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Machine Learning

Machine Learning Concepts

What is Machine Learning?

- Machine Learning is a subset of artificial intelligence. It focuses mainly on the designing of systems, thereby allowing them to learn and make predictions based on some experience which is data in case of machines.
- Machine Learning enables the computer to act and make data-driven decisions rather than being explicitly programmed in order to carry out a certain task. These programs or algorithms are designed to learn and improve over time when exposed to new data.

What is Machine Learning?

- **Arthur Samuel**, a pioneer in the field of artificial intelligence and computer gaming, coined the term **"Machine Learning"**. He defined machine learning as – **"Field of study that gives computers the capability to learn without being explicitly programmed"**

- Machine Learning(ML) can be explained as automating and improving the learning process of computers based on their experiences without being actually programmed i.e. without any human assistance. The process starts with feeding a good quality data and then training our machines(computers) by building machine learning models using the data and different algorithms. The choice of algorithms depends on what type of data do we have and what kind of task we are trying to automate.

What is Machine Learning?

- *"Optimizing a performance criterion using example data and past experience."*
- Machine learning technology involves both **statistics** and **computer science**. Statistics allows one to draw inferences from the given data. To implement efficient algorithms we can also use computer science. It represents the required model, and evaluate the performance of the model.
- Machine learning involves some advanced statistical concepts such as modeling and optimization. **Modeling** refers to the conditions or probability distribution for the given sample data. **Optimization** also includes techniques used to find the most appropriate parameters for the given set of data.

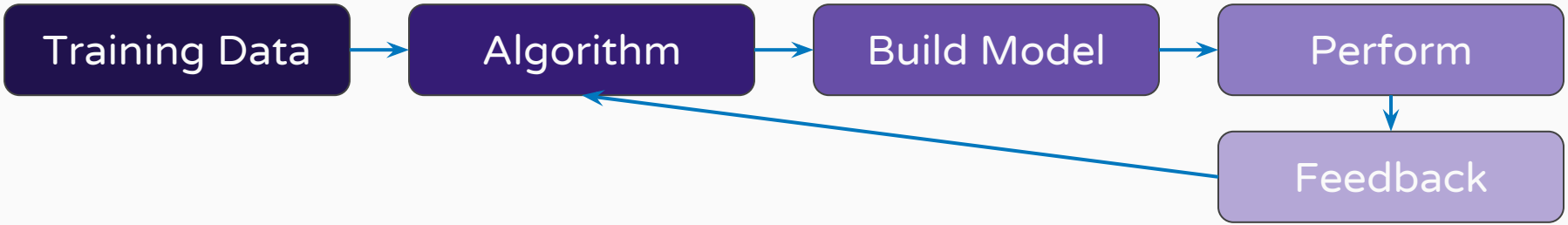
Machine Learning

What does exactly learning means for a computer?

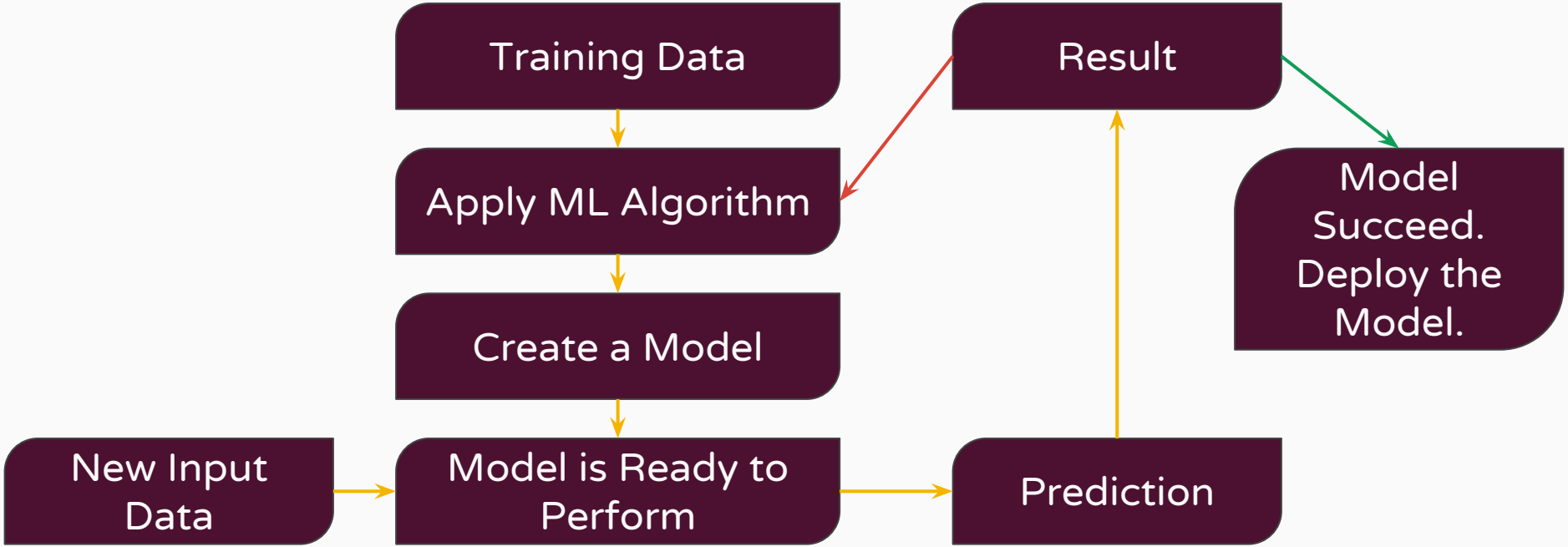
- A computer is said to be learning from **Experiences** with respect to some class of **Tasks**, if its performance in a given Task improves with the Experience.
- A computer program is said to learn from experience **E** with respect to some class of tasks **T** and performance measure **P**, if its performance at tasks in **T**, as measured by **P**, improves with experience **E**

