these terms are used interchangeably in the domain of Artificial Intelligence (AI). Hence it's quite important to know the key differences between deep learning and machine learning. The easiest way to understand the comparison of machine learning and deep learning is to know the fact that deep learning is the subset of machine learning only. And both of these technologies are the subset of Artificial intelligence. Nowadays everyone is talking about artificial intelligence, and automating human tasks with the help of AI. Every company wants to incorporate the power of AI in its current technology to maximize its revenue. AI is a huge field, machine learning and deep learning are part of it.

As you can see in the above image, AI is the superset, ML comes under the AI and deep learning comes under the ML. Talking about the main idea of **Artificial Intelligence**, it is to automate human tasks and to develop intelligent machines that could learn without human

intervention. It deals with making the machines smart enough so that they can perform those tasks which normally require human intelligence. Self-driving cars are the best example of artificial intelligence. These are the robot cars that can sense the environment and can drive safely with little or no human involvement.

Now, **Machine learning** is the subfield of Artificial Intelligence. Have you ever thought about how youtube knows which videos should be recommended to you? How does Netflix know which shows you'll most probably love to watch without even knowing your preferences? The answer is machine learning. They have a huge amount of databases to predict your likes and dislikes. But, it has some limitations which led to the evolution of deep learning.

Have you ever wondered how Google translates an entire webpage to a different language in just a few seconds? How does your phone gallery group images based on locations? Well, the technology behind all of this is deep learning. **Deep learning** is the subfield of machine learning which uses an "artificial neural network"(A simulation of a human's neurons network) to make decisions just like our brain makes decisions using

neurons. Deep learning tries to mimic the way the human brain operates. As we learn from our mistakes, a deep learning model also learns from its previous decisions.

What is Machine Learning?

Machine learning (ML) is the subset of artificial intelligence that provides the “ability to learn” to the machines without being explicitly programmed. We want machines to learn by themselves. But how do we make such machines? How do we make machines that can learn just like humans? So, the answer lies in how humans learn things. Suppose you want to teach a 2-year-old kid about fruits. You want him to identify apples, bananas, and oranges. What strategy will you follow? Firstly you’ll show him several fruits and tell him see this is an apple, see this is an orange or banana. After showing several fruits you’ll expect the kid to identify the fruit by himself and most probably he will do it. This is how exactly a machine learns.

As shown in the above image, we first feed the data into the machine. Input and its corresponding output make the initial data. This data is also

known as training data. This training dataset is used to build a predictive model. After that, this model is used to predict the output for some other new input. Inputs that are used to test the performance of a model are called test data. Now the accuracy of the prediction depends on the quality of data that you've given to train the model aka training data.

Note: In simple programming, we write the code or algorithm, give the input, and get the output. But in machine learning, we give the input and output to the machines and let them learn from it. After that, we give another input to make predictions using the model.

Limitations of Machine Learning

Now, let us look at some limitations of ML which led to the evolution of Deep Learning.

- ML models are not capable of doing feature engineering by themselves. Now, what is feature engineering? Feature Engineering is the process of handling the features in such a way that it results in a good model. Suppose you have the task of classifying apples and oranges. If done using machine learning you have to tell the features based on which they both can be differentiated. These features could be the size, color, stem length,

and so on and so forth. This data needs to be prepared by the humans and then it is fed to the machine. On the other hand, with deep learning, these features are automatically picked by the neural network. In a nutshell, In machine learning, feature engineering is done by humans explicitly but in deep learning, it is done by the model itself without human intervention.

- Machine learning algorithms cannot solve complex AI problems like Natural Language Processing, Image Recognition, etc.
- ML models do not perform well with very large datasets.

Deep learning models are capable of overcoming all these limitations. Let's see what exactly deep learning is and how it solves all these problems.

What is Deep Learning?

Deep learning is a type of machine learning inspired by the human brain. The idea of **Deep learning** is to build learning algorithms or models that can mimic the human brain. As humans have neurons in their brain to process something, in the same way deep learning algorithms have

artificial neural networks to process the data. This artificial neural network acts as neurons for the machines. Now the question arises how it overcomes the limitations of machine learning like feature engineering.

As discussed, Deep learning is implemented through Deep Neural Networks. The idea of neural networks is totally based on neurons of the human brain. Here we just give the raw input to a multilayer neural network and it does all the computation. Featuring engineering is done automatically by this artificial neural network by adjusting the weightage of each input feature according to the output.

Now, let's dive into the working of neural networks by taking the same example of classifying images of apples and bananas. Suppose you want to recognize an image of an apple having dimensions 15px by 15px. In total, we have 225 pixels and these 225 pixels are fed to the 1st layer of neural networks. The first layer of a neural network is called the input layer and the last layer is known as the output layer. All the other layers between input and output are known as hidden layers. A neural network can have any number of hidden layers. Each layer of the neural network

consists of a bunch of neurons. At neurons the actual data processing takes place. The information is transferred from one layer to another layer via weighted channels (Channels which have some weight associated with them). These channels transform the input data within the hidden layers. The input gets multiplied with the weight value of the channel and then output is passed to the next layer. On getting the information from the previous layer, current layer neurons get activated and start their processing. During this whole process weights of each channel are continuously adjusted in order to give the best results.

