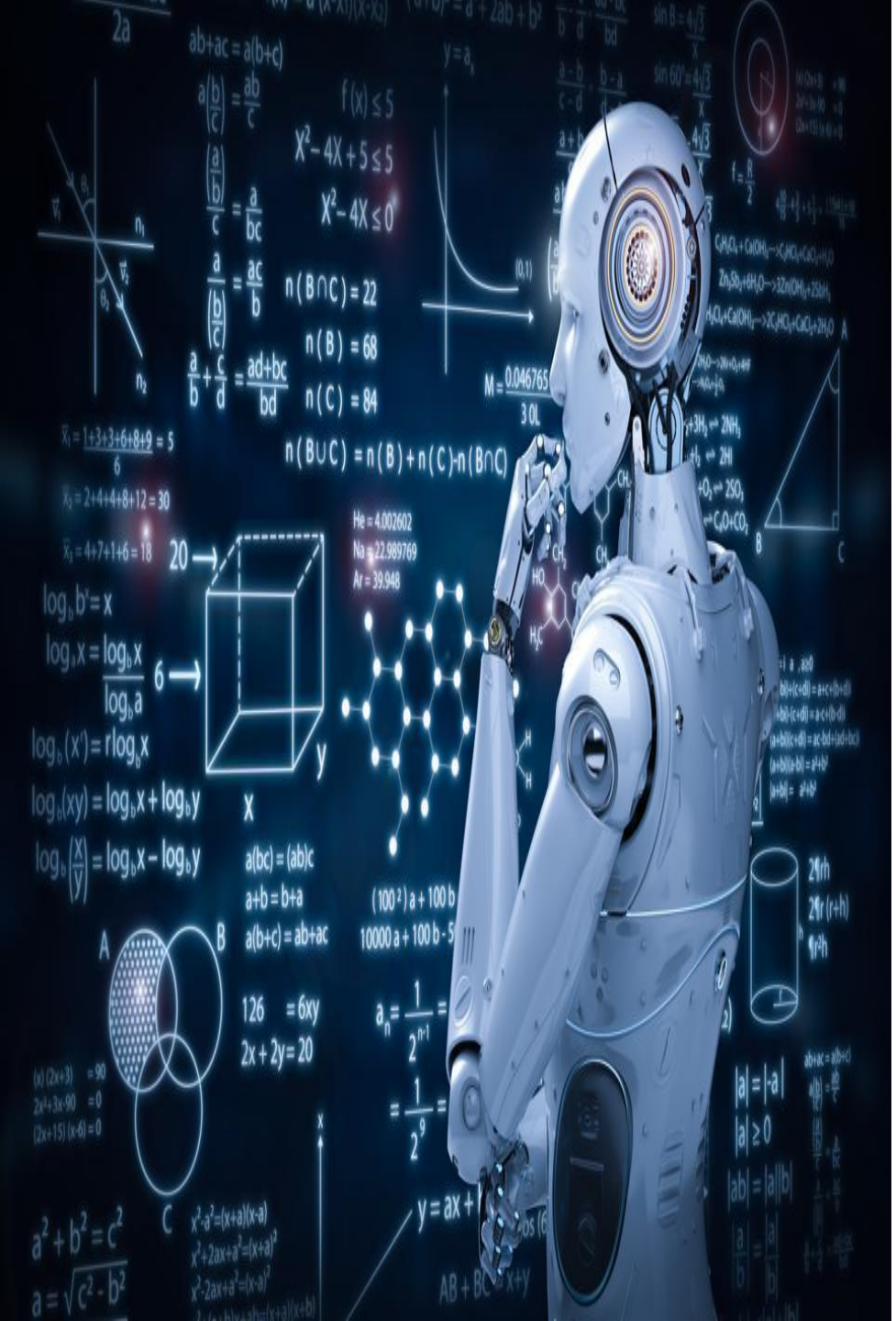
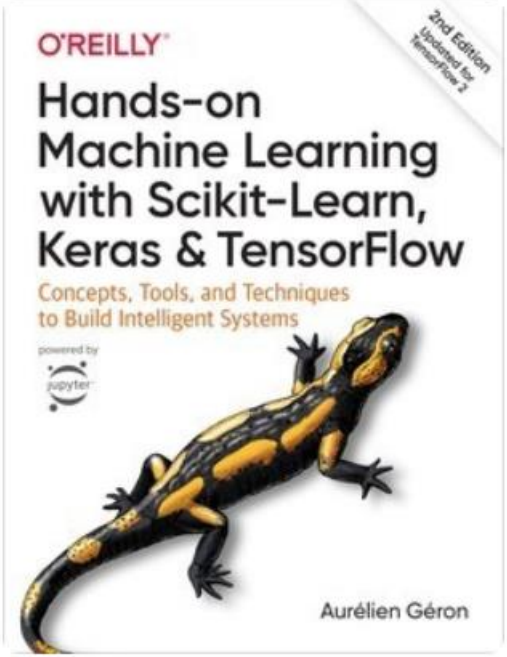


