Data Science with Python Programming

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Introduction to Machine Learning and it's types

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Learning outcomes:

- What is a Machine Learning?
- Need for Machine Learning
- Application of Machine Learning

Types of Machine Learning

- Supervised learning
- Unsupervised learning
- Reinforcement learning

What is a Machine Learning?

Machine learning is an application of **artificial intelligence** (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed. **Machine learning** focuses on the development of computer programs that can access data and use it learn for themselves.

What is a Machine Learning?

Machine learning (ML) is a method of data analysis that automates analytical model building. It is a branch of artificial intelligence based on the idea that systems can learn from data, identify patterns and make decisions with minimal human intervention.

It covers the statistical part of AI. It shows the PC to take care of issues by looking at hundreds or thousands of models, gaining from them, and afterwards utilising that experience to take care of a similar issue in new circumstances.

Need for Machine Learning

Human beings, at this moment, are the most intelligent and advanced species on earth because they can think, evaluate and solve complex problems. On the other side, **AI** is still in its initial stage and haven't surpassed human intelligence in many aspects. Then the question is that what is the need to make machine learn? The most suitable reason for doing this is, "to make decisions, based on data, with efficiency and scale".

Need for Machine Learning

Lately, organizations are investing heavily in newer technologies like Artificial Intelligence, Machine Learning and Deep Learning to get the key information from data to perform several real-world tasks and solve problems. We can call it data-driven decisions taken by machines, particularly to automate the process. These data-driven decisions can be used, instead of using programing logic, in the problems that cannot be programmed inherently. The fact is that we can't do without human intelligence, but other aspect is that we all need to solve real-world problems with efficiency at a huge scale. That is why the need for machine learning arises.

Application of Machine Learning

Machine Learning is the most rapidly growing technology and according to researchers we are in the golden year of AI and ML. It is used to solve many real-world complex problems which cannot be solved with traditional approach. Following are some real-world applications of ML –

- **Emotion analysis**
- **Sentiment analysis**
- **Error detection and prevention**
- **Weather forecasting and prediction**
- **Stock market analysis and forecasting**
- **Speech synthesis**

