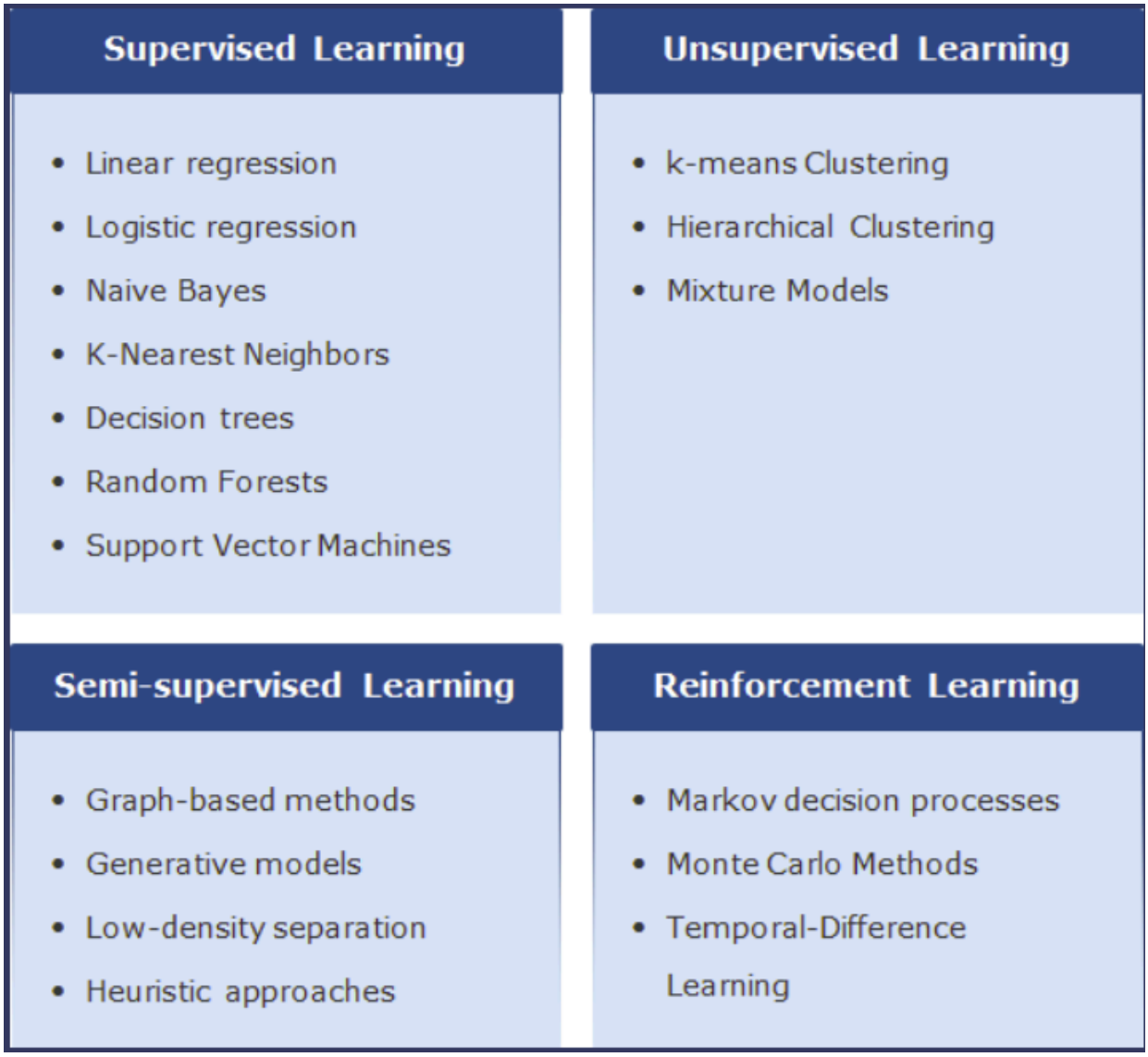
Some Famous Machine Learning Algorithms



Reinforcement learning

Reinforcement learning

Reinforcement machine learning algorithm is a reward based and immediate feedback technique. Here, the machine's goal is to maximize the numerical reward at each and every step. In the process of learning, the machine is not provided any supervision as opposed to the previous ML algorithms we discussed till now. Instead, the machine is expected to figure out the optimum actions which will reap the maximum reward at each step, all on their own, without any interference.

The actions that the machine takes at each step might not only affect the immediate reward but may also affect all the subsequent rewards. The ultimate aim is to reach the max possible reward in the least amount of steps possible.Thus, trial and error search methodology and immediate feedback in the form of a numerical reward are the two main characteristics of reinforcement learning.

An example of reinforcement learning would be when a machine, learning to play chess, decides whether a move is right by planning the possible moves, anticipating the corresponding counter moves and finally choosing one based on reward based appeal for a particular position or set of moves. Another example could be when a trash collecting bot's charge is about to reach critical levels and it needs to make a decision, to clean one more room before reaching out for the charging station or to immediately rush to the nearest charging station. The decision taken by the bot depends on the ease with which it can reach the charging station, based on its prior knowledge.

Semi-Supervised Machine Learning

In real-time, it may so happen that the unlabeled data points exceed the number of labeled data points in a data set. In order to fit a model to such data we use the semi-supervised machine learning technique, wherein we perform the following steps:

- **Step 1:** Train the model with labeled data points only.
- **Step 2:** Use the above model to predict the labels of the unlabeled data points
- **Step 3:** Combine the existing labeled data points with the newly labeled data points and use it to retrain the model
- **Step 4:** Repeat the 2nd and 3rd steps until it converges

Applications of semi-supervised learning are text processing, video-indexing, bioinformatics, web page classification and news classification among others.