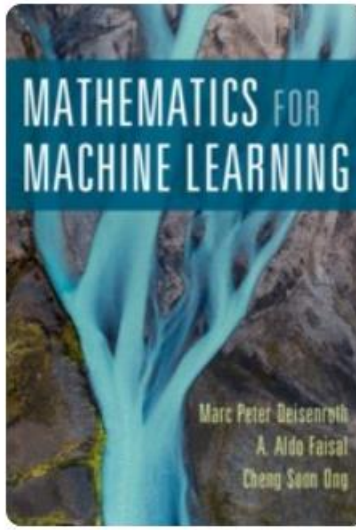
Practical Machine Learning

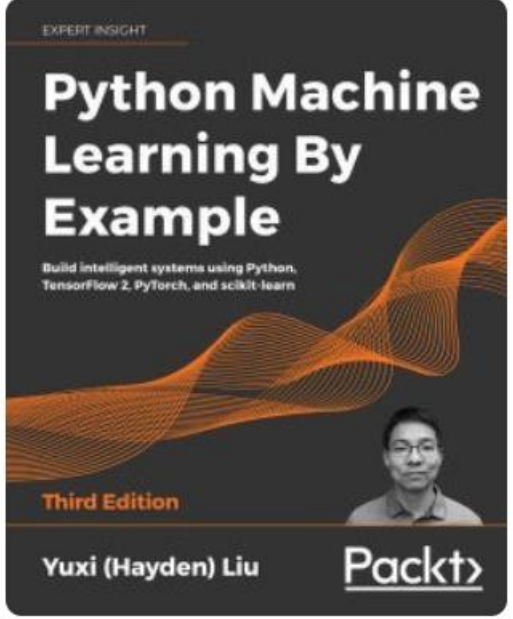
Day 1: Mar22 DBDA

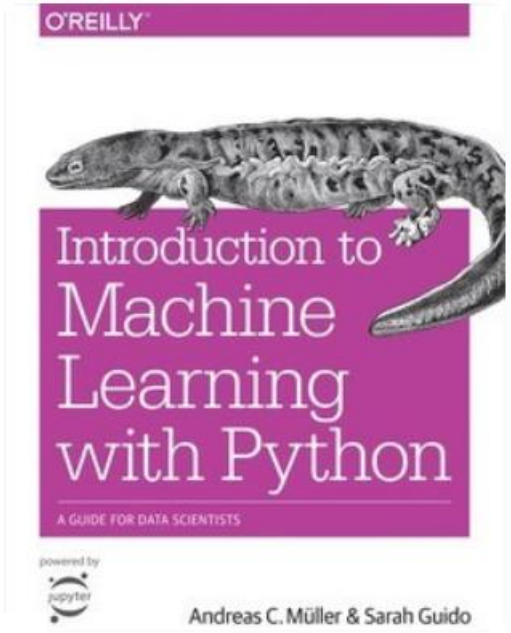
Kiran Waghmare

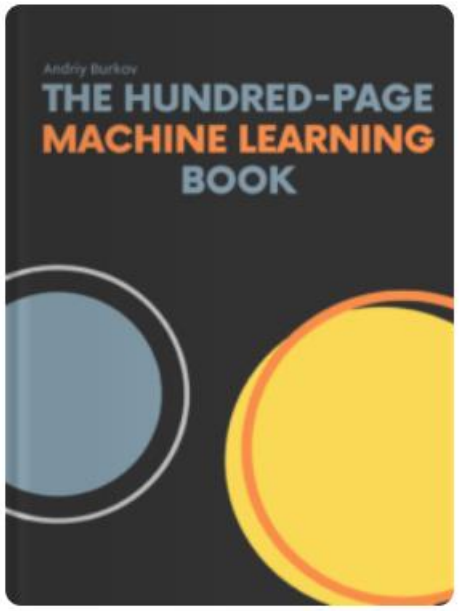
Machine Learning Roadmap

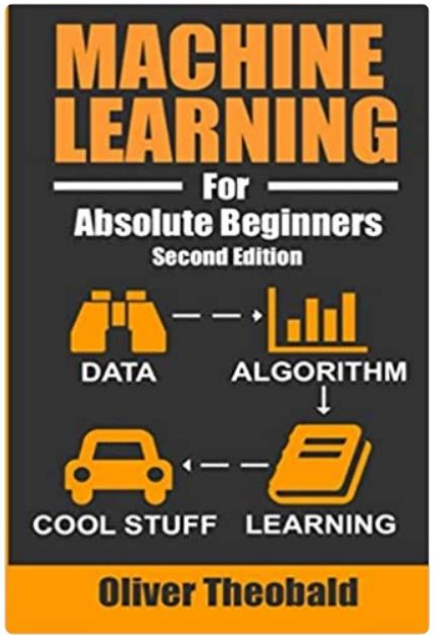

O'REILLY
2nd Edition
Updated for TensorFlow 2
Hands-on Machine Learning with Scikit-Learn, Keras & TensorFlow
Concepts, Tools, and Techniques to Build Intelligent Systems
powered by jupyter
Aurélien Géron

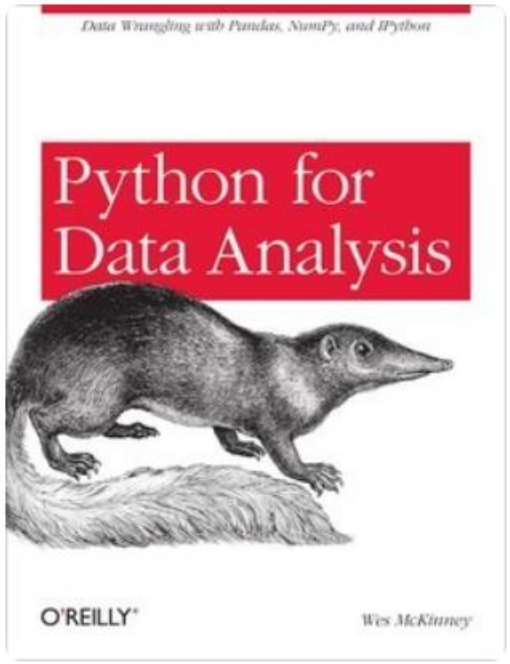

MATHEMATICS FOR MACHINE LEARNING
Marc Peter Deisenroth
A. Aldo Faisal
Cheng Soon Ong

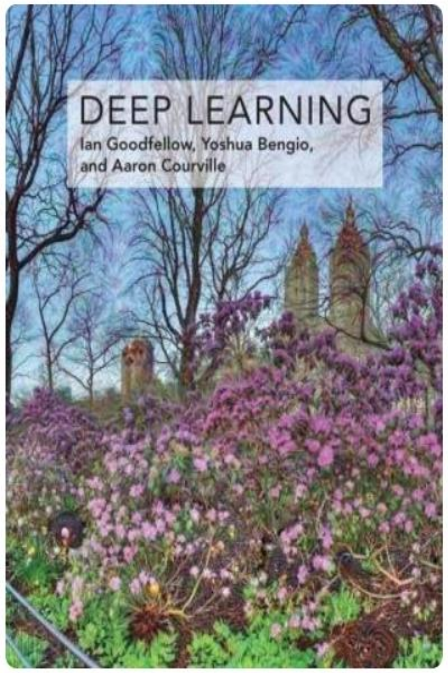

EXPERT INSIGHT
Python Machine Learning By Example
Build intelligent systems using Python, TensorFlow 2, PyTorch, and scikit-learn
Third Edition
Yuxi (Hayden) Liu
Packt


O'REILLY
Introduction to Machine Learning with Python
A GUIDE FOR DATA SCIENTISTS
powered by jupyter
Andreas C. Müller & Sarah Guido


Andriy Burkov
THE HUNDRED-PAGE MACHINE LEARNING BOOK

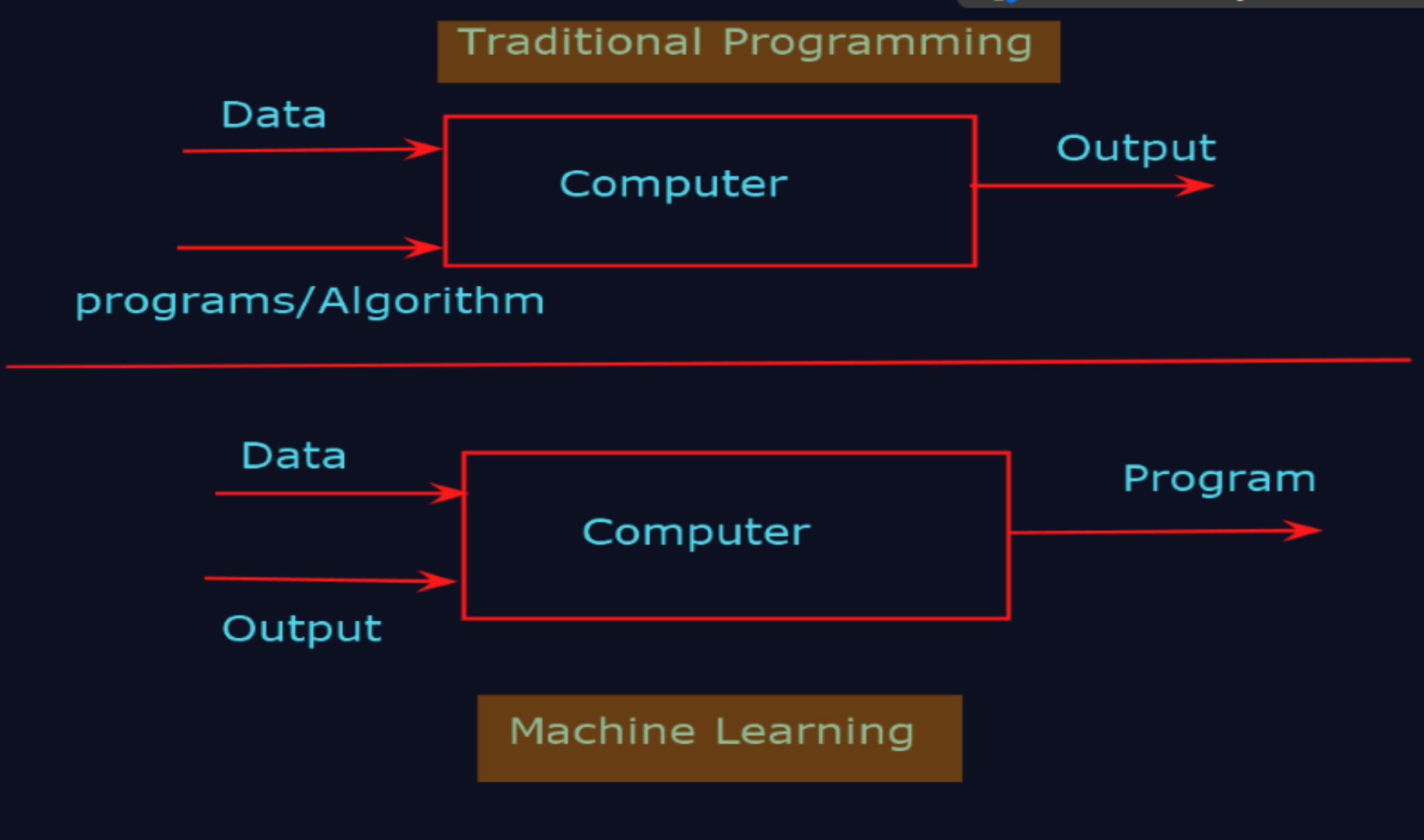

MACHINE LEARNING
For
Absolute Beginners
Second Edition
DATA
ALGORITHM
COOL STUFF
LEARNING
Oliver Theobald


Data Wrangling with Pandas, NumPy, and IPython
Python for Data Analysis
O'REILLY
Wes McKinney


DEEP LEARNING
Ian Goodfellow, Yoshua Bengio, and Aaron Courville

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


Traditional Programming
Data
Computer
Output
programs/Algorithm
Data
Computer
Program
Output
Machine Learning

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. "

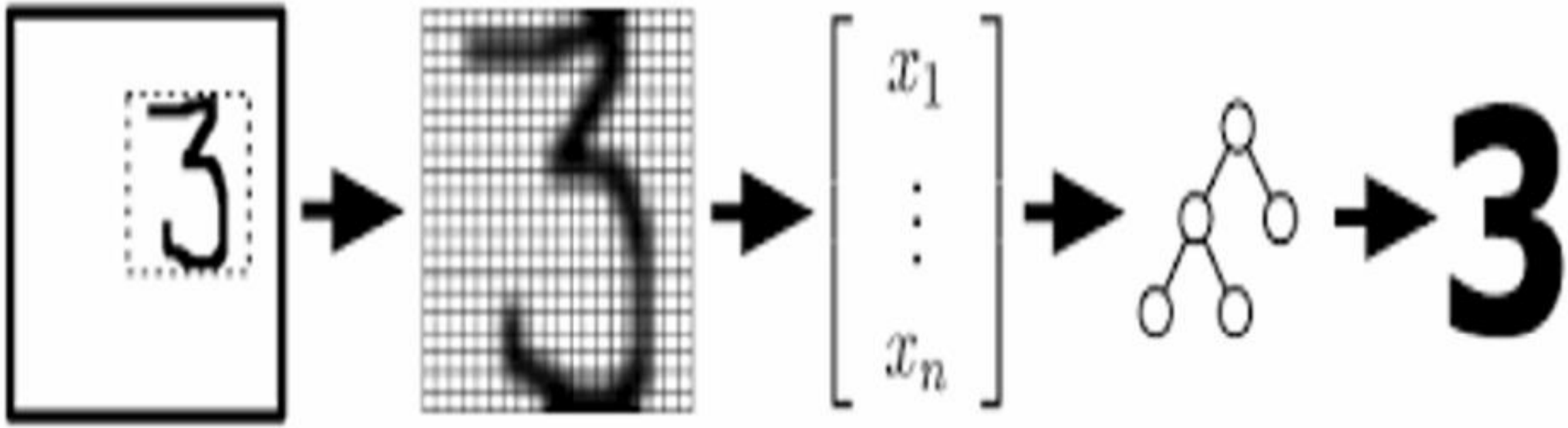
Herbert Simon
Turing Award 1975
Nobel Prize in Economics 1978

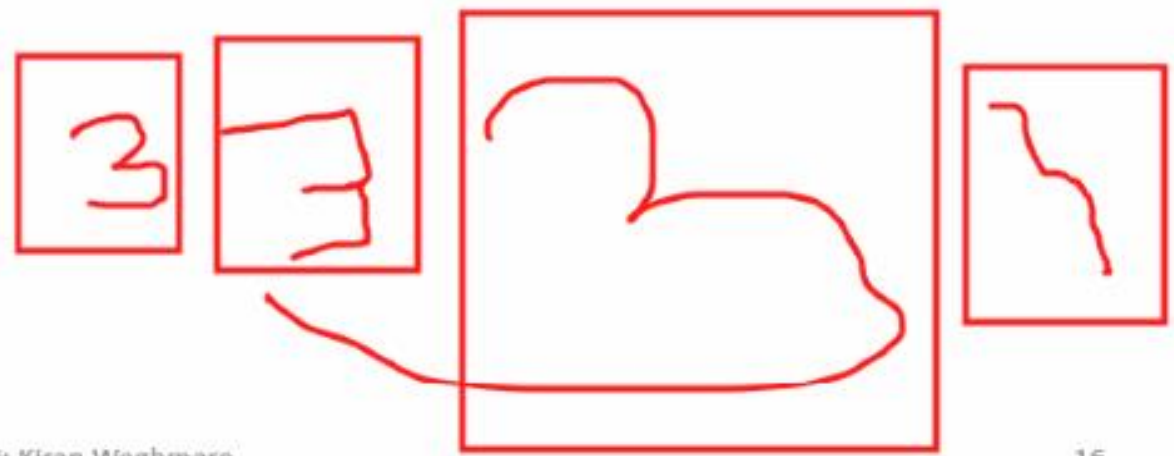
What is Machine Learning?

- [Arthur Samuel, 1959]
  - Field of study that gives computers
  - the ability to learn without being explicitly programmed

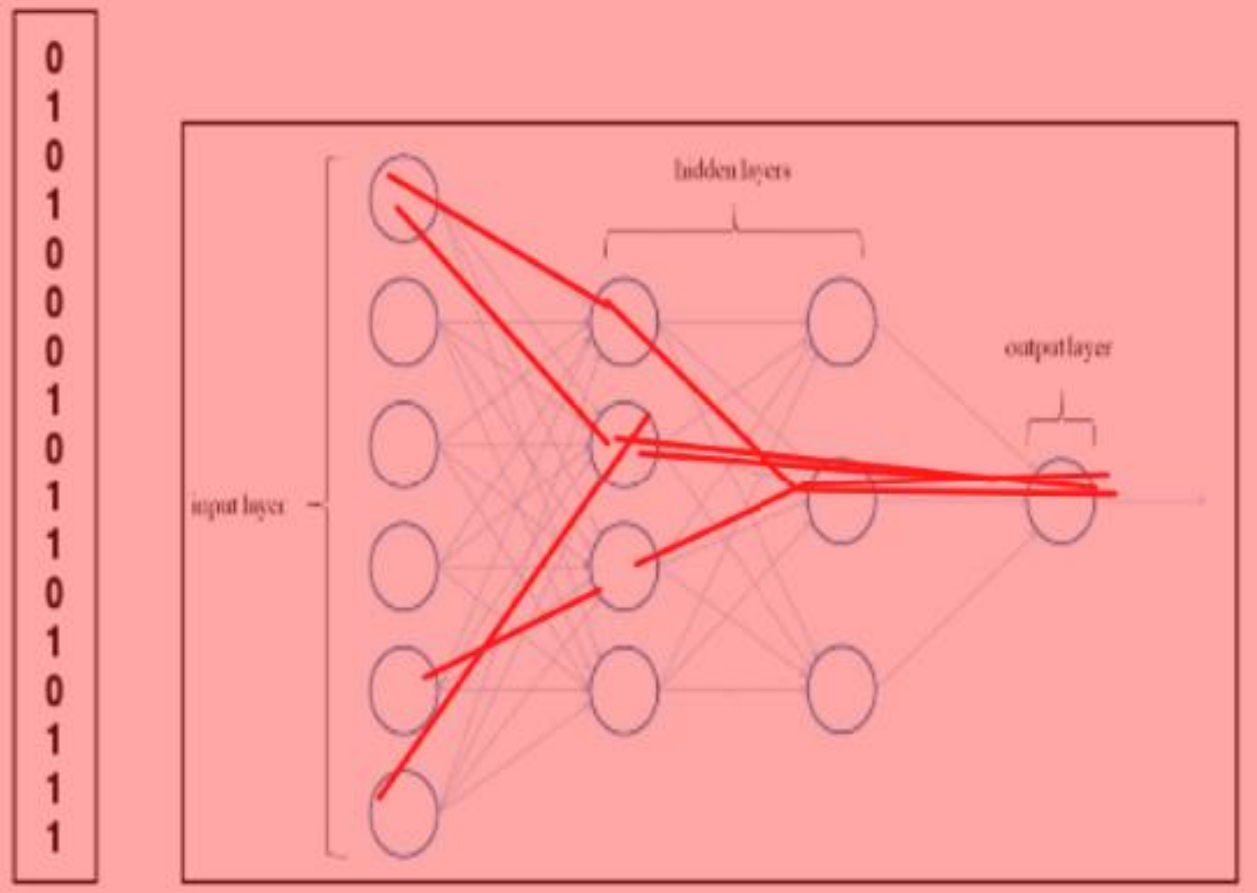
- [Kevin Murphy] algorithms that
  - automatically detect patterns in data
  - use the uncovered patterns to predict future data or other outcomes of interest

- [Tom Mitchell] algorithms that
  - improve their performance (P)
  - at some task (T)
  - with experience (E)


x_1
x_n
3
Original Image (125x125)
Normalized Image (20x20)
Features
Model
Digit



Position



Encoding

Neural Network

-1.1

Eval

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

Pattern Analysis
Trends
Data driven
Data mining

Profit analysis
Reduce the complexity
Decision making applications
hidden pattern and extracting the useful information.

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.

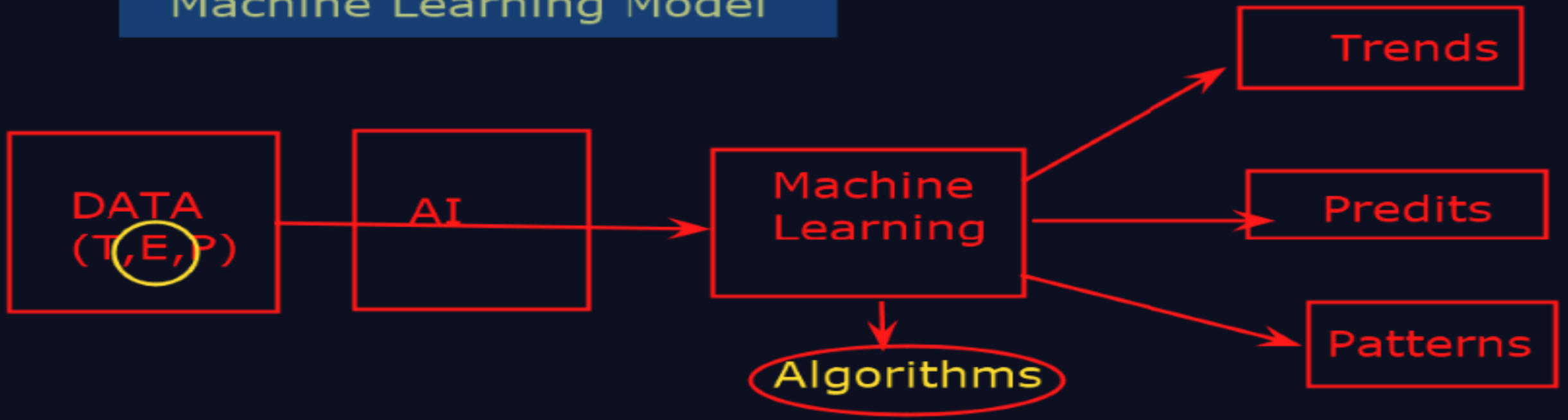
What is Machine Learning Model?

- **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**

Output: sweet, juicy, ripe, overripe

Machine Learning Model



Dataset → Training | Testing

I/p--->o/P

Feature: Physical characteristic

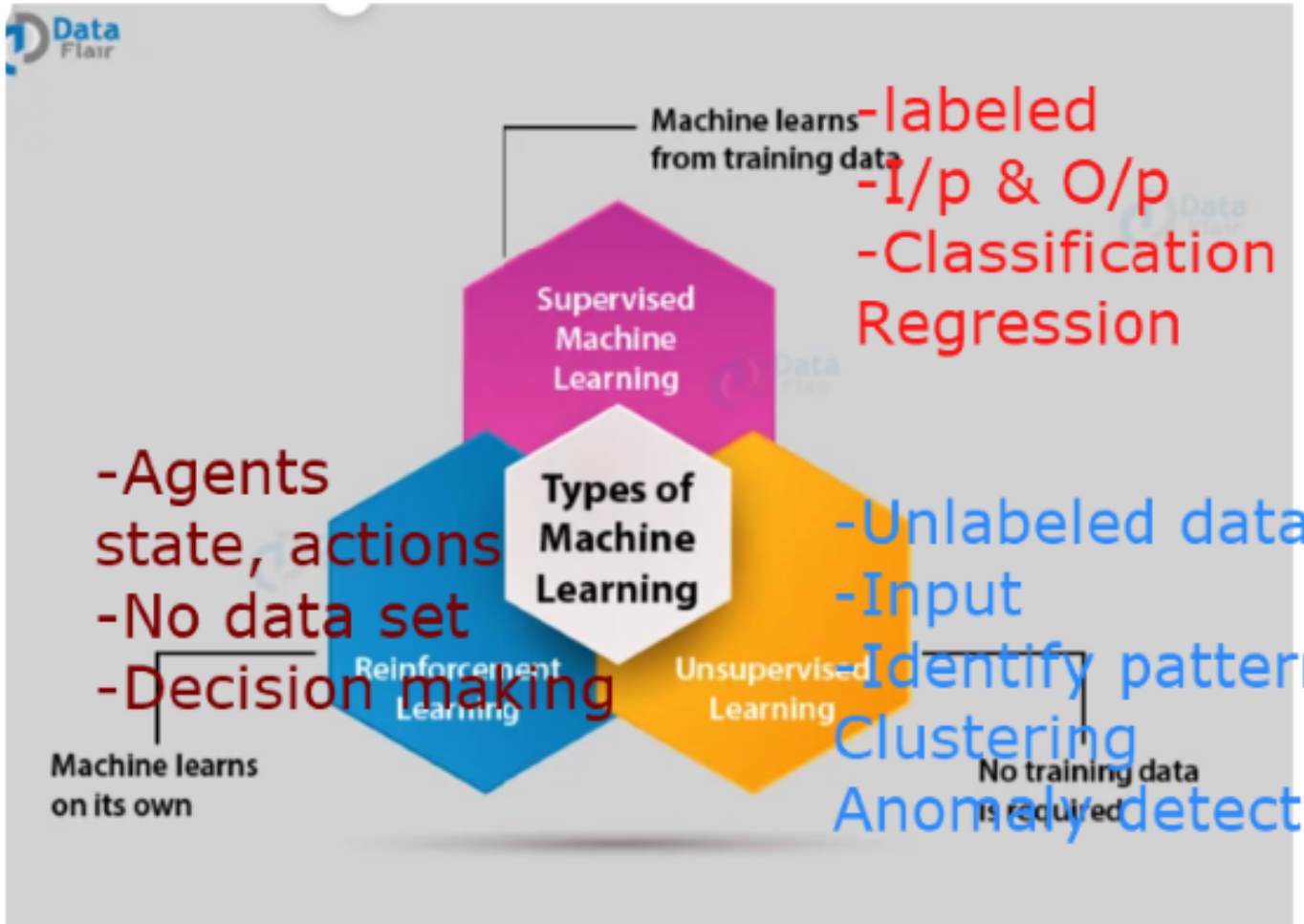
color,sie,shape,loc,vendor,ripe

Types of Machine Learning

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

Automation

Training	Testing



Types of Machine Learning:

Mouse Select Text Draw Stamp Spotlight Eraser Format Undo Redo

Who can see what you share here? Recording On

-labeled
-I/p & O/p
-Classification
Regression

Automation

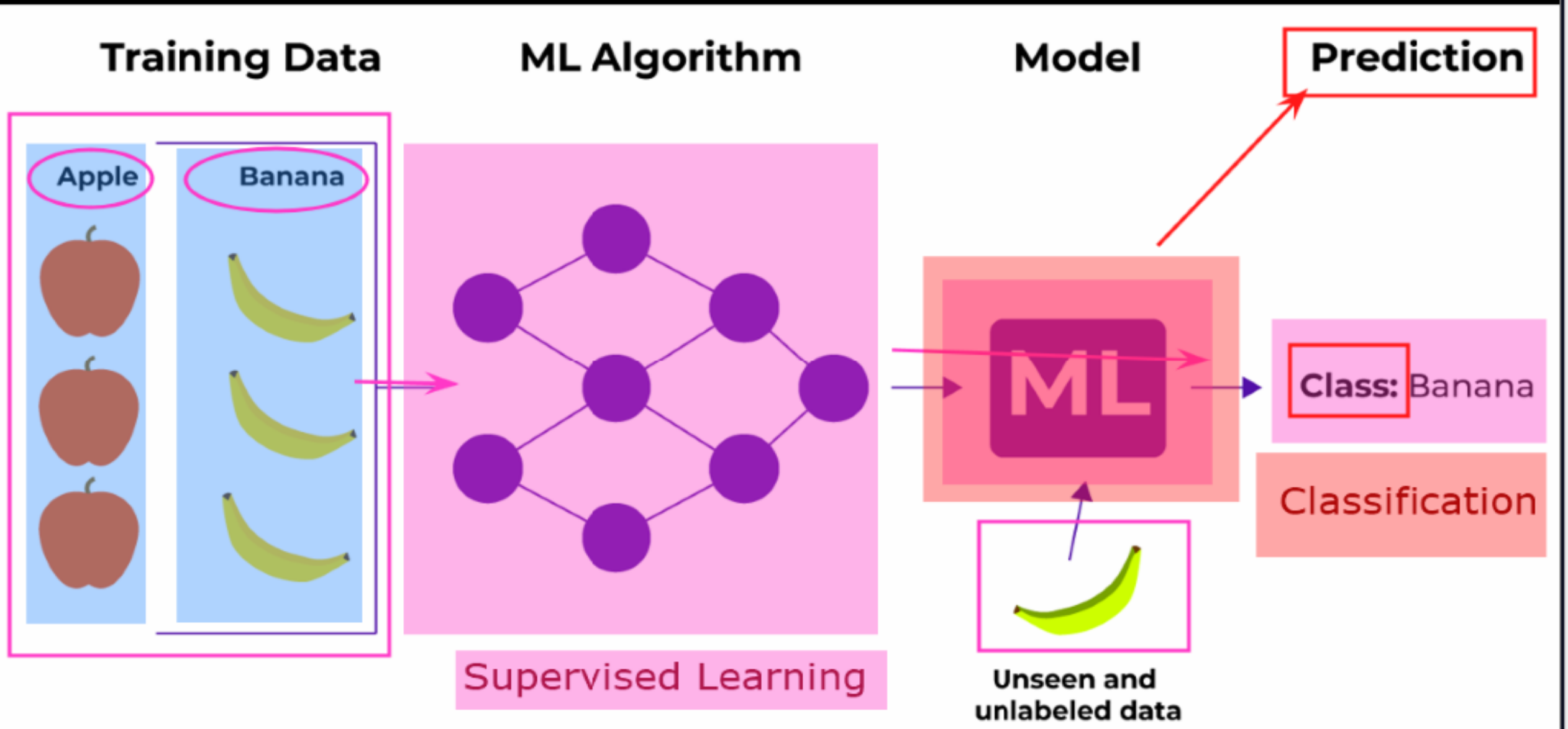
-Agents
state, actions
-No data set
-Decision making

Training | Testing

-Unlabeled data
-Input
-Identify pattern
Clustering
Anomaly detection

Supervised learning

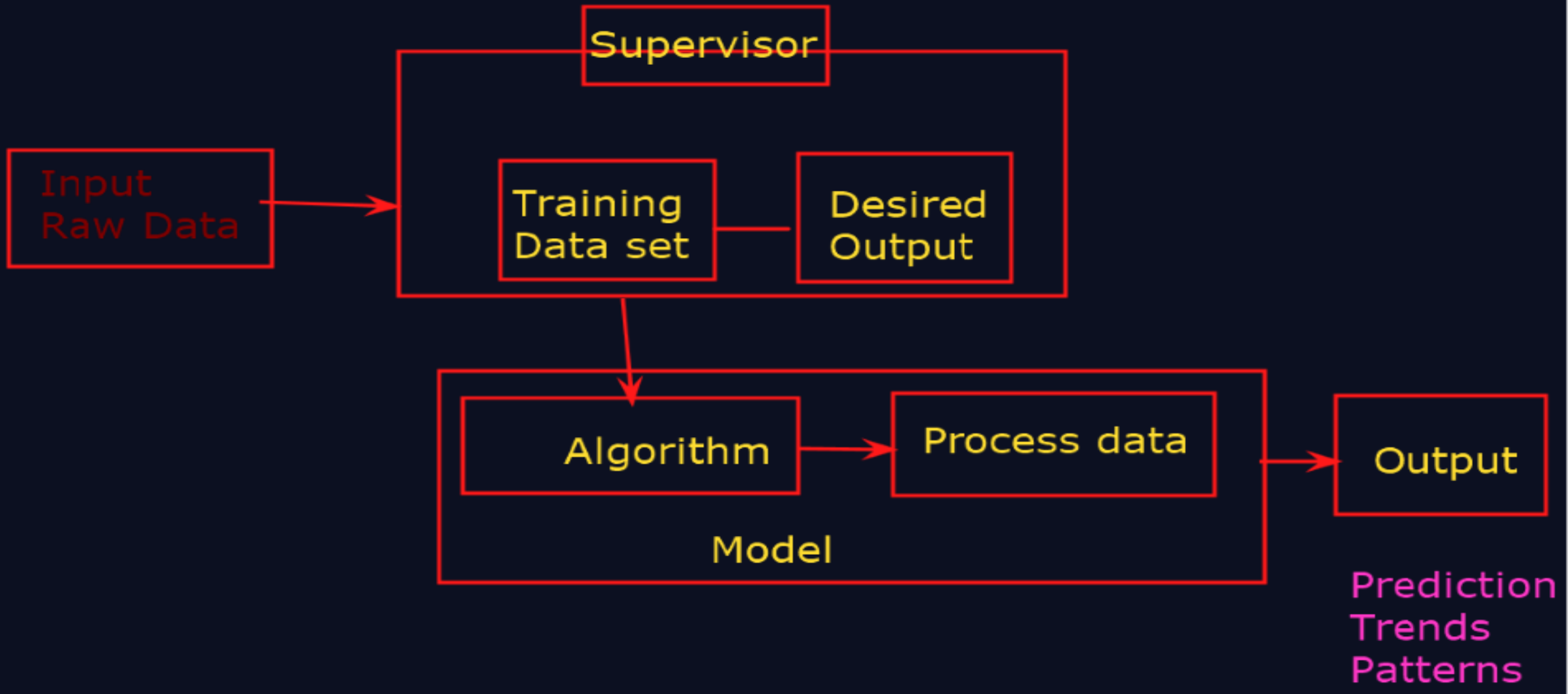
- machine learning task of learning a function that maps an **input** to an **output** supported example input-output pairs.
- In Supervised Learning, the dataset on which we **train our model is labeled**. There is a clear and **distinct mapping** of input and output. Based on the example inputs, the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


Training Data
ML Algorithm
Model
Prediction
Apple
Banana
ML
Class: Banana
Classification
Supervised Learning
Unseen and unlabeled data

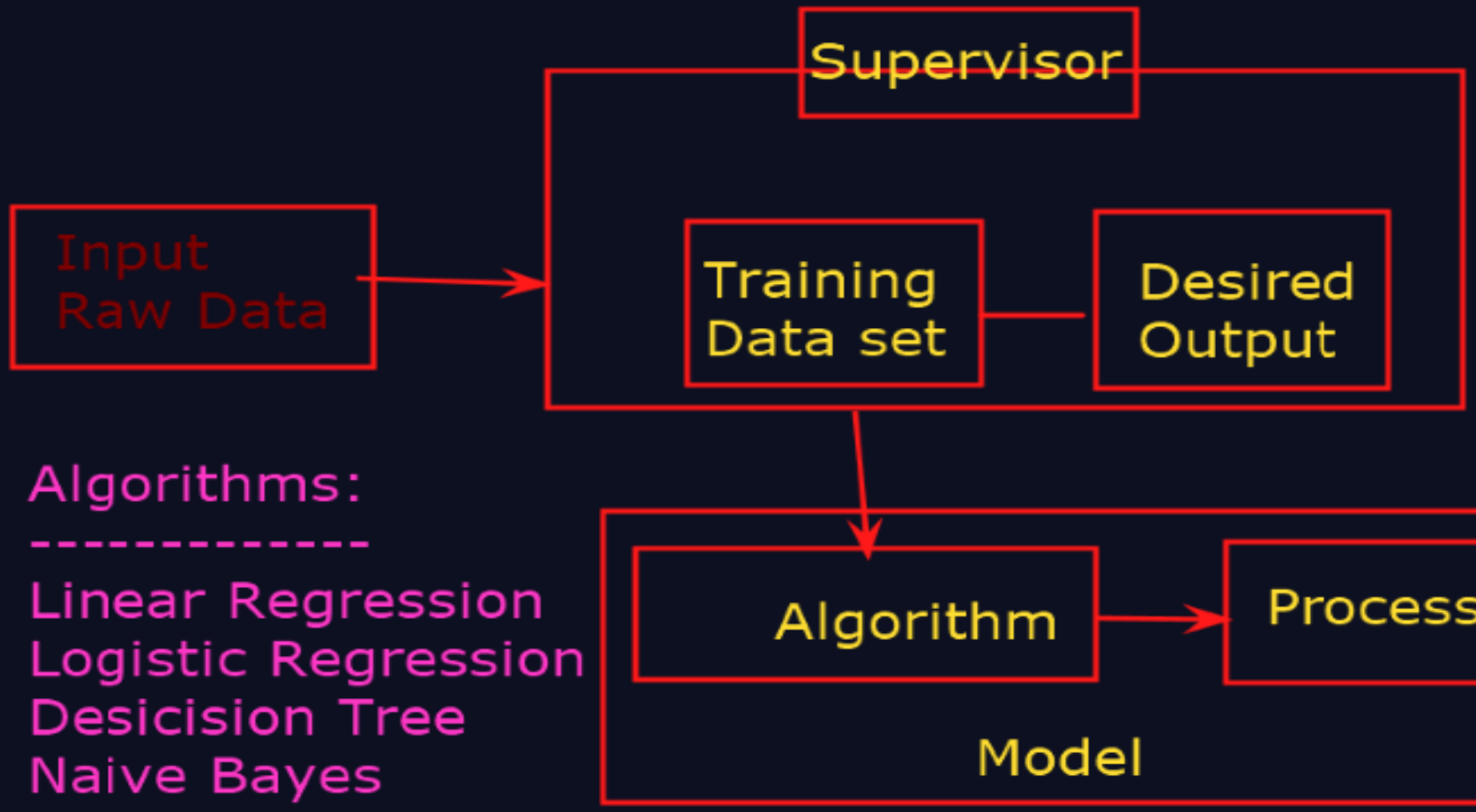
Mouse Select Text Draw Stamp Spotlight Eraser Format Undo Redo

Who can see what you share here? Recording On

Types of Machine Learning:



Types of Machine Learning:



1. Classification
2. Regression

Algorithms:

