



Practical Machine Learning

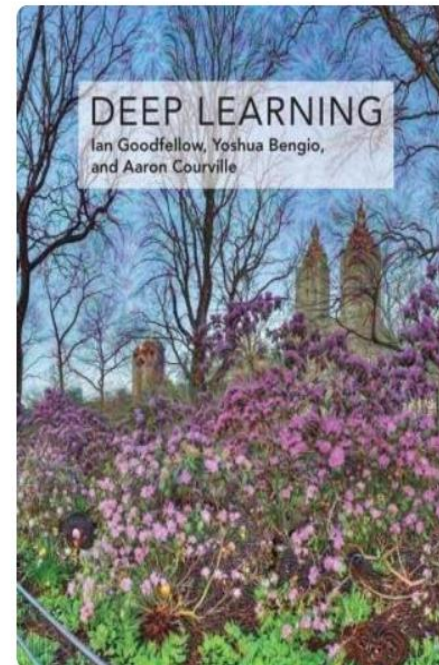
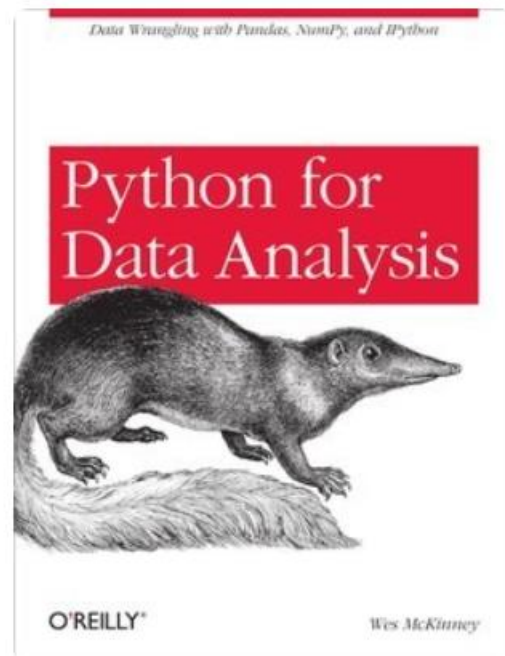
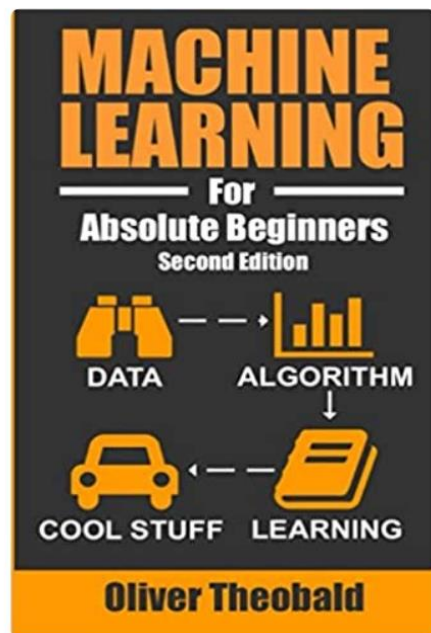
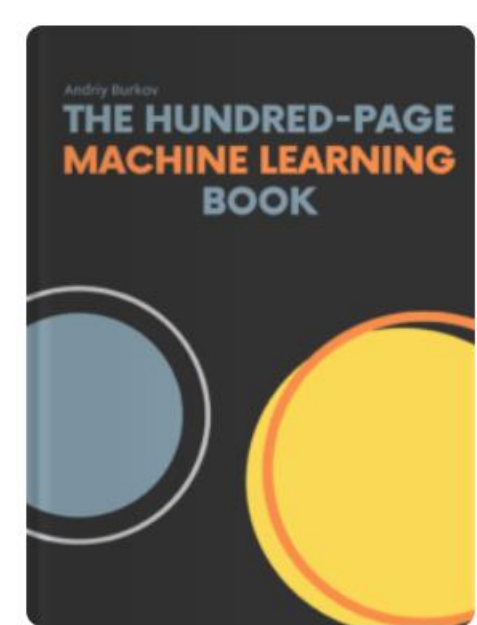
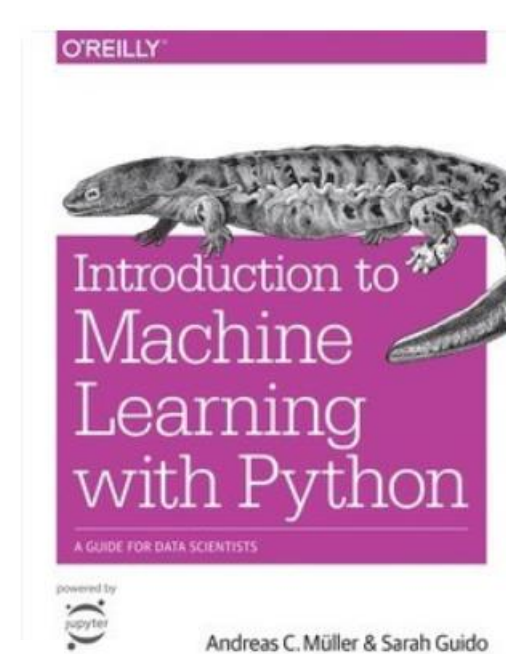
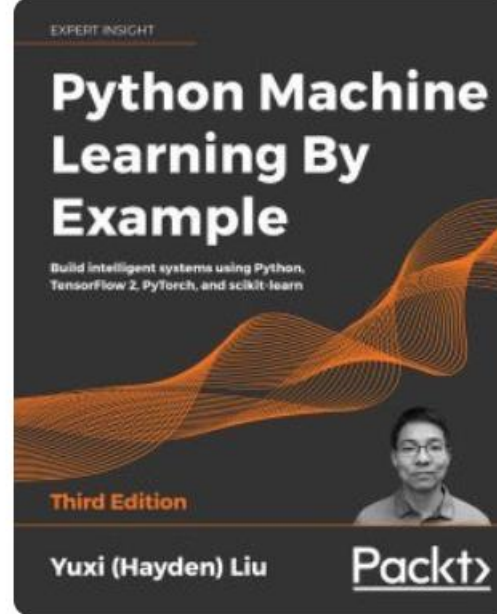
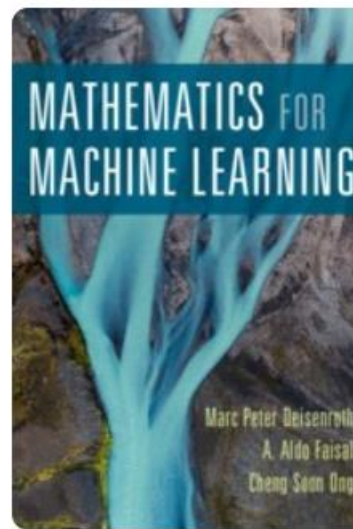
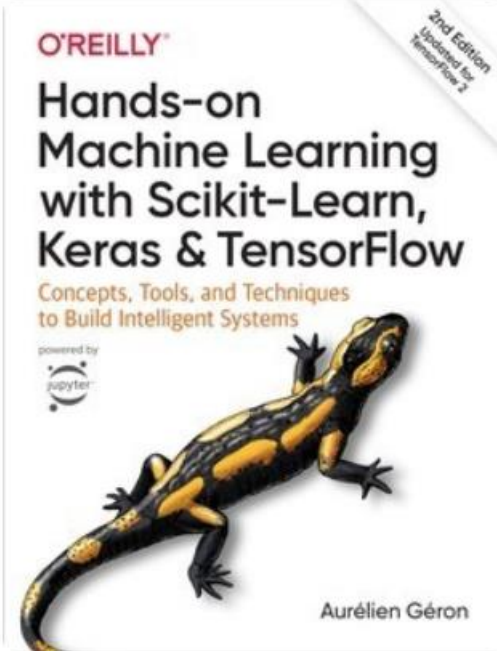
Day 1: Mar23 DBDA