Unsupervised Machine Learning

Unsupervised machine learning model: Summary

We can summarize our learning of the unsupervised machine learning as follows:

- In the first step, we fix some variables or parameters based on which the machine will arrange the given data (in our example, we have taken "color" as the parameter).
- In the second step, the machine groups similar data points together. In our example, fruits with the same color are grouped together.

Supervised Machine Learning

Supervised machine learning model: Summary

We can summarize our learning of the supervised machine learning as follows:

- In the first step, we train the machine with known data so that it learns something from it.
- In the second step we expect the machine to utilize the knowledge it gained in the previous step and classify a new unknown data point.
- In the third step, the model is evaluated on the basis of how accurately it has classified the unknown data.

Supervised machine learning model: Types

There can be two types of supervised machine learning techniques as shown below:

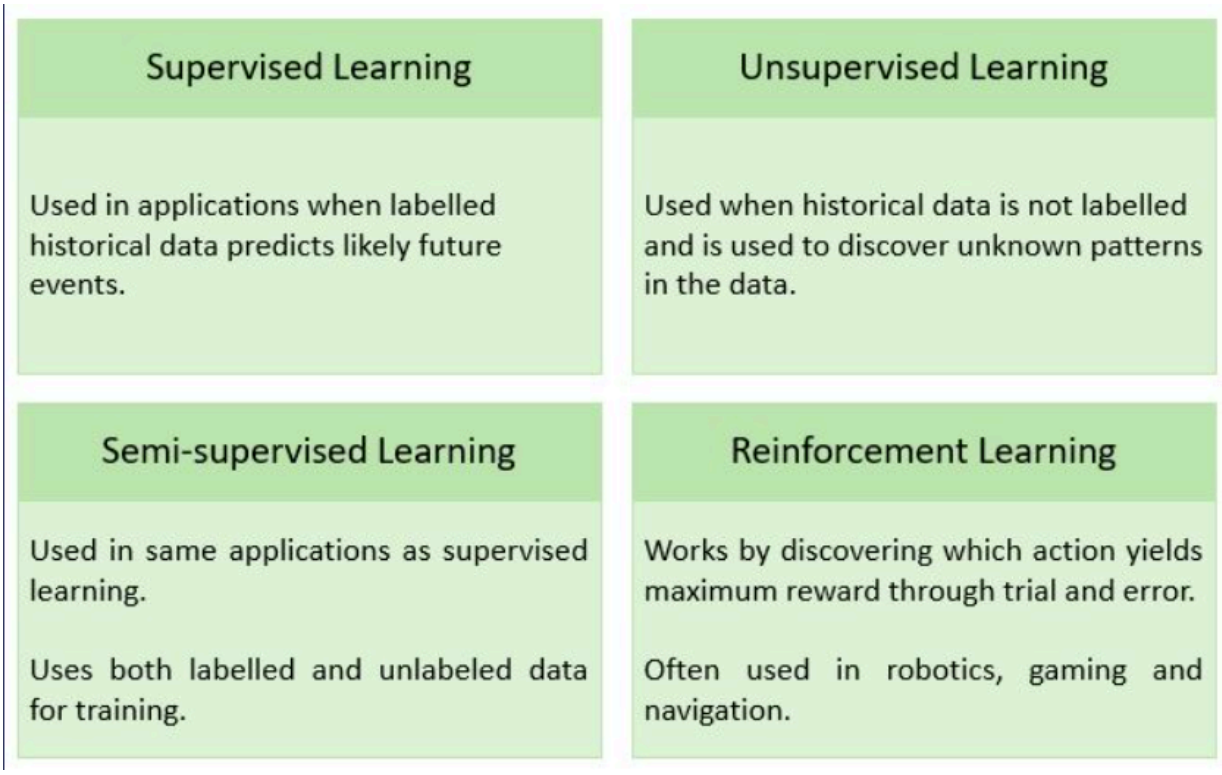
- **Classification:** Used to predict discrete results.

For example, assume that a company wants to predict the budget period of a new project that they have acquired as 'short-term' or 'long-term', based on various input attributes about the project such as the number of resources required, software requirements, hardware requirements etc. We will need to use the classification machine learning technique here.

- **Regression:** Used to predict continuous numeric results

For example, if we are trying to predict the approximate budget requirement of a new project that the company has acquired in actual quantifiable figures, based on various input attributes about the project such as number of resources required, software requirement, hardware requirement etc., then we use the regression technique.

Types of machine learning



What is Machine Learning?

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In 1959, Arthur Samuel defined machine learning as "A field of study that gives computers the ability to learn without being explicitly programmed".

How can a machine learn?

How can a machine behave like an intelligent entity? How can it learn and make decisions? These questions can be answered with the following definitions of machine learning.

- Machine Learning is the field of scientific study that concentrates on induction algorithms and on other algorithms that can be said to "learn". (Ref. Stanford glossary of terms)

- A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T, as measured by P, improves with experience E. (Ref. Tom M. Mitchell)

Why make a machine learn?

Machine learning becomes essential when:

- Analysis on a given data by a human being has huge associated cost, time and effort. Note that we are talking about data that is huge in volume, with a lot of variety and coming with high velocity.
- Human intervention is not sustainable (e.g. If we want to navigate on Mars and we don't have the expertise available, we can make a machine learn and let it navigate on unknown territory without any human intervention).
- Human expertise cannot always be explained (e.g. speech recognition, image processing).
- A solution needs to be adapted to a particular case (e.g. user biometrics).