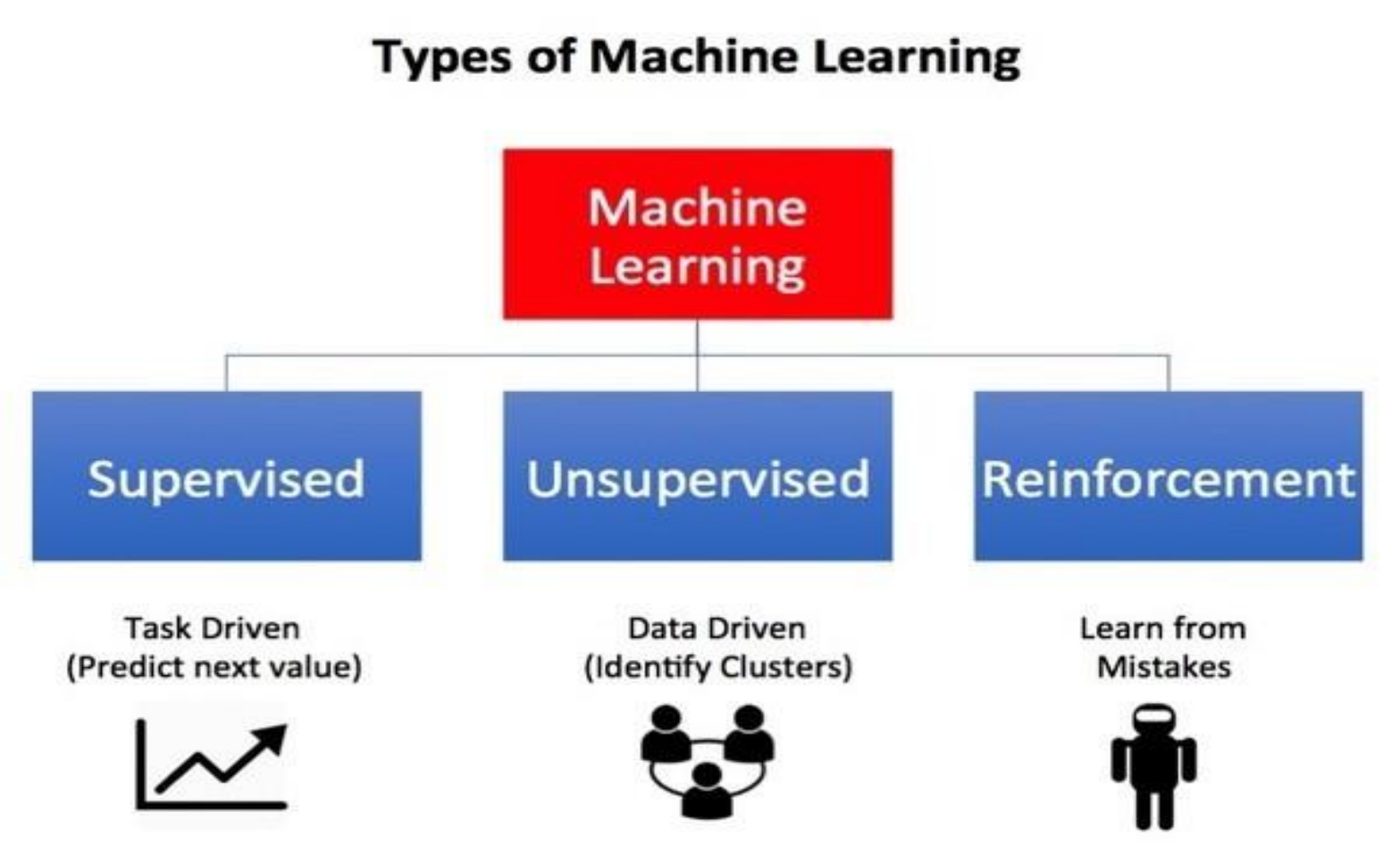
Application of Machine Learning

- Speech recognition
- Customer segmentation
- Object recognition
- Fraud detection
- Fraud prevention
- Recommendation of products to customer in online shopping
- Traffic Alerts
- Social Media (Automatic Friend Tagging Suggestions)

Types of Machine Learning

At a high-level, machine learning is simply the study of teaching a computer program or algorithm how to progressively improve upon a set task that it is given. On the research-side of things, machine learning can be viewed through the lens of theoretical and mathematical modeling of how this process works. However, more practically it is the study of how to build applications that exhibit this iterative improvement. There are many ways to frame this idea, but largely there are three major recognized categories: supervised learning, unsupervised learning, and reinforcement learning.

Types of Machine Learning



Types of Machine Learning

Supervised learning:

Supervised learning is the most popular paradigm for machine learning. It is the easiest to understand and the simplest to implement. Basically supervised learning is a learning in which we teach or train the machine using data which is well labelled that means some data is already tagged with the correct answer. After that, the machine is provided with a new set of examples(data) so that supervised learning algorithm analyses the training data(set of training examples) and produces a correct outcome from labelled data.

Types of Machine Learning

Supervised learning:

At the end of the training, the algorithm has an idea of how the data works and the relationship between the input and the output.

This solution is then deployed for use with the final dataset, which it learns from in the same way as the training dataset. This means that supervised machine learning algorithms will continue to improve even after being deployed, discovering new patterns and relationships as it trains itself on new data.

Types of Machine Learning

Supervised learning:

For instance, suppose you are given a basket filled with different kinds of fruits. Now the first step is to train the machine with all different fruits one by one like this:

If shape of object is rounded and depression at top having colour Red then it will be labelled as –**Apple**. If shape of object is long curving cylinder having colour Green-Yellow then it will be labelled as –**Banana**. Now suppose after training the data, you have given a new separate fruit say Banana from basket and asked to identify it.

