Master in Innovation Management

Friday, 28th April 2023, 6 PM (CET)

Module VII: Artificial Intelligence And Machine Learning. The interaction between The Two Approaches.

- The dimensions of the AI. Learning from data. Main algorithms. The models. The most useful features for the transformation of processes and products.

SPEAKER

Claudia Tarabù
University Researcher

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Welcome to the seventh lesson of the Master In Innovation Management of Ascheri Academy.

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Webinar 28th April 2023

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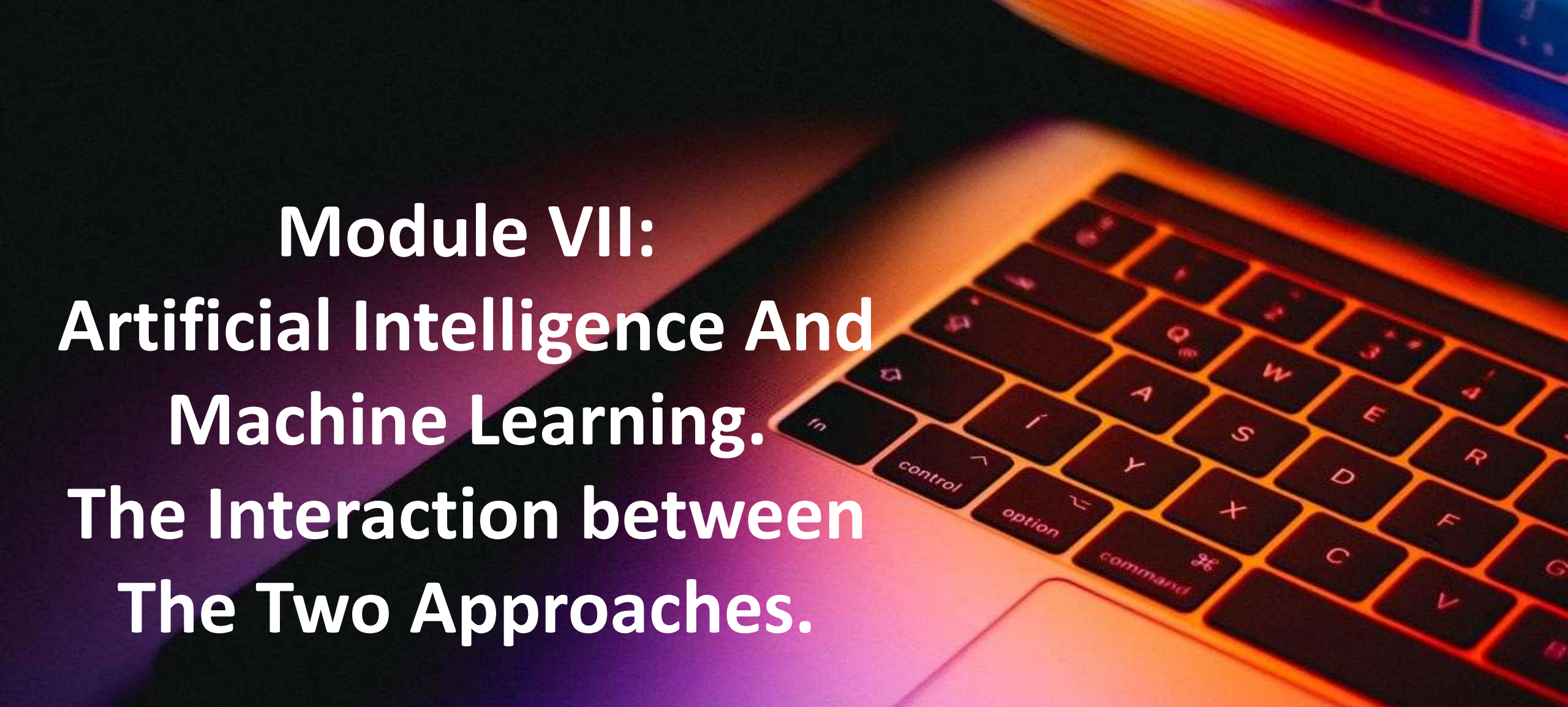
Module VII: Artificial Intelligence And Machine Learning. The Interaction between The Two Approaches.