Kiran Waghmare

CDAC Mumbai

Machine Learning Roadmap





Agenda

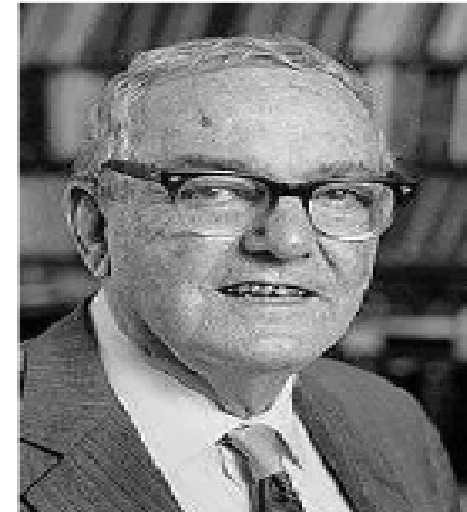
- What is machine learning?
- Algorithm types of Machine learning
- Supervised and Unsupervised Learning
- Uses of Machine learning
- Evaluating ML techniques
- Introduction to Scikit Learn

Why Machine Learning?

- Develop systems that can automatically adapt and customize themselves to individual users.
 - Personalized news or mail filter
- Discover new knowledge from large databases (**data mining**).
 - Market basket analysis (e.g. diapers and beer)
- Ability to mimic human and replace certain monotonous tasks - which require some intelligence.
 - like recognizing handwritten characters
- Develop systems that are too difficult/expensive to construct manually because they require specific detailed skills or knowledge tuned to a specific task (knowledge engineering bottleneck).

Machine Learning

- **Herbert Alexander Simon:**
“Learning is any process by which a system improves performance from experience.”
- “Machine Learning is concerned with computer programs that automatically improve their performance through experience. “



Herbert Simon
[Turing Award](#) 1975
[Nobel Prize in Economics](#) 1978

What is Machine Learning?

