Supervised Learning - Unsupervised Learning & Reinforcement Learning


Supervised Learning   Vs   Unsupervised Learning   Vs   Reinforcement Learning

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Supervised Learning

Consider yourself as a student sitting in a math class wherein your teacher is supervising you on how you're solving a problem or whether you're doing it correctly or not. This situation is similar to what a supervised learning algorithm follows, i.e., with input provided as a labeled dataset, a model can learn from it. Labeled dataset means, for each dataset given, an answer or solution to it is given as well. This would help the model in learning and hence providing the result of the problem easily.

Load labeled input data

Train model

Test model
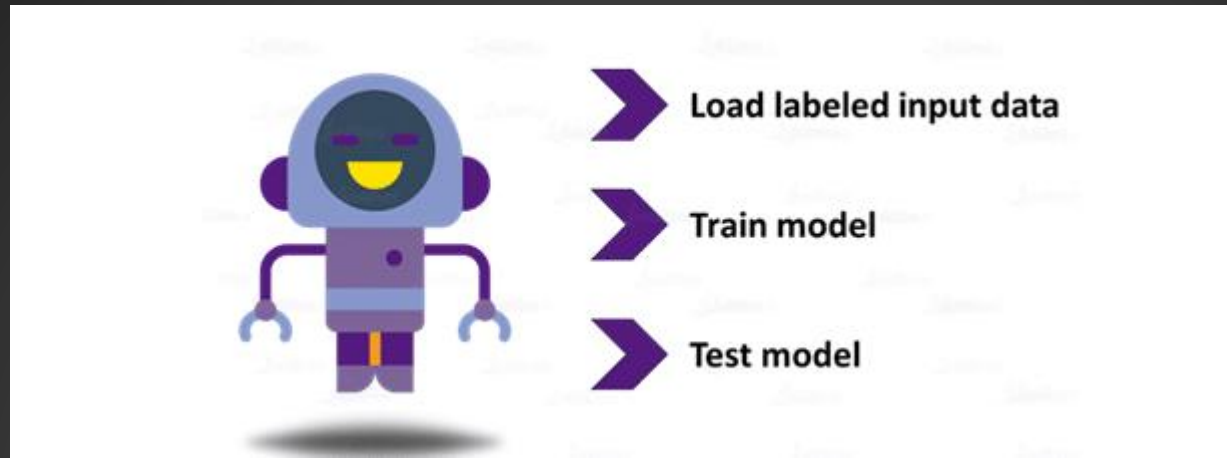
So, a labeled dataset of animal images would tell the model whether an image is of a dog, a cat, etc..

Using which, a model gets training, and so, whenever a new image comes up to the model, it can

compare that image with the labeled dataset for predicting the correct label.

How do you think supervised learning is useful? Let's talk about that next!

Well, to make you understand that let me introduce to you the types of problems that supervised learning deals with. There are two types of problems: classification problems and regression problems. Classification problems ask the algorithm to predict a discrete value that can identify the input data as a member of a particular class or group. Taking up the animal photos dataset, each photo has been labeled as a dog, a cat, etc., and then the algorithm has to classify the new images into any of these labeled categories.

Regression problems are responsible for continuous data, e.g., for predicting the price of a piece of land in a city, given the area, location, etc.. Here, the input is sent to the machine for predicting the price according to previous instances. And the machine determines a function that would map the pairs. If it is unable to provide accurate results, backward propagation is used to repeat the whole function until it receives satisfactory results.

Next, let's talk about unsupervised learning before you go ahead into understanding the **difference between supervised and unsupervised learning**.

Unsupervised Learning: What is it?
As you saw, in supervised learning, the dataset is properly labeled, meaning, a set of data is provided to train the algorithm. The major difference between supervised and unsupervised learning is that there is **no complete and clean labeled dataset in unsupervised learning**.

Unsupervised learning is a type of **self-organized learning** that helps find previously unknown patterns in data set **without pre-existing labels**.
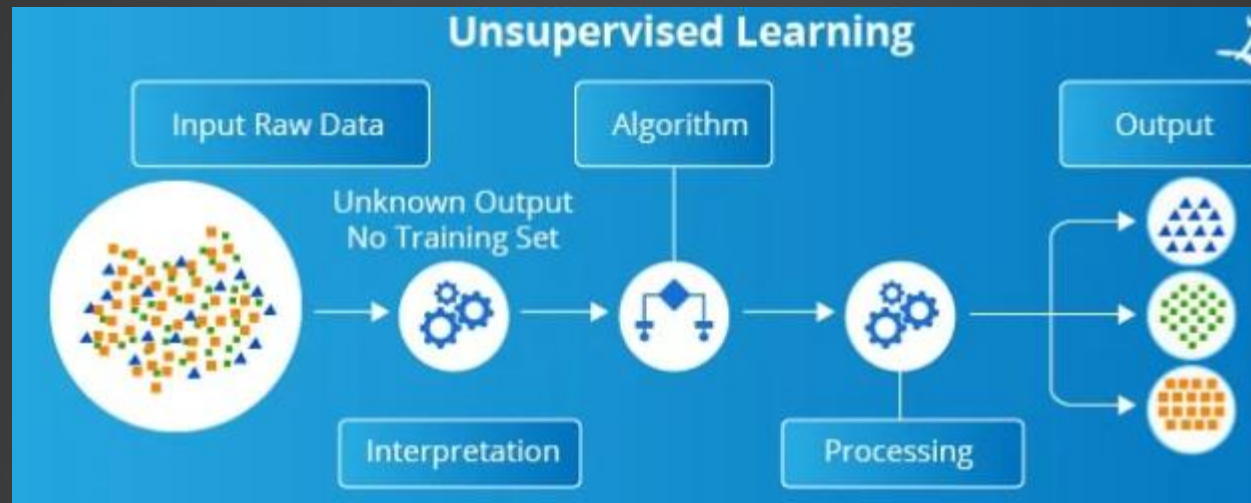
So, can we use Unsupervised Learning in practical scenarios? Let's talk about that next before looking at Supervised Learning vs Unsupervised Learning vs Reinforcement Learning!