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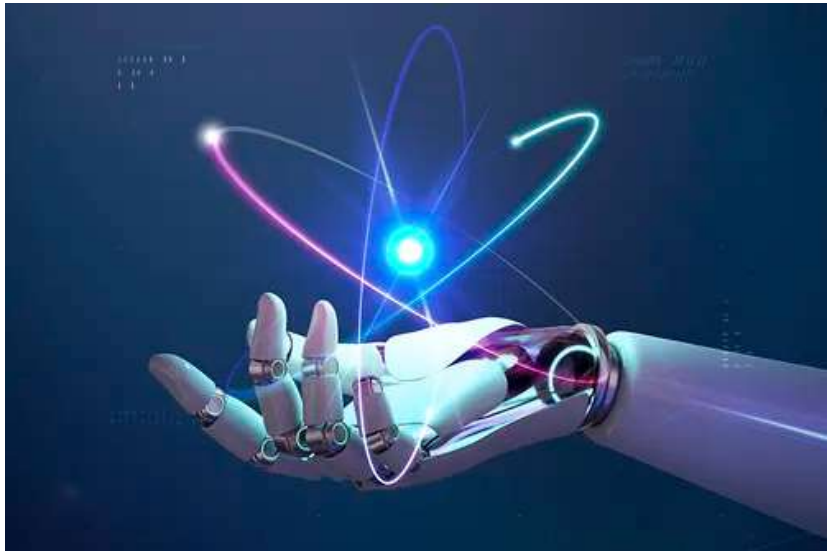
Introduction to Artificial Intelligence

According to the father of **Artificial Intelligence**, John McCarthy, it is *"The science and engineering of making intelligent machines, especially intelligent computer programs."* **AI is a computer program that performs something smart. It can be a complex statistical model or an if-then statement. The if-then statements are simple rules programmed by humans.**

There are several top-notch technologies that come under the umbrella of AI. The three forces (Data, Algorithms and Computing power) that brought AI to life is being popularly quoted as Trinity of Artificial Intelligence. We can also say that AI is a technique for building systems that mimic human behavior or decision-making.



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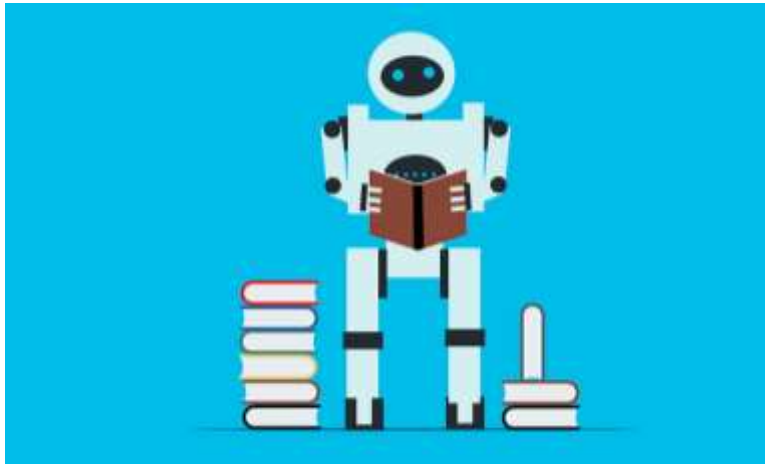
Introduction to Machine Learning



Machine learning is a subset of AI that uses data to solve tasks. **These solvers are trained models of data that learn based on the information provided to them. This information is derived from probability theory and linear algebra. ML algorithms use our data to learn and automatically solve predictive tasks.** These predictions could be accurately recognizing speech or spotting humans or traffic signs in front of a self-driving car. One of the most important aspects of machine learning is that it doesn't require any human intervention to make changes when required. This makes it highly efficient.

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Introduction to Deep Learning

Deep Learning is a subset of machine learning, which is essentially a neural network with three or more layers. These neural networks attempt to simulate the behavior of the human brain—albeit far from matching its ability—allowing it to “learn” from large amounts of data. While a neural network with a single layer can still make approximate predictions, additional hidden layers can help to optimize and refine for accuracy.