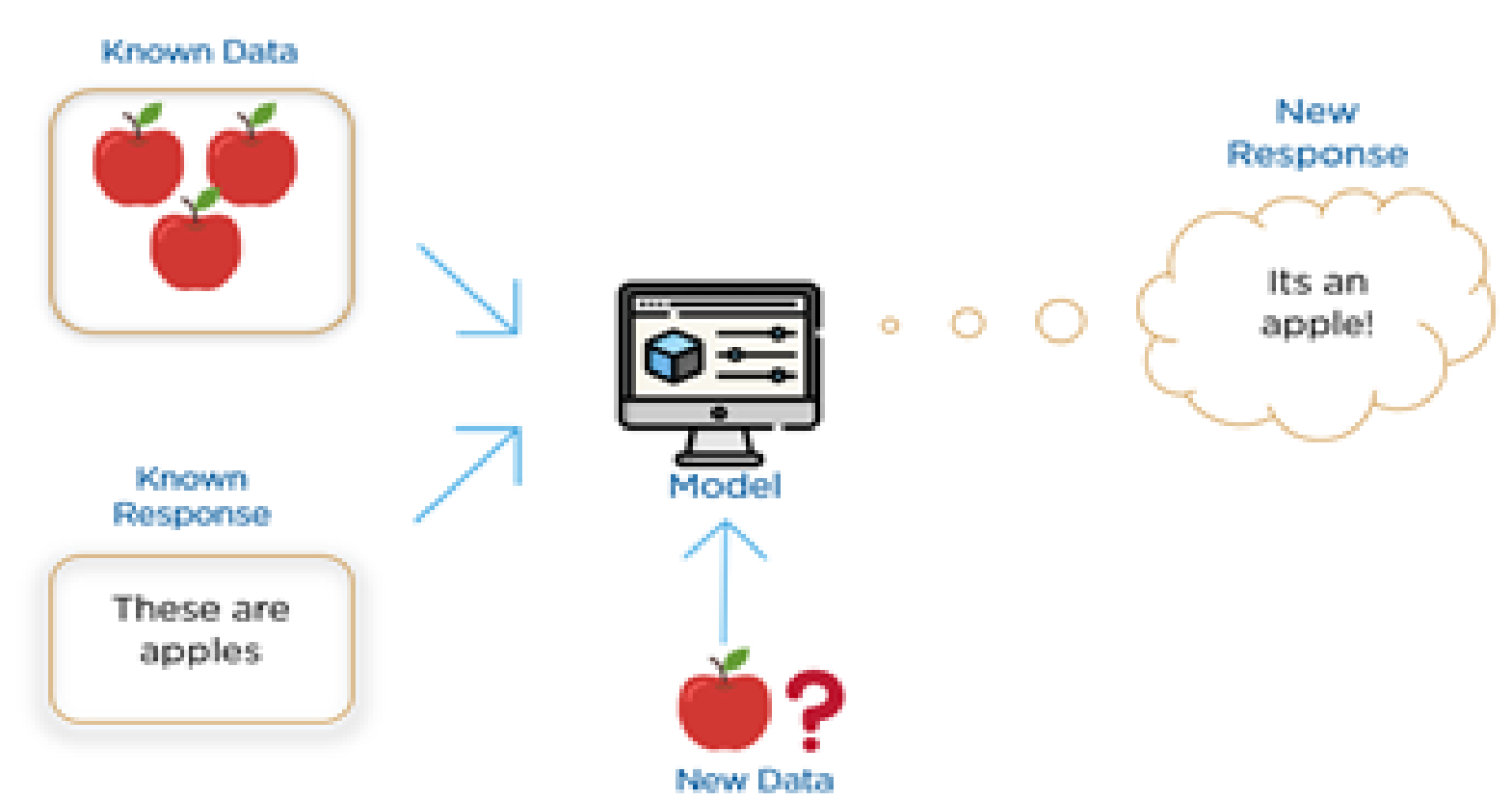
Types of Machine Learning

Supervised learning:

Since the machine has already learned the things from previous data and this time have to use it wisely. It will first classify the fruit with its shape and colour and would confirm the fruit name as BANANA and put it in Banana category. Thus the machine learns the things from training data(basket containing fruits) and then apply the knowledge to test data(new fruit).