How is Unsupervised Learning used?

When you are talking about unsupervised learning algorithms, a model **receives a dataset** without providing any instructions. Also, you don't know exactly what you need to get from the model as an output yet. You might be guessing that there is some kind of relationship between the data within the dataset you have, but the problem here is that the data is too complex for guessing. What will the model do then? Well, in such cases **grouping of data** is done and **comparison** is made by the model to **guess the output**.

Consider the animal photo example used in supervised learning. Suppose, there is no labeled dataset provided. Then, how can the model find out if an animal is a cat or a dog or a bird? Well, if the model has been provided some information such as if an animal has feathers, a beak, wings, etc. it is a bird. In the same way, if an animal has fluffy fur, floppy ears, a curly tail, and maybe some spots, it is a dog, and so on.

Hence, according to this information, the model can distinguish the animals successfully. But, if it is not able to do so correctly, the model follows backward propagation for reconsidering the image.

Difference Between Supervised and Unsupervised Learning

Criteria	Supervised Learning	Unsupervised Learning
Method	Input and output variables are given	Only the input data is given
Analysis of Data	Uses offline analysis	Uses real-time analysis
Goal	The output is predicted using the labeled input dataset	The output is predicted based on the patterns in the input dataset

Reinforcement Learning: What is it?

After discussing on supervised and unsupervised learning models, now, let me explain to you reinforcement learning. As it is based on neither supervised learning nor unsupervised learning, what is it? To be straight forward, in reinforcement learning, algorithms learn to react to an environment on their own.

To be a little more specific, reinforcement learning is a type of learning that is based on interaction with the environment. It is rapidly growing, along with producing a huge variety of learning algorithms that can be used for various applications

To begin with, there is always a start and an end state for an agent (the AI-driven system); however, there might be different paths for reaching the end state, like a maze. This is the scenario wherein reinforcement learning is able to find a solution for a problem. Examples of reinforcement learning include self-navigating vacuum cleaners, driverless cars, scheduling of elevators, etc.

Reinforcement Learning: How does it work?

Consider an example of a child trying to take his/her first steps. What will be the instructions he/she follows to start walking?

➢ Observing others walking and trying to replicate the same
➢ Standing still
➢ Remaining still
➢ Trying to balance the body weight, along with deciding on which foot to advance first to start walking. It sounds like a difficult and challenging task for a child to get up and walk, right? But for us, it is easy since we have become used to it over time.
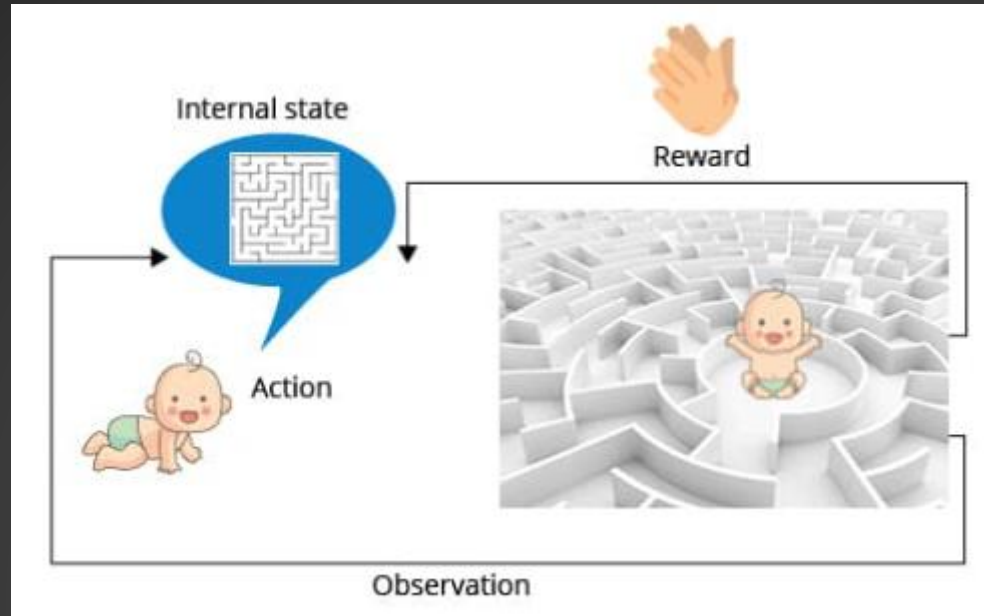
Now, putting it together, a child is an agent who is trying to manipulate the environment (surface or floor) by trying to walk and going from one state to another (taking a step). A child gets a reward when he/she takes a few steps (appreciation) but will not receive any reward or appreciation if he/she is unable to walk. This is a simplified description of a reinforcement learning problem.

Supervised vs Unsupervised vs Reinforcement Learning

Finally, now that you are well aware of Supervised, Unsupervised, and Reinforcement learning algorithms, let's look at the difference between supervised unsupervised and reinforcement learning!

Criteria	Supervised Learning	Unsupervised Learning	Reinforcement Learning
Definition	The machine learns by using labeled data	The machine is trained on unlabeled data without any guidance	An agent interacts with its environment by performing actions & learning from errors or rewards
Type of problems	Regression & classification	Association & clustering	Reward-based
Type of data	Labeled data	Unlabeled data	No predefined data
Training	External supervision	No supervision	No supervision
Approach	Maps the labeled inputs to the known outputs	Understands patterns & discovers the output	Follows the trial-and-error method