How does Machine Learning works?

- The machine needs to be trained on some data and based on that, it will detect a pattern to create a model. This process of gaining knowledge from the data and providing powerful insights is all about machine learning.
- Using the data, the system learns an algorithm and then uses it to build a predictive model. Later on, we adjust the model or we enhance the accuracy of the model using the feedback data. Using this feedback data, tune the model and predict action on the new data set.



How does Machine Learning works?



How does Machine Learning works?

- Machine Learning algorithm is trained using a training data set to create a model. When new input data is introduced to the ML algorithm, it makes a prediction on the basis of the model.
- The prediction is evaluated for accuracy and if the accuracy is acceptable, the ML algorithm is deployed. If the accuracy is not acceptable, the ML algorithm is trained again and again with an augmented training data set.

Types of Machine Learning:

Supervised Learning:

- **Supervised machine learning algorithms** can apply what has been learned in the past to new data using labeled examples to predict future events. Starting from the analysis of a known training dataset, the learning algorithm produces an inferred function to make predictions about the output values. The system is able to provide targets for any new input after sufficient training. The learning algorithm can also compare its output with the correct, intended output and find errors in order to modify the model accordingly.

Types of Machine Learning:

Unsupervised Learning:

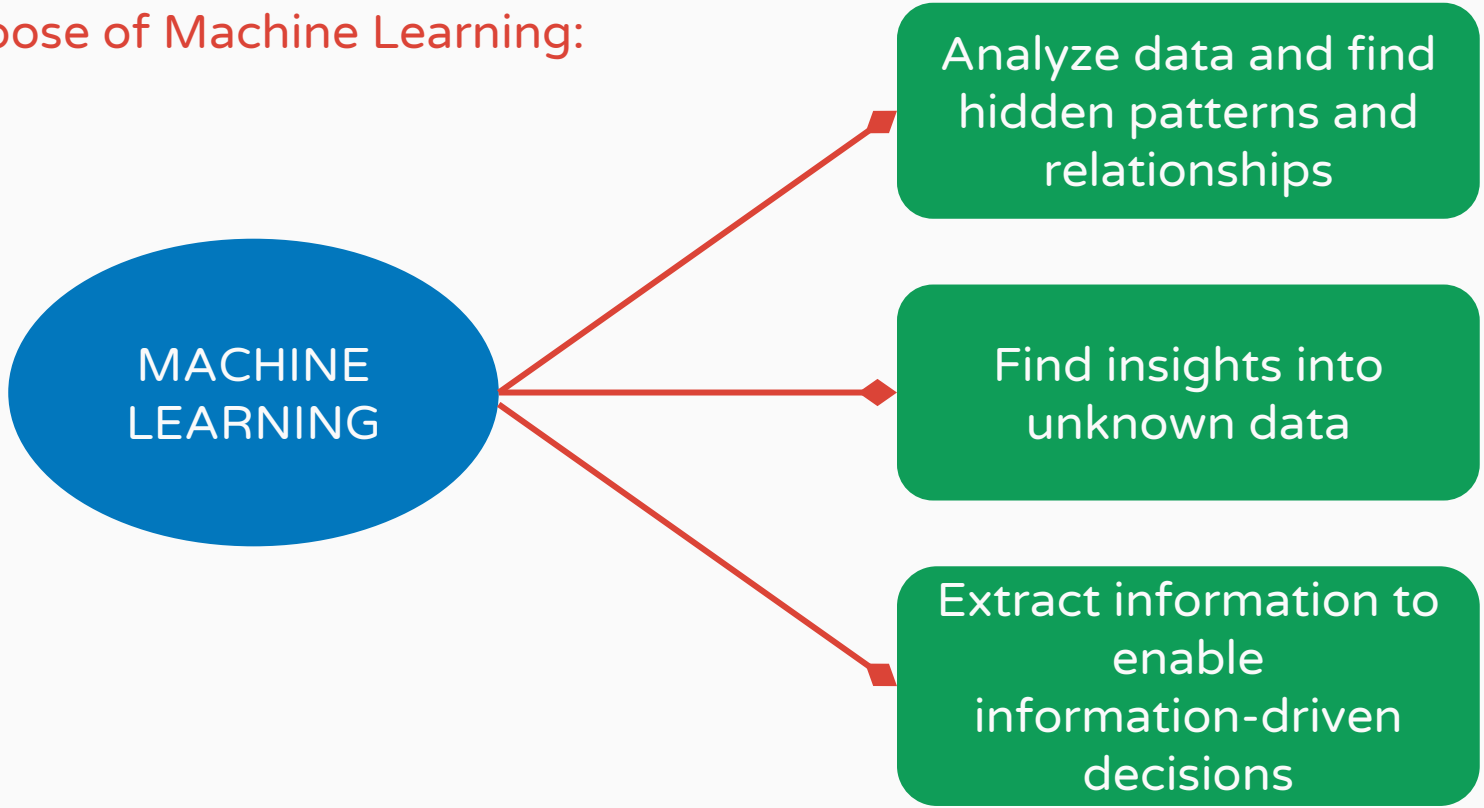
- **Unsupervised machine learning algorithms** are used when the information used to train is neither classified nor labeled. Unsupervised learning studies how systems can infer a function to describe a hidden structure from unlabeled data. The system doesn't figure out the right output, but it explores the data and can draw inferences from datasets to describe hidden structures from unlabeled data.

On the basis of “output” desired from a machine learned system, two types of Problem Statements we have:

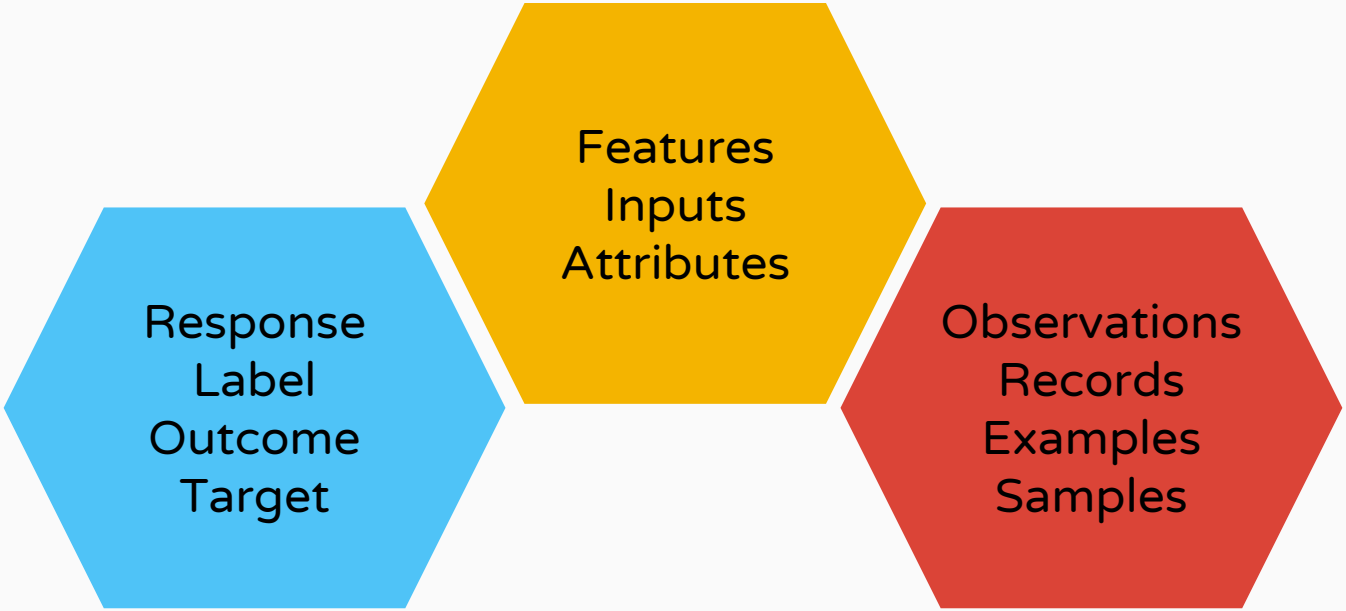
- **Classification**: Outputs are divided into two or more classes, and the learner must produce a model that assigns unseen inputs to one or more (multi-label classification) of these classes. This is typically tackled in a supervised way. **Here outputs are Discrete Variables.** Spam filtering is an example of classification, where the inputs are email (or other) messages and the classes are “spam” and “not spam”.
- **Regression**: It is also a supervised learning problem, but the outputs are continuous rather than discrete. **Here outputs are Continuous Variables.** For example, predicting the stock prices using historical data.