- [Arthur Samuel, 1959]
 - Field of study that gives computers
 - the ability to learn without being explicitly programmed
- [Kevin Murphy] algorithms that
 - automatically detect patterns in data
 - use the uncovered patterns to predict future data or other outcomes of interest
- [Tom Mitchell] algorithms that
 - improve their performance (P)
 - at some task (T)
 - with experience (E)

Definition

A computer program which learns from experience is called a *machine learning program* or simply a *learning program*. Such a program is sometimes also referred to as a *learner*.

What is Machine Learning?

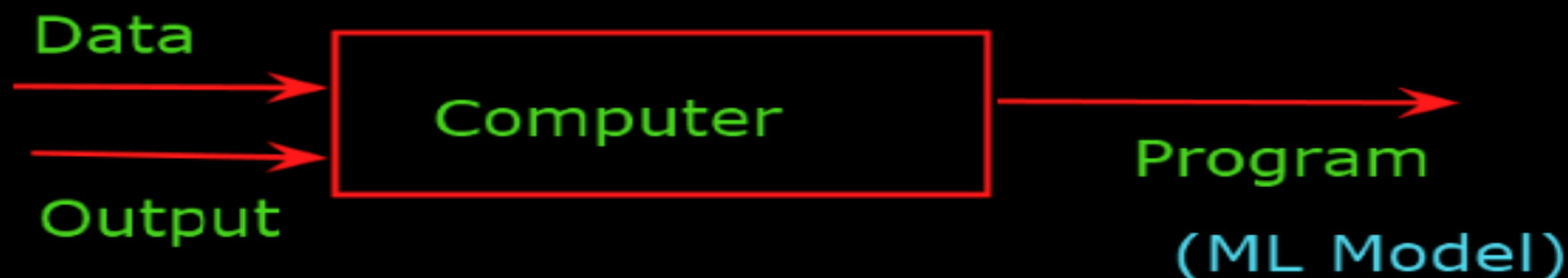
- If you are a Scientist



Traditional Programming



Machine Learning Programming



What is Machine Learning?

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Learning: acquisition of knowledge using experience

ML : A computer program is said to learn from experience E with respect to some class of task T and performance measure P, if its performance at task T, as measured by P, improves with experience E

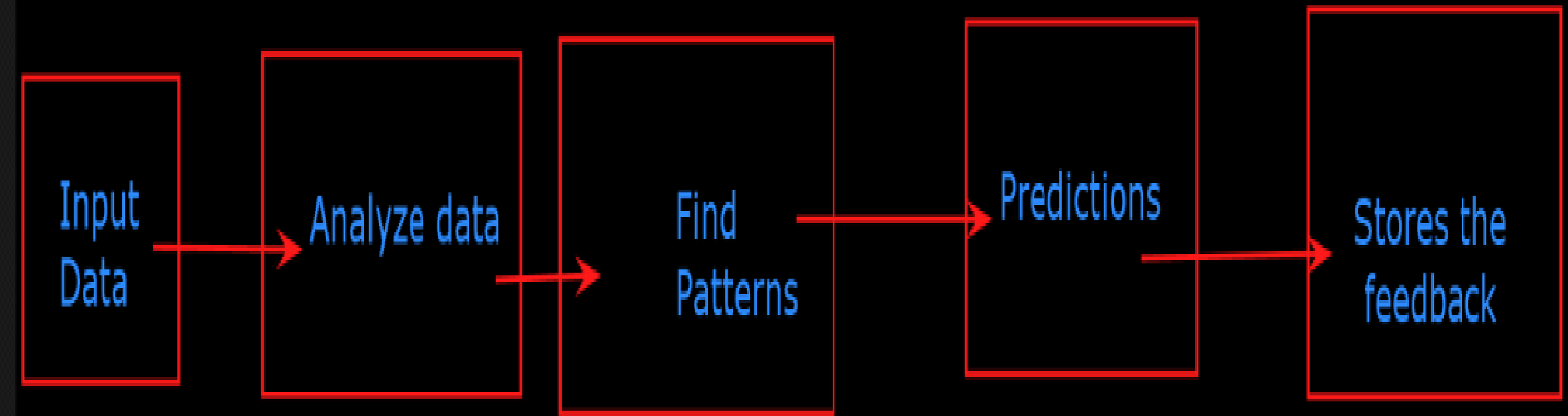
Learning: Improving with experience at some task.