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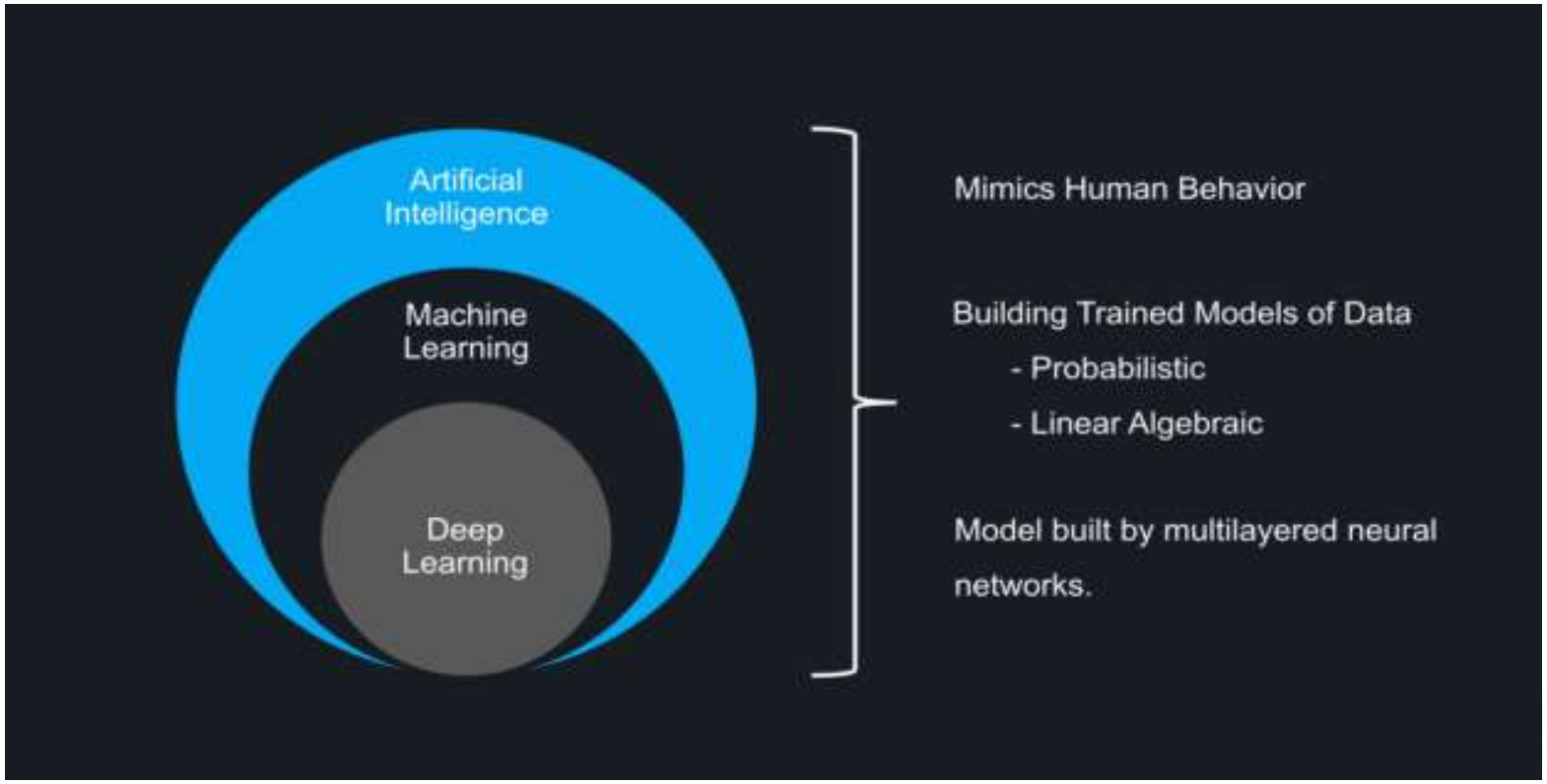
Comparing AI vs ML vs DL