Machine Learning

Purpose of Machine Learning:



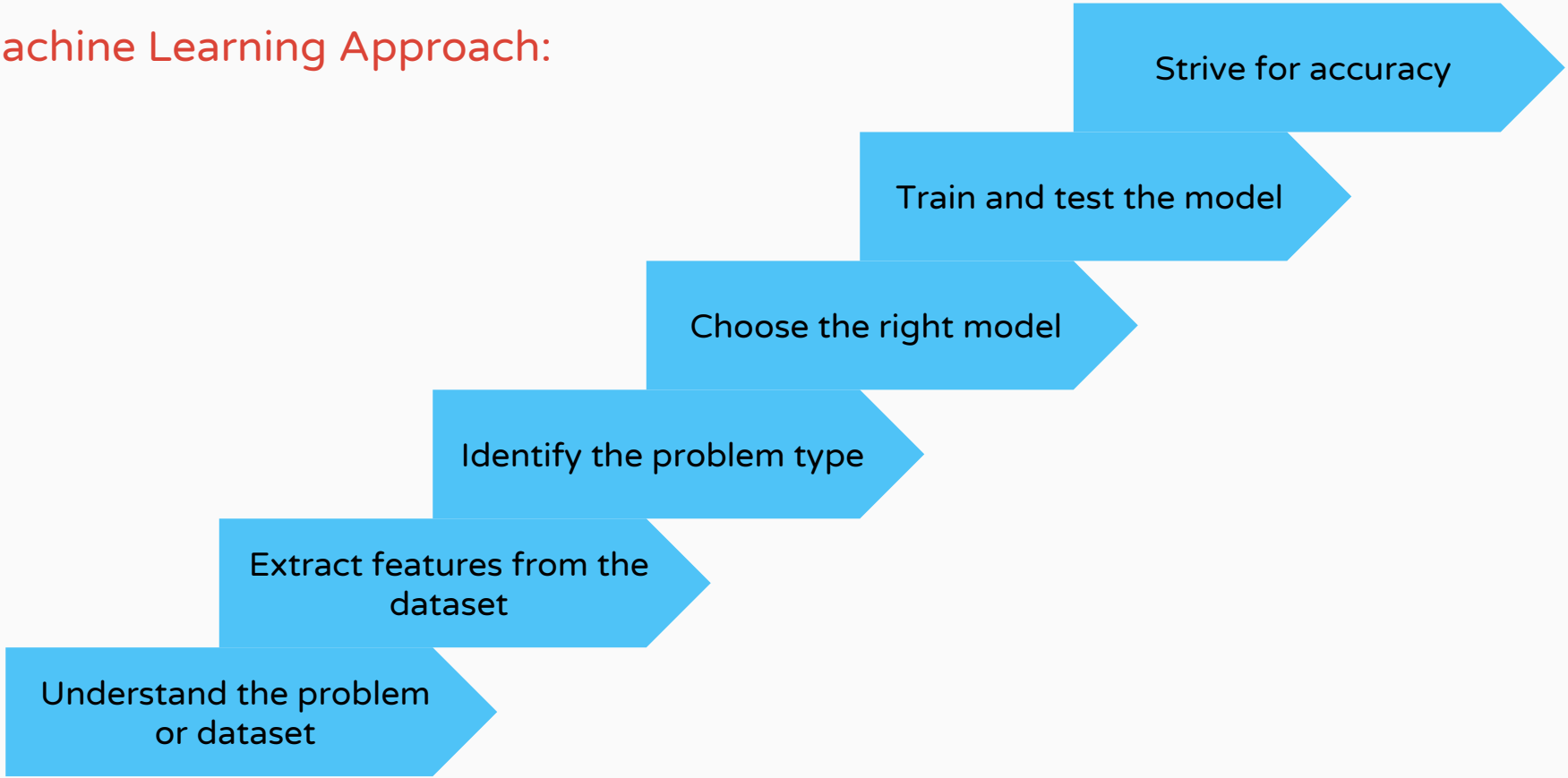
Machine Learning Terminologies:



Machine Learning Terminologies:

- **Model:** A model is a **specific representation** learned from data by applying some machine learning algorithm. A model is also called **hypothesis**.
- **Feature:** A feature is an individual measurable property of our data. A set of numeric features can be conveniently described by a **feature vector**. Feature vectors are fed as input to the model.
- **Target (Label):** A target variable or label is the value to be predicted by our model.
- **Training:** The idea is to give a set of inputs(features) and it's expected outputs(labels), so after training we will have a model (hypothesis) that will then map new data to one of the categories trained on.
- **Prediction:** Once our model is ready, it can be fed a set of inputs to which it will provide a predicted output(label).

Machine Learning Approach:



Step 1 & 2: Understand the dataset & Extract its Features:

Features Attributes

Response Label/Target

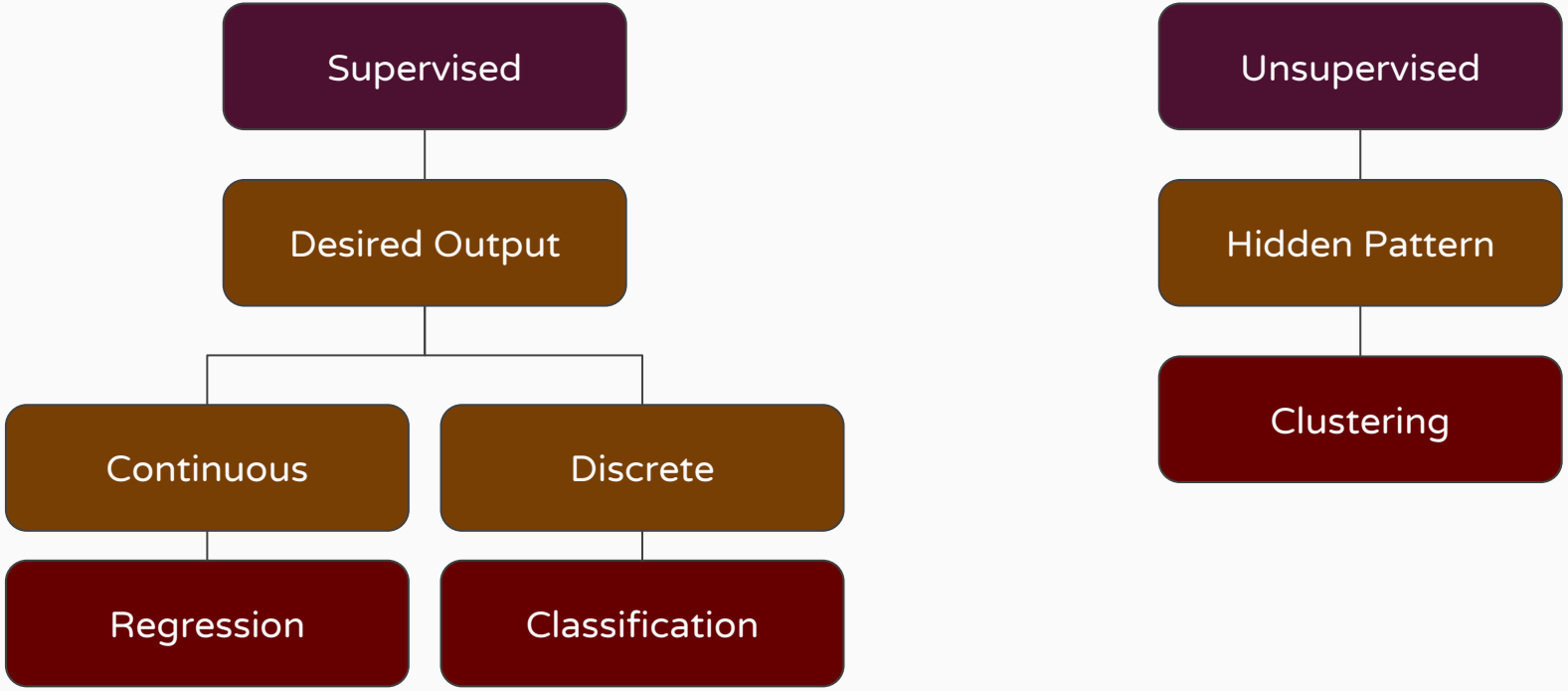
Observation Samples

Education (in Years)	Professional Training (Yes/No)	Hourly Rate (INR)
15	0	100
18	1	200
20	1	350
16	0	250
17	1	250
20	1	400