Machine Learning: Data + Algorithms + Computing

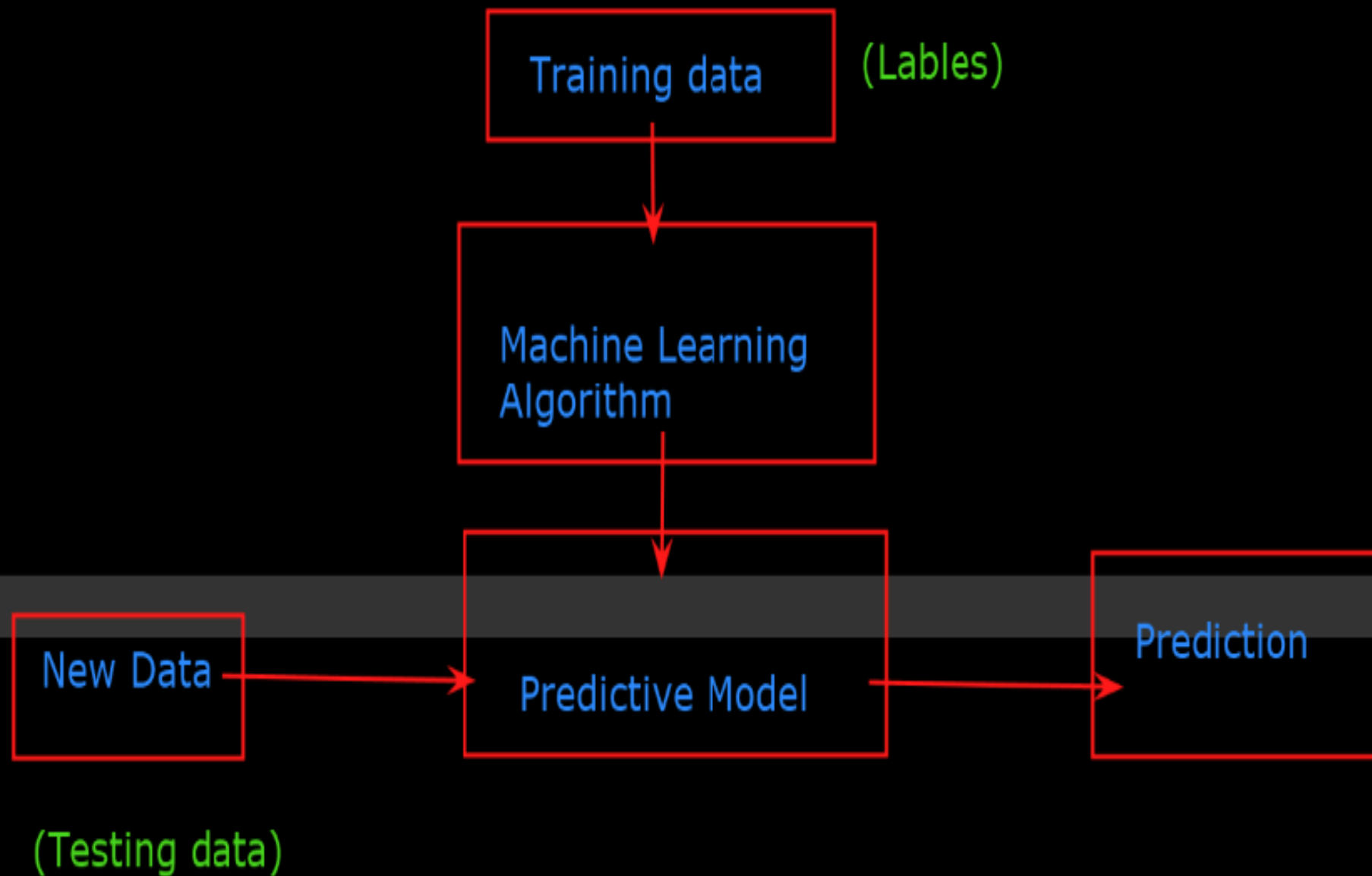
Machine Learning: Algorithms + Mathematics + Computer Science

Mathematics: Applied Maths + Statistics + Psychology + Applications

How does Machine Learning work :



How does Machine Learning work :



Features of Machine Learning:

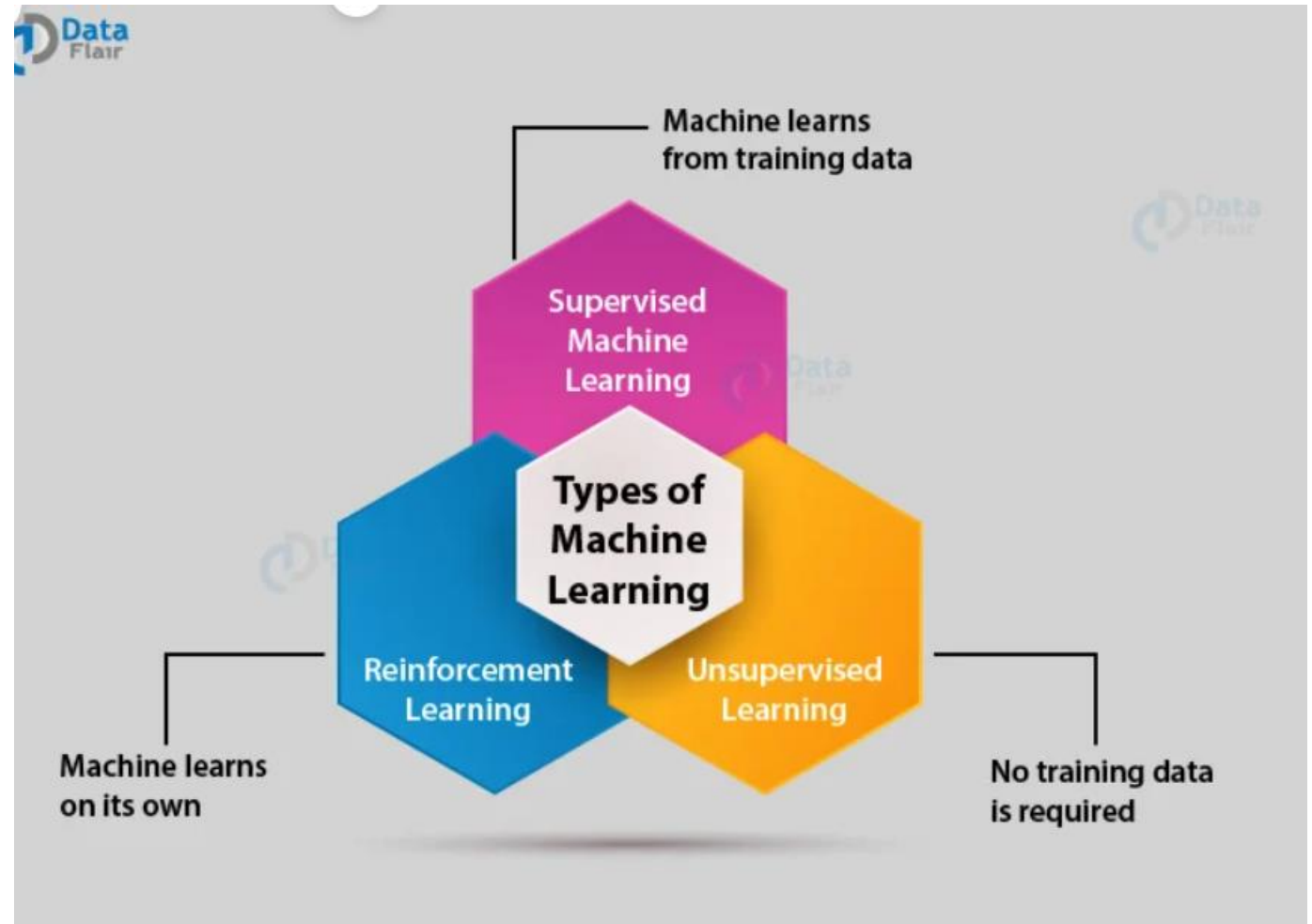
- Machine learning **uses data to detect various patterns** in a given dataset.
- It can **learn from past data** and improve automatically.
- It is a **data-driven technology**.
- Machine learning is much **similar to data mining** as it also deals with a huge amount of data.
- Following are some key points that show the importance of Machine Learning:
 - **Rapid increment** in the production of data
 - **Solving complex problems**, which are difficult for a human
 - **Decision-making in various sectors** including finance
 - Finding **hidden patterns and extracting useful information** from data.

What is Machine Learning Model?

- **Definition:**
 - Machine Learning is a concept which allows the machine
 - **to learn from examples and experience,**
 - and that **too without being explicitly programmed.**
- Machine Learning algorithms are an evolution of **normal algorithms.**
- They make your **programs “smarter”,** by **allowing them to automatically learn** from the data you provide.
- The algorithm is mainly divided into:
 - **Training Phase**
 - **Testing phase**

Types of Machine Learning

- Machine Learning Algorithms can be classified into 3 types as follows –
 - **Supervised Learning**
 - **Unsupervised Learning**
 - **Reinforcement Learning**