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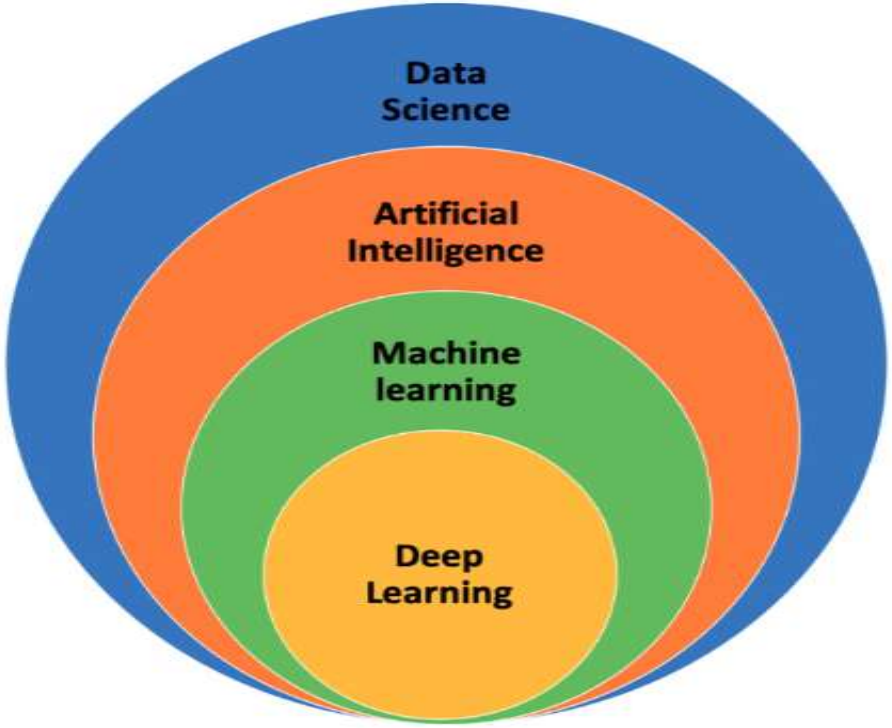
Relationship between DS, AI, ML and DL



(Source: diagram of Robert Hoyt; *Digital Health and Healthcare Quality: A Primer on the Evolving 4th Industrial Revolution*. Available from: https://www.researchgate.net/publication/344954449_Digital_Health_and_Healthcare_Quality_A_Primer_on_the_Evolving_4th_Industrial_Revolution)

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Let's watch this introductory video 👀

https://www.youtube.com/watch?v=ad79nYk2keg

(Source: Simplilearn)

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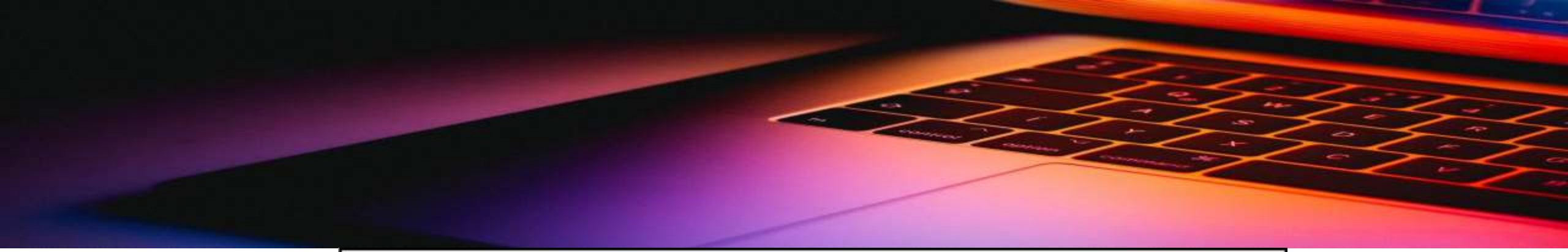
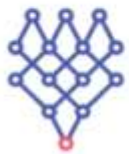


Types of AI

The emergence of artificial superintelligence will change humanity, but it's not happening soon. Here are the types of AI leading up that new reality.

Reactive AI	Limited memory	Theory of mind	Self-aware
Good for simple classification and pattern recognition tasks	Can handle complex classification tasks	Able to understand human motives and reasoning. Can deliver personal experience to everyone based on their motives and needs.	Human-level intelligence that can bypass our intelligence, too
Great for scenarios where all parameters are known; can beat humans because it can make calculations much faster	Able to use historical data to make predictions	Able to learn with fewer examples because it understands motive and intent	
Incapable of dealing with scenarios including imperfect information or requiring historical understanding	Capable of complex tasks such as self-driving cars, but still vulnerable to outliers or adversarial examples	Considered the next milestone for AI's evolution	
	This is the current state of AI, and some say we have hit a wall		