Step 3 & 4: Identify the Problem Type and Learning Model:

Supervised Learning	Unsupervised Learning
The dataset used to train a model should have observations, features and responses. The model is trained to predict the Right response for a given set of data points.	The response or the outcome of the data is not known.
Supervised learning models are used to predict an outcome.	Unsupervised learning models are used to identify and visualize patterns in data by grouping similar types of data.
The goal of this model is to generalize a dataset so that general rule can be applied to new data as well.	The goal of this model is to represent data in a way that meaningful information can be extracted.

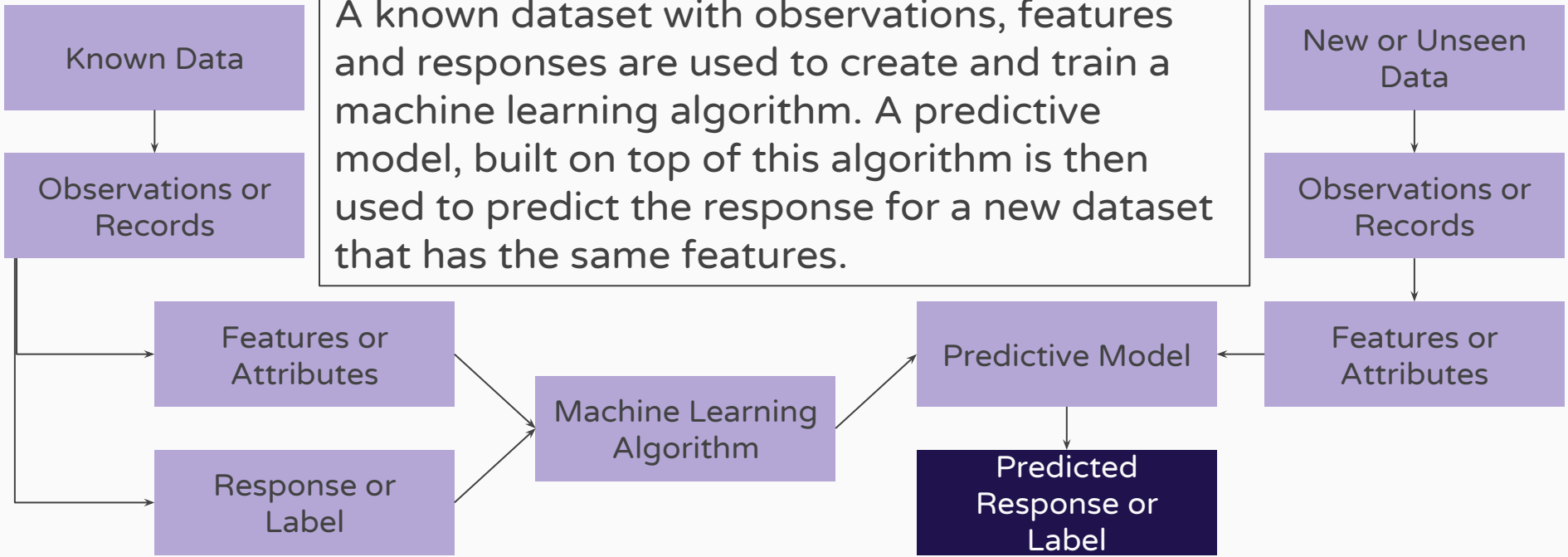
Step 3 & 4: Identify the Problem Type and Learning Model:



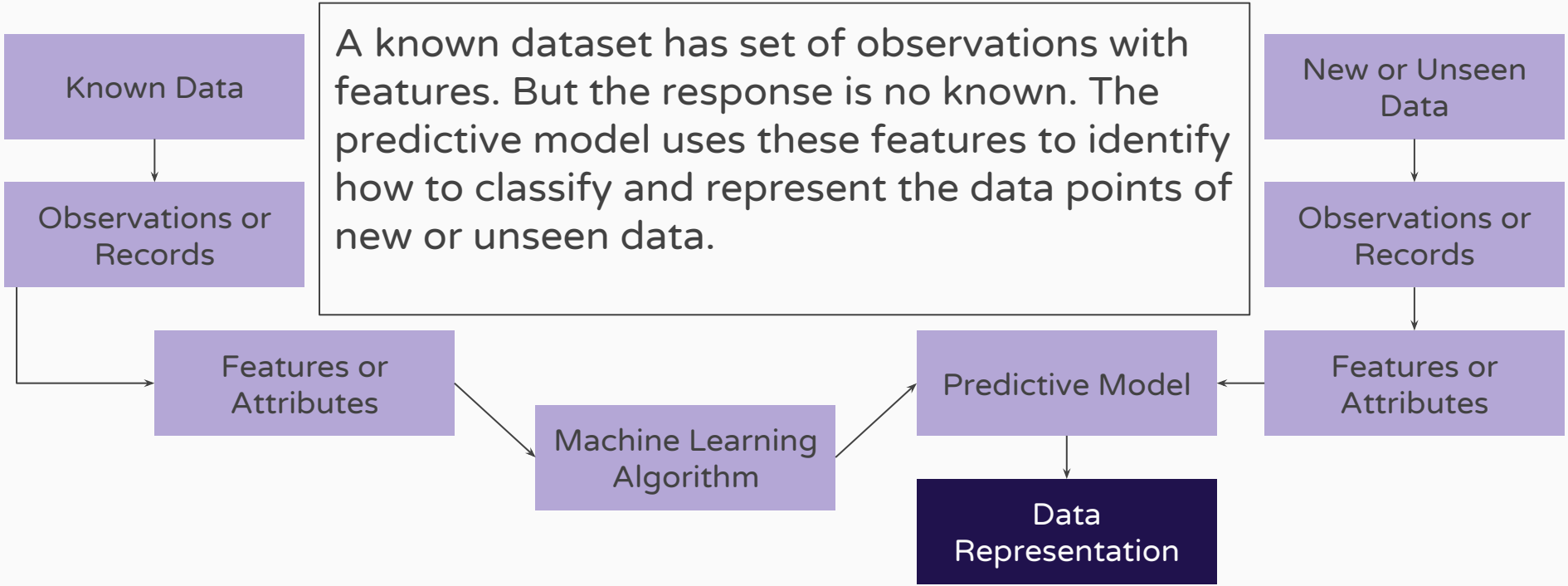
Machine Learning

How it Works? → Supervised Learning Model:

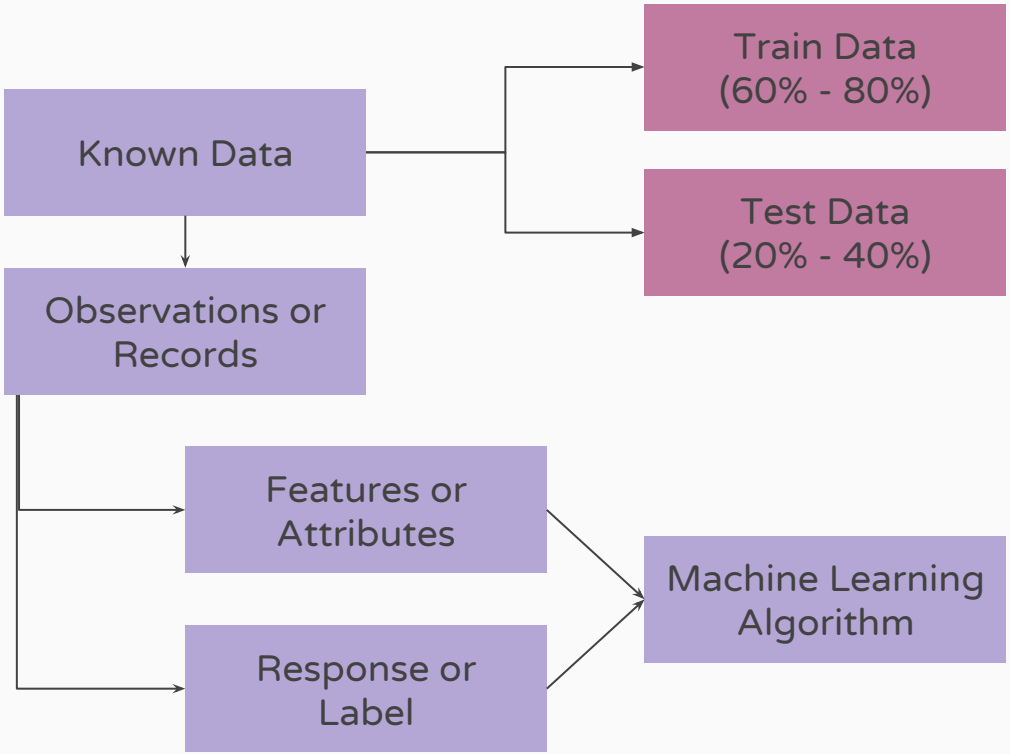
A known dataset with observations, features and responses are used to create and train a machine learning algorithm. A predictive model, built on top of this algorithm is then used to predict the response for a new dataset that has the same features.