Types of Machine Learning

Supervised learning:



Types of Machine Learning

Supervised learning:

Supervised learning classified into two categories of algorithms:

1) Regression

2) Classification

Types of Machine Learning

1) Regression :

Regression is the kind of Supervised Learning that learns from the Labelled Datasets and is then able to **predict a continuous-valued output** for the new data given to the algorithm. It is used whenever the output required is a number such as money or height or price etc. **Regression** analysis is a very widely used statistical tool to establish a relationship model between two variables. One of these variable is called predictor variable whose value is gathered through experiments. The other variable is called response variable whose value is derived from the predictor variable.

Types of Machine Learning

2) Classification:

Classification is a process of categorizing a given set of data into classes, It can be performed on both structured or unstructured data. The process starts with predicting the class of given data points. The classes are often referred to as target, label or categories. It is the kind of learning where the algorithm needs to map the new data that is obtained to any one of the 2 classes that we have in our dataset. The classes need to be mapped to either 1 or 0 which in real-life translated to 'Yes' or 'No', 'Rains' or 'Does Not Rain' and so forth. **An easy to understand example is classifying emails as "*spam*" or "*not spam*."**

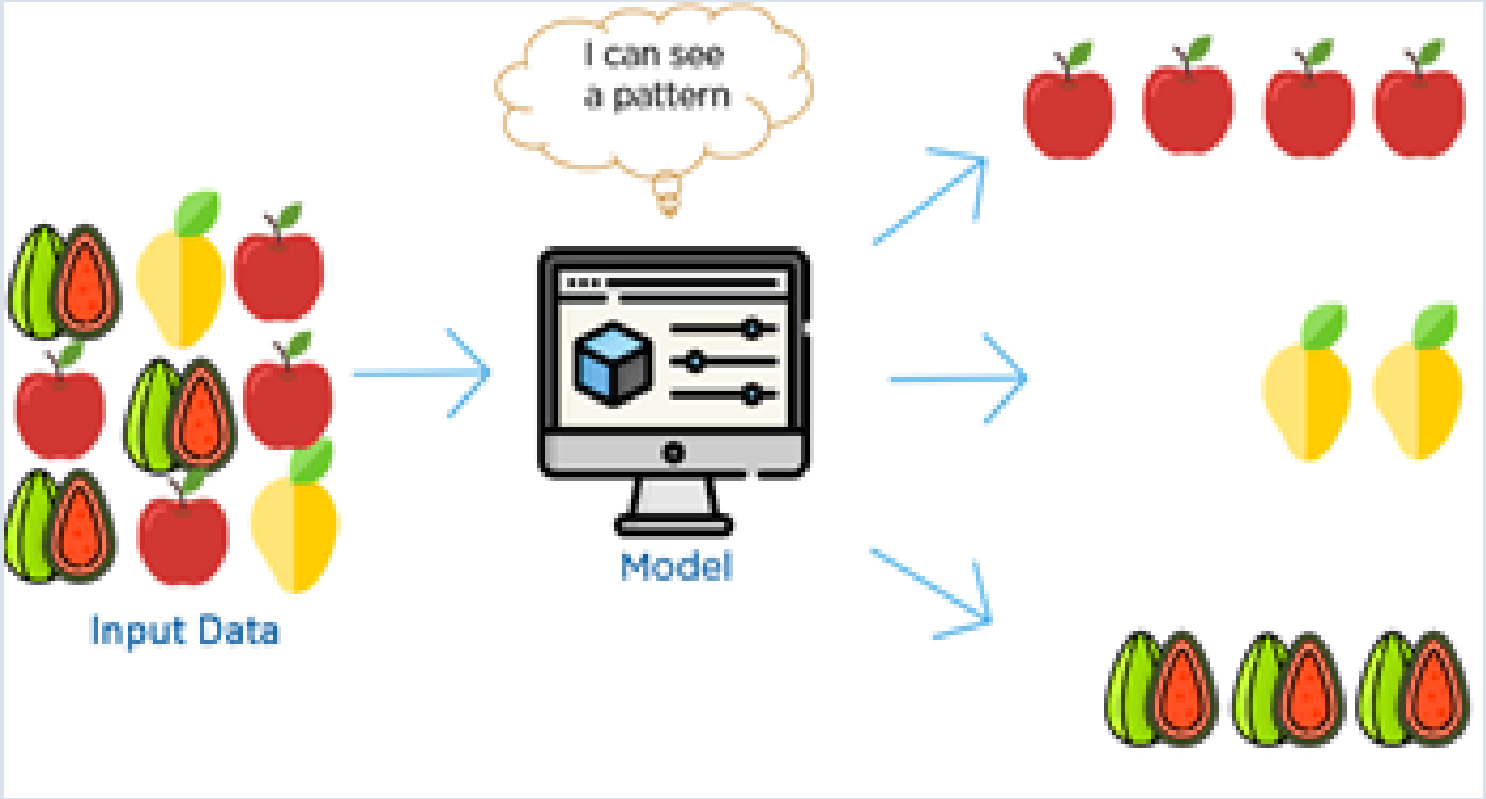
Types of Machine Learning

Unsupervised learning:

Unsupervised learning is the training of machine using information that is neither classified nor labelled and allowing the algorithm to act on that information without guidance. Here the task of machine is to group unsorted information according to similarities, patterns and differences without any prior training of data. Unsupervised learning works well on transactional data. For example, it can identify segments of customers with similar attributes who can then be treated similarly in marketing campaigns. Or it can find the main attributes that separate customer segments from each other.

Types of Machine Learning

Unsupervised learning:



Types of Machine Learning

Unsupervised learning:

Unsupervised learning classified into two categories of algorithms:

1) **Clustering**

2) **Association**

Types of Machine Learning

Unsupervised learning:

1) Clustering:

Clustering is an important concept when it comes to unsupervised learning. It mainly deals with finding a structure or pattern in a collection of uncategorized data. Clustering algorithms will process your data and find natural clusters(groups) if they exist in the data. You can also modify how many clusters your algorithms should identify. It allows you to adjust the granularity of these groups.