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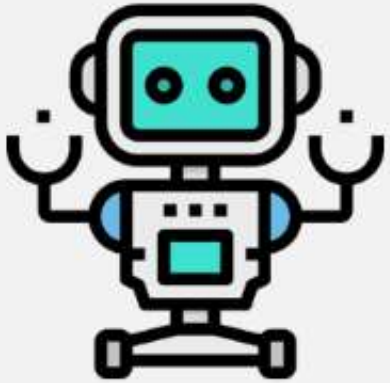
(Source: Huawei.com)

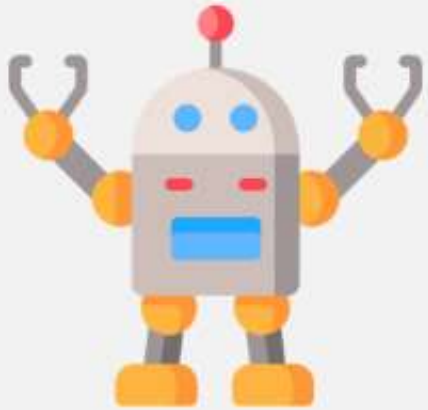
Types of Machine Learning

Supervised Learning



Unsupervised Learning

Reinforcement Learning



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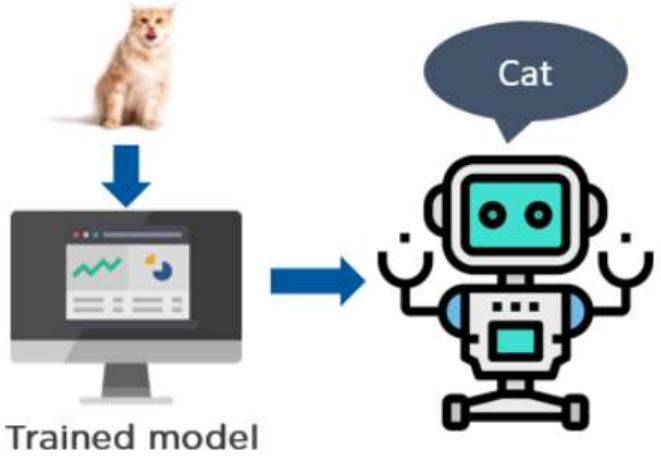
Supervised Learning

Supervised learning is a **type of machine learning that uses labeled data to train machine learning models**. In labeled data, the output is already known. The model just needs to map the inputs to the respective outputs. Some of the most popularly used supervised learning algorithms are:

- Linear Regression;
- Logistic Regression;
- Support Vector Machine;
- K Nearest Neighbor;
- Decision Tree;
- Random Forest;
- Naive Bayes.



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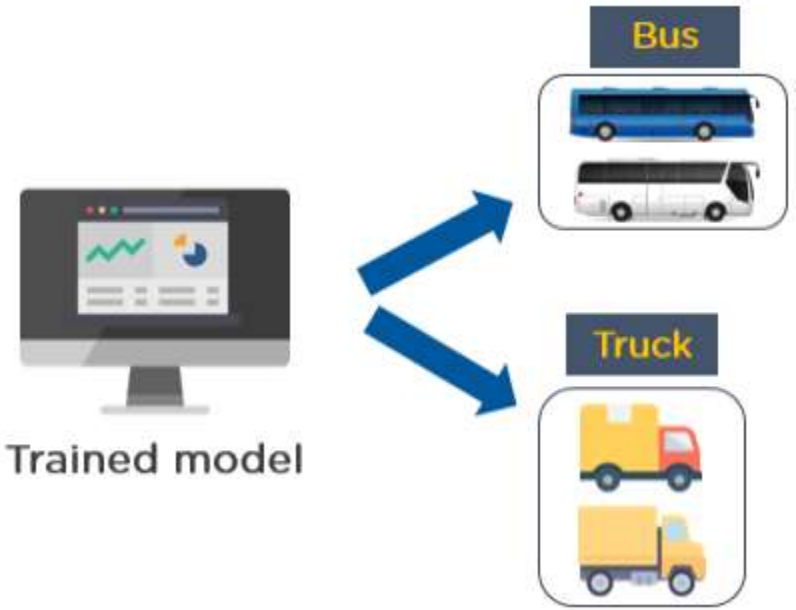
Unsupervised Learning

Unsupervised learning is a type of machine learning that uses unlabeled data to train machines. Unlabeled data doesn't have a fixed output variable. The model learns from the data, discovers the patterns and features in the data, and returns the output. Selecting the right algorithm depends on the type of problem you are trying to solve. Some of the common examples of unsupervised learning are:

- K Means Clustering;
- Hierarchical Clustering;
- DBSCAN;
- Principal Component Analysis.