Deep Learning Vs Machine Learning

Let us look at some key differences between machine learning and deep learning.

	Machine Learning	Deep Learning
Definition	Subfield of AI that focuses on machines being able to learn without being explicitly programmed.	Subfield of ML that focuses on machines being able to mimic the human brain to perform highly complex AI problems.
Data Feeding	We give structured data to the machine that builds the ML model.	We give unstructured data or you can say the raw input to the neural network.
Volume of Data	ML models deal with datasets having thousands of data rows.	Deep learning models mostly deal with datasets having millions of data rows.
Training Time	ML models take less time in training because of the small data size.	It takes a huge amount of time because of massive data points.

Human Involvement	Machine learning models are easy to build but require more human interaction to make better predictions.	Deep learning models are difficult to build as they use complex multilayered neural networks but they have the capability to learn by themselves.
Feature Engineering	Feature engineering is done explicitly by humans.	No need of feature engineering, neural networks automatically detect important features.
Goal	To give the output as close as it can be to the expected output.	To mimic the human brain processing, how they actually think. If somehow machines are able to think that way they will automatically generate the right output.
Interpreting Results	It is easy to explain the results of an ML model.	It is difficult to explain the results of a deep learning model since it's hard to interpret the output of a complex multi-layered neural network.
Performance	ML models show good performance on small and medium-sized datasets.	Deep learning models show better performance on huge datasets.
Applications	Fraud detection, Recommendation systems, Pattern recognition, and so on.	Customer support, Image processing, Speech recognition, Object recognition, Natural language processing, computer vision, and so on.

Conclusion

In this article, you were introduced to artificial intelligence and its two most popular techniques namely machine learning and deep learning. You've learned about what exactly these two terms mean and what were the limitations of ML that led to the evolution of deep learning. You also learned about how these two learning techniques are different from each other.

FAQs

1. Is deep learning and machine learning the same?

No, they are not the same. As we've discussed earlier, they both are the subfields of AI and deep learning is the subset of machine learning. Machine learning algorithms work only on structured data. If the data is unstructured then humans have to perform the step of feature engineering. On the other hand, Deep learning has the capability to work with unstructured data as well.

2. Which is better: deep learning or machine learning?

Deep learning and machine learning both are playing a crucial role in today's world. ML models are good for small and medium-sized datasets. On the other hand, deep learning models require large datasets to show accurate results. Ultimately, it totally depends on your use case.

3. Is deep learning more accurate than machine learning?

The accuracy of models highly depends on the size of the input dataset that is fed to the machines. When the dataset is small ML models are preferable. Similarly, when the dataset is large, deep learning models are preferable. It also depends on the quality of training data. If you've not done feature engineering properly then ML models could show poor results even on a small dataset.

4. Is Lstm a deep learning method?

Yes, LSTM stands for Long-Short Term Memory and they come under deep learning. They are a part of recurrent neural networks. It's a complex area of deep learning.

5. Should I learn deep learning first?

No. You should learn machine learning first and then you can go for deep learning. Machine learning involves mathematical models that are required in order to learn deep learning algorithms. First learn about basic ML algorithms like Linear regression, Logistic regression, and so on. Deep learning is much more complex than machine learning.

6. Which is difficult to learn? Deep learning or machine learning?

Deep learning is comparatively difficult to learn because it includes the study of multi-layered neural networks. People get scared at first sight only and they don't even start. But once you start, you'll get to know how interesting it is. You can refer to some courses on Coursera. Deeplearning.ai has some great free courses there.

7. Why is deep learning popular now?

Deep learning is helping so many AI developers nowadays. Everyone is talking about artificial intelligence irrespective of the knowledge they

have about AI. The popularity of deep learning is mainly because of the following two reasons:

- Over the years we have accumulated a huge amount of data to process and our traditional ML models are not capable of handling that.
- Neural networks require machines with high computation power and now everyone has powerful machines and also the urge to explore this fascinating field of computer science.

8. How to choose between machine learning and deep learning?

If you're working on some AI project and you're confused about which algorithm will give the best result then consider asking these questions to yourself:

- What is the size of the dataset?

If it's huge like in millions then go for deep learning otherwise machine learning.

- What's your main goal?

Just check your project goal with the above applications of machine learning and deep learning.

- How's your data?

If it's structured, use a machine learning model and if it's unstructured then try neural networks.

9. Where deep learning is used?

In the medical industry, it is used to analyze MRI images to detect cancer.

In customer support, when most people converse with customer support agents the conversation seems so real that they don't even realize it's actually a bot on the other side.

Self-driving cars are now a reality because of deep learning.

Virtual Assistants like Alexa, Siri, and Google Assistant all are built using deep learning algorithms.

Deep learning is used in entertainment industries like Netflix, Amazon, and Youtube to give users personalised recommendations.

Takeaway

Deep learning and Machine learning both come under artificial intelligence. Deep learning is the subset of machine learning. Machine learning is about machines being able to learn without programming and deep learning is about machines learning to think using artificial neural networks. Deep learning networks require less human intervention as the multiple layers of neural networks process the data which eventually learn through their own mistakes and errors.