Supervised learning

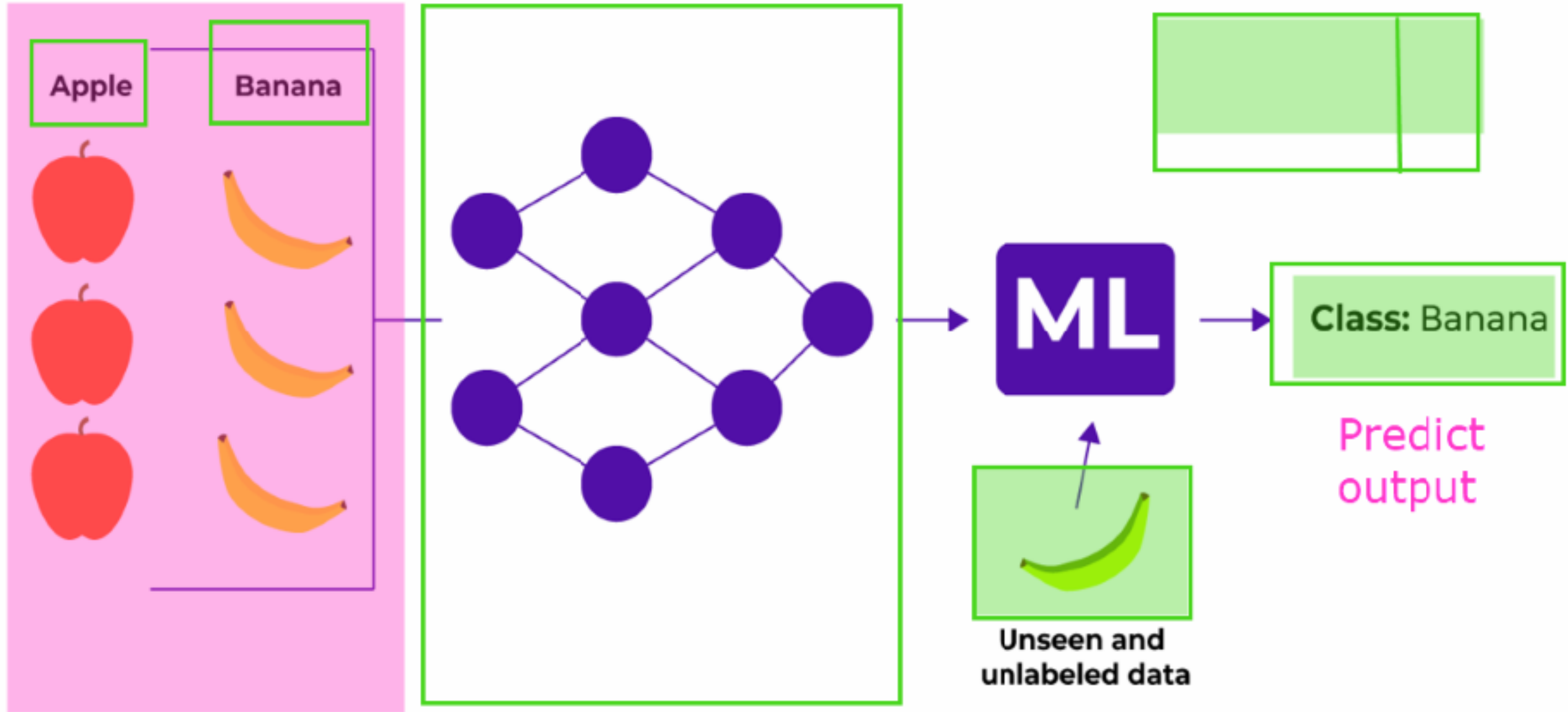
- machine learning task of **learning a function** that **maps an input to an output** supported example input-output pairs.
- In Supervised Learning, the dataset on which we **train our model is labeled**. There is a **clear and distinct mapping** of input and output. Based on the example inputs, the model is able to get **trained in the instances**.