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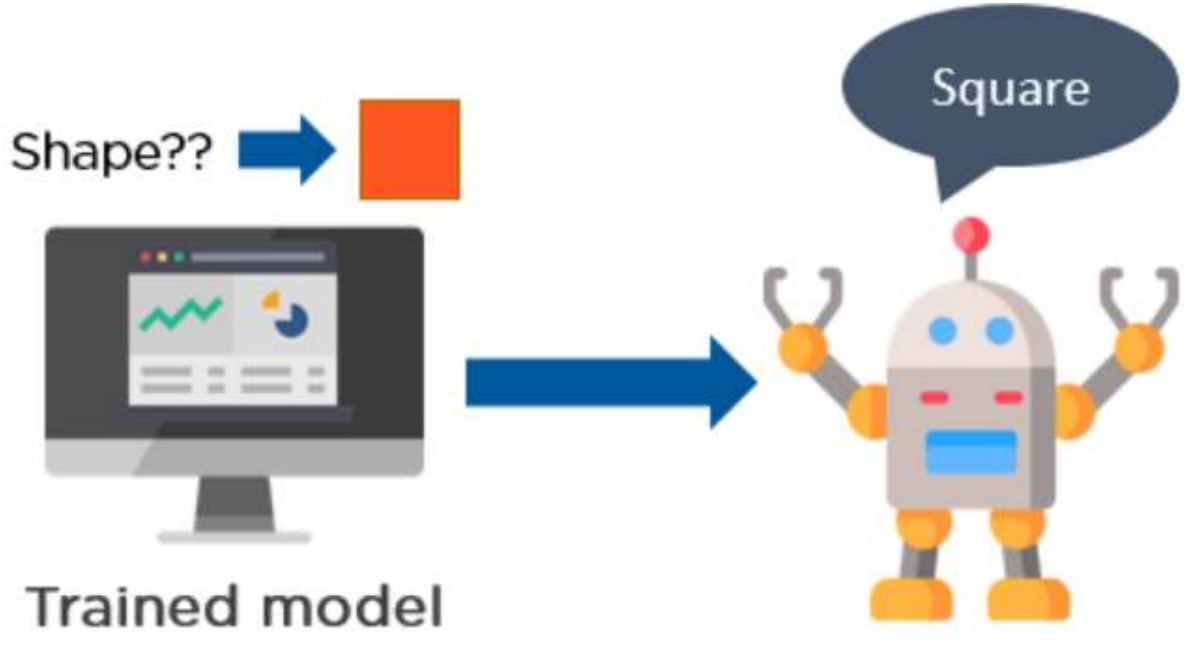
Reinforcement Learning

Reinforcement Learning trains a machine to take suitable actions and maximize its rewards in a particular situation. It uses an agent and an environment to produce actions and rewards. The agent has a start and an end state. But, there might be different paths for reaching the end state, like a maze. In this learning technique, there is no predefined target variable. Some of the important reinforcement learning algorithms are:

- Q-learning;
- Sarsa;
- Monte Carlo;
- Deep Q network.



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The Importance of Feature Engineering

Feature engineering (or feature extraction or feature discovery) is a machine learning technique that leverages data to create new variables that aren't in the training set. It can produce new features for both supervised and unsupervised learning, with the goal of simplifying and speeding up data transformations while also enhancing model accuracy. Feature engineering is required when working with machine learning models. Regardless of the data or architecture, a terrible or beautiful feature will have a direct impact on your model.

Feature Engineering is a very important step in machine learning. Feature engineering refers to the process of designing artificial features into an algorithm. These artificial features are then used by that algorithm in order to improve its performance, or in other words reap better results. Data scientists spend most of their time with data, and it becomes important to make models accurate.

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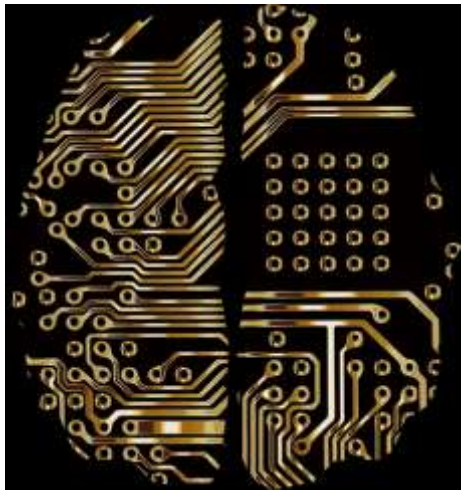
Characteristics of Deep Learning

Deep learning is based on the branch of machine learning, which is a subset of artificial intelligence. Since neural networks imitate the human brain and so deep learning will do. In deep learning, nothing is programmed explicitly. Basically, **it is a machine learning class that makes use of numerous nonlinear processing units to perform feature extraction as well as transformation.** The output from each preceding layer is taken as input by each one of the successive layers.

Deep learning models are capable enough to focus on the accurate features themselves by requiring a little guidance from the programmer and are very helpful in solving out the problem of dimensionality. Deep learning algorithms are used, especially when we have a huge number of inputs and outputs.

Deep learning is implemented with the help of Neural Networks, and the idea behind the motivation of Neural Network is the biological neurons, which is nothing but a brain cell.



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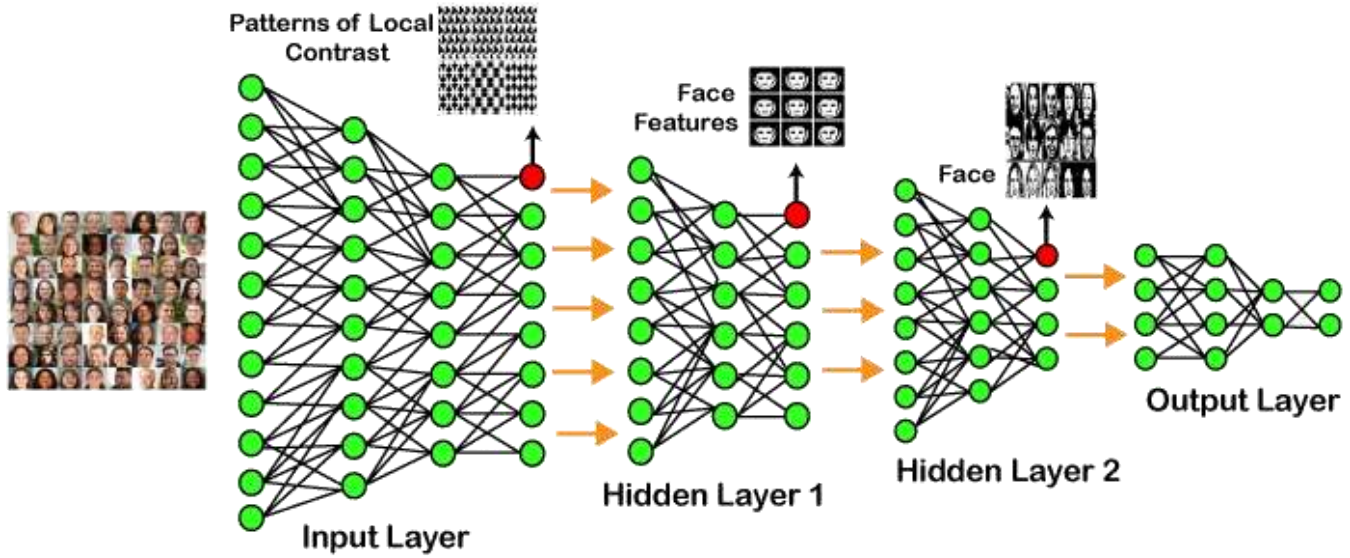
Example of Deep Learning



Deep learning is a collection of statistical techniques of machine learning for learning feature hierarchies that are actually based on artificial neural networks. So basically, deep learning is implemented by the help of deep networks, which are nothing but neural networks with multiple hidden layers.