Types of Machine Learning

Unsupervised learning:

1) Clustering:

Types of Machine Learning

Unsupervised learning:

2) Association:

Association rules allow you to establish associations amongst data objects inside large databases. This unsupervised technique is about discovering interesting relationships between variables in large databases. For example, people that buy a new home most likely to buy new furniture.

Types of Machine Learning

Reinforcement learning:
Reinforcement learning directly takes inspiration from how human beings learn from data in their lives. It features an algorithm that improves upon itself and learns from new situations using a trial-and-error method. Favourable outputs are encouraged or ‘reinforced’, and non-favourable outputs are discouraged or ‘punished’.

Types of Machine Learning

Reinforcement learning:

Based on the psychological concept of conditioning, reinforcement learning works by putting the algorithm in a work environment with an interpreter and a reward system. In every iteration of the algorithm, the output result is given to the interpreter, which decides whether the outcome is favourable or not.

Reinforcement learning is connected to applications for which the algorithm must make decisions (so the product is prescriptive, not just descriptive, as in unsupervised learning), and the decisions bear consequences. In the human world, it is just like learning by trial and error.

Types of Machine Learning

Reinforcement learning:

It is often used for robotics, gaming and navigation. With reinforcement learning, the algorithm discovers through trial and error which actions yield the greatest rewards. This type of learning has three primary components: the agent (the learner or decision maker), the environment (everything the agent interacts with) and actions (what the agent can do). The objective is for the agent to choose actions that maximize the expected reward over a given amount of time. The agent will reach the goal much faster by following a good policy. So the goal in reinforcement learning is to learn the best policy.

Types of Machine Learning

Semi-supervised learning:

Semi-supervised learning is an approach to machine learning that combines a small amount of labelled data with a large amount of unlabelled data during training. Semi-supervised learning falls between unsupervised learning (with no labelled training data) and supervised learning (with only labelled training data). This type of learning can be used with methods such as classification, regression and prediction.

Types of Machine Learning

Semi-supervised learning:
Semi-supervised learning is useful when the cost associated with labelling is too high to allow for a fully labelled training process. Early examples of this include identifying a person's face on a web cam.