Training Data

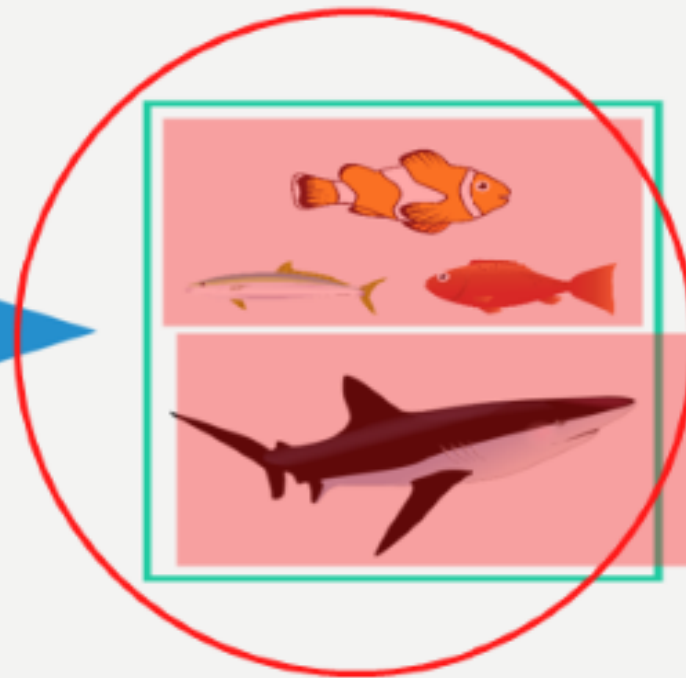
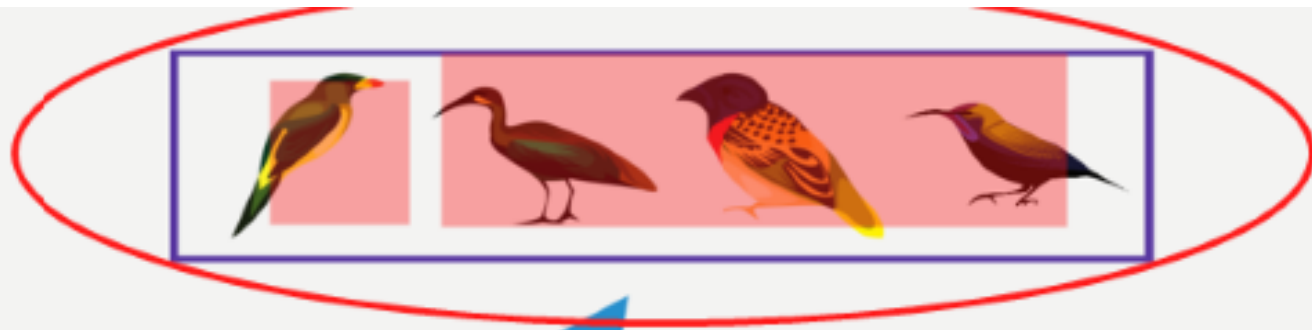
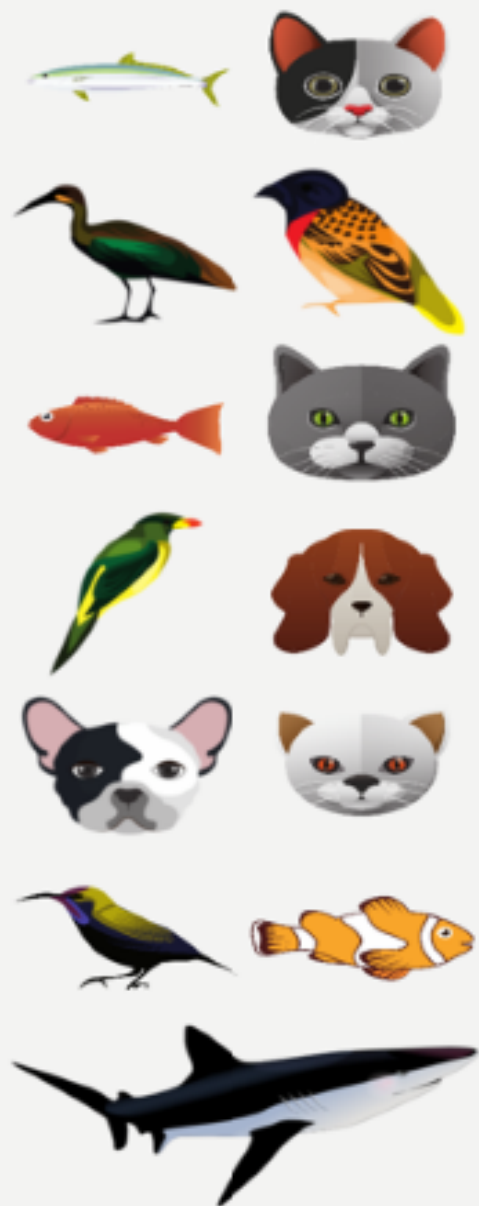
ML Algorithm

Model

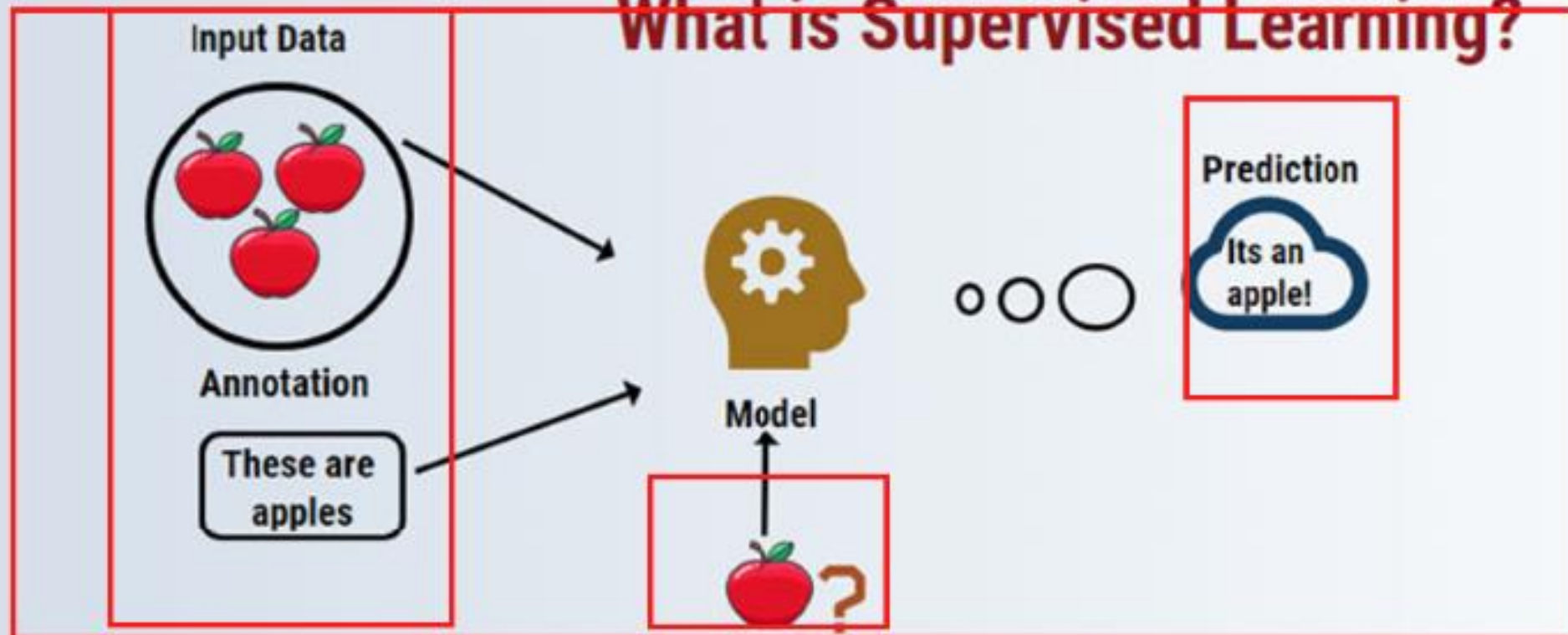
Prediction



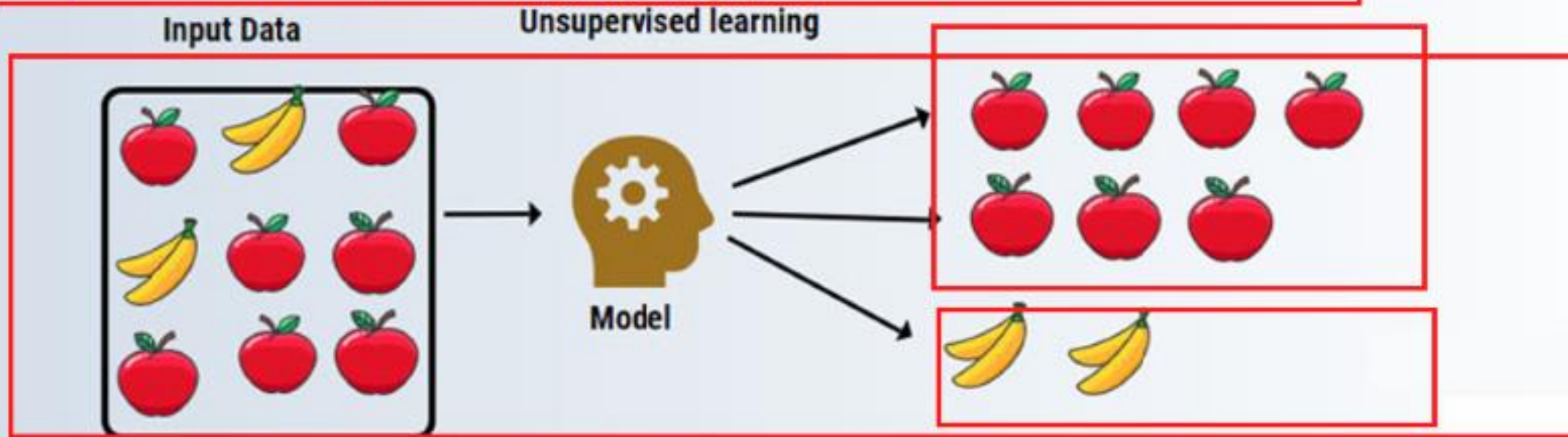
No labels



What is Supervised Learning?



Unsupervised learning



Supervised Learning

data **label**



Dog



Bird



Airplane



Deer



Cat



Truck



Ship

Semi-Supervised Learning

data **label**



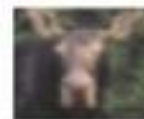
Dog



Bird



No label



No label



No label



No label



No label

Reinforcement Learning

- Reinforcement learning is one among three basic machine learning paradigms, alongside supervised learning and unsupervised learning.
- Reinforcement Learning is an **emerging** and **most popular** type of Machine Learning Algorithm.
- It is used in various **autonomous systems** like **cars** and **industrial robotics**.
- The aim of this algorithm is to reach a goal in a **dynamic environment**.
- It can reach this **goal** based on several rewards that are provided to it by the system.

Agent



Am I
audible?

Yes

Reward +ve

(Strong Network)

No

Reward -ve

(Poor Network)

Environment

(Network Testing Zone)

**Keep searching
until you get
strong network**

Artificial Intelligence

Any technique which enables computers to mimic human behavior.

Machine Learning

Subset of AI techniques which use statistical methods to enable machines to improve with experiences.

Deep Learning

Subset of ML which make the computation of multi-layer neural networks feasible.