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Let’s watch this amazing video 🙂🙂

https://www.youtube.com/watch?v=yUszJyS3d7A
(Source: Engineered Arts)

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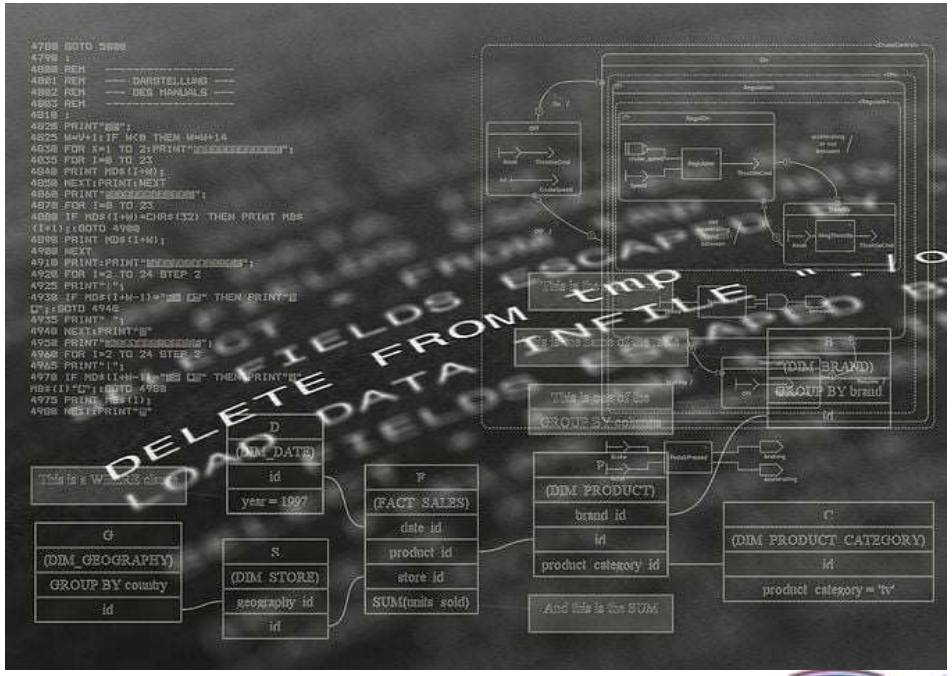
How Do AI Algorithms Work?

While a general algorithm can be simple, AI algorithms are by nature more complex. **AI algorithms work by taking in training data that helps the algorithm to learn. How that data is acquired and is labeled marks the key difference between different types of AI algorithms.**

At the core level, **an AI algorithm takes in training data (labeled or unlabeled, supplied by developers, or acquired by the program itself) and uses that information to learn and grow.** Then it completes its tasks, using the training data as a basis. Some types of AI algorithms can be taught to learn on their own and take in new data to change and refine their process. Others will need the intervention of a programmer in order to streamline.



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Uses of AI Algorithms

There are thousands of applications for AI systems and algorithms. **Even simple algorithms may have hundreds of possible applications**. The possibilities are endless.
Some common uses of AI algorithms include:

- Data entry and classification;
- Advanced or predictive analytics;
- Search engines (Google, Yahoo, Bing, etc.);
- Digital assistants (Siri, Alexa, etc.);
- Robotics (assembly machines, self-driving cars, etc.)

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Applications of AI

(Source: www.techvidvan.com)

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Advantages and Disadvantages of Artificial Intelligence

(Source: www.javatpoint.com)

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Let’s reflect by watching this interesting video 👀

https://www.youtube.com/watch?v=wTbrk0suwbg
(Source: Simplilearn)

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Wrap-up

Module VII:

- Introduction to Artificial Intelligence;
- Introduction to Machine Learning;
- Introduction to Deep Learning:
- Comparing AI vs ML vs DL;
- Relationship between DS, AI, ML and DL;
- Types of AI;
- Types of ML;
- Supervised Learning;
- Unsupervised Learning;
- Reinforcement Learning;
- The Importance of Feature Engineering;
- Characteristics of Deep Learning;
- Example of Deep Learning;

- How Do AI Algorithms Work?
- Uses of AI Algorithms;
- Applications of AI;
- Advantages and Disadvantages of AI.

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Many thanks for your attention. See you at the next lesson ☺

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