How it Works? → Unsupervised Learning Model:



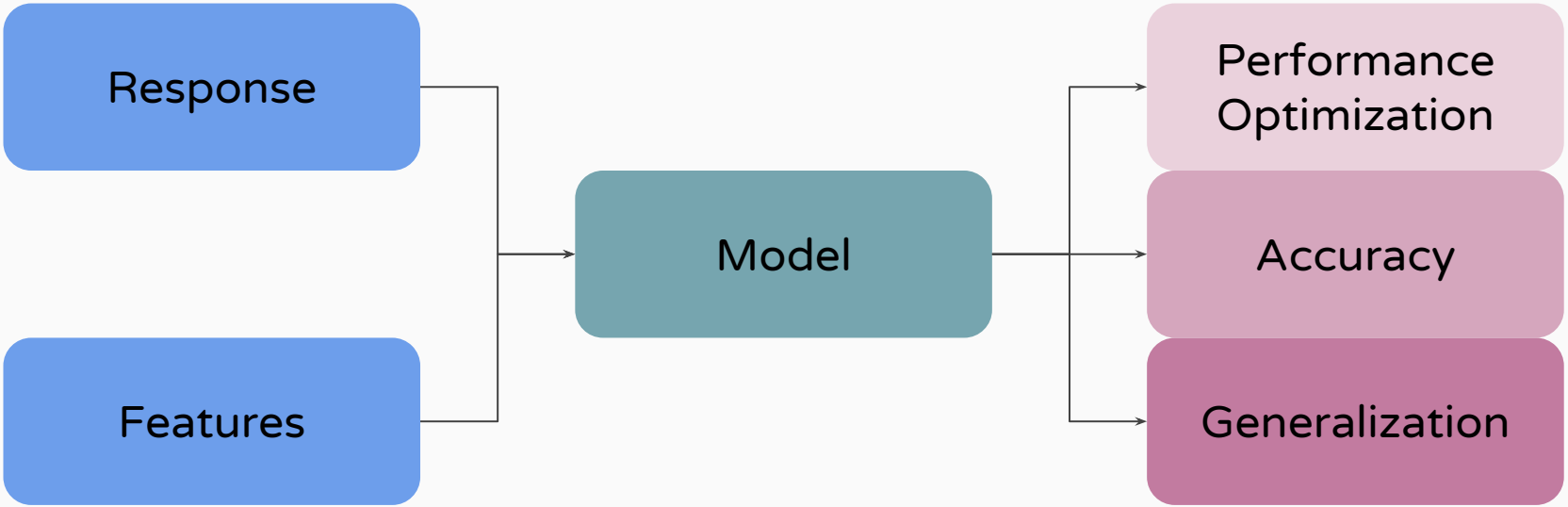
Step 5 & 6: Train, Test and Optimise the Model:



Step 5 & 6: Train, Test and Optimise the Model:

Observation	Education (in Years)	Professional Training (Yes/No)	Hourly Rate (INR)	Response
Train Set	15	0	100	Train Set
Train Set	18	1	200	Train Set
Test Set	20	1	350	Test Set
Train Set	16	0	250	
Train Set	17	1	250	
Test Set	20	1	400	

Model Considerations:



General Steps to follow to build a Predictive Model using Scikit-Learn:

- ❏ Read the Data, Explore the Data, Visualize the patterns in the Data, Apply Statistical Approaches to gain insights in the Data
- ❏ Do Data Preprocessing including Missing Values Handling, Categorical to Numeric Features Conversion, Rescaling the Features if required, Outliers detection and handling
- ❏ Separate the Data into features and target
- ❏ Split the Data into Training and Testing parts
- ❏ Create a model on Training part
- ❏ Make predictions on Testing part
- ❏ Check accuracy and errors occured if any in predicting the model
- ❏ Optimised the model to increase the accuracy and to reduce the errors
- ❏ Tuning the model for better performance
- ❏ After successfully attempt deploy the model into production

End

Thanks!

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“Keep Learning, Happy Learning”

Best Luck!

Have a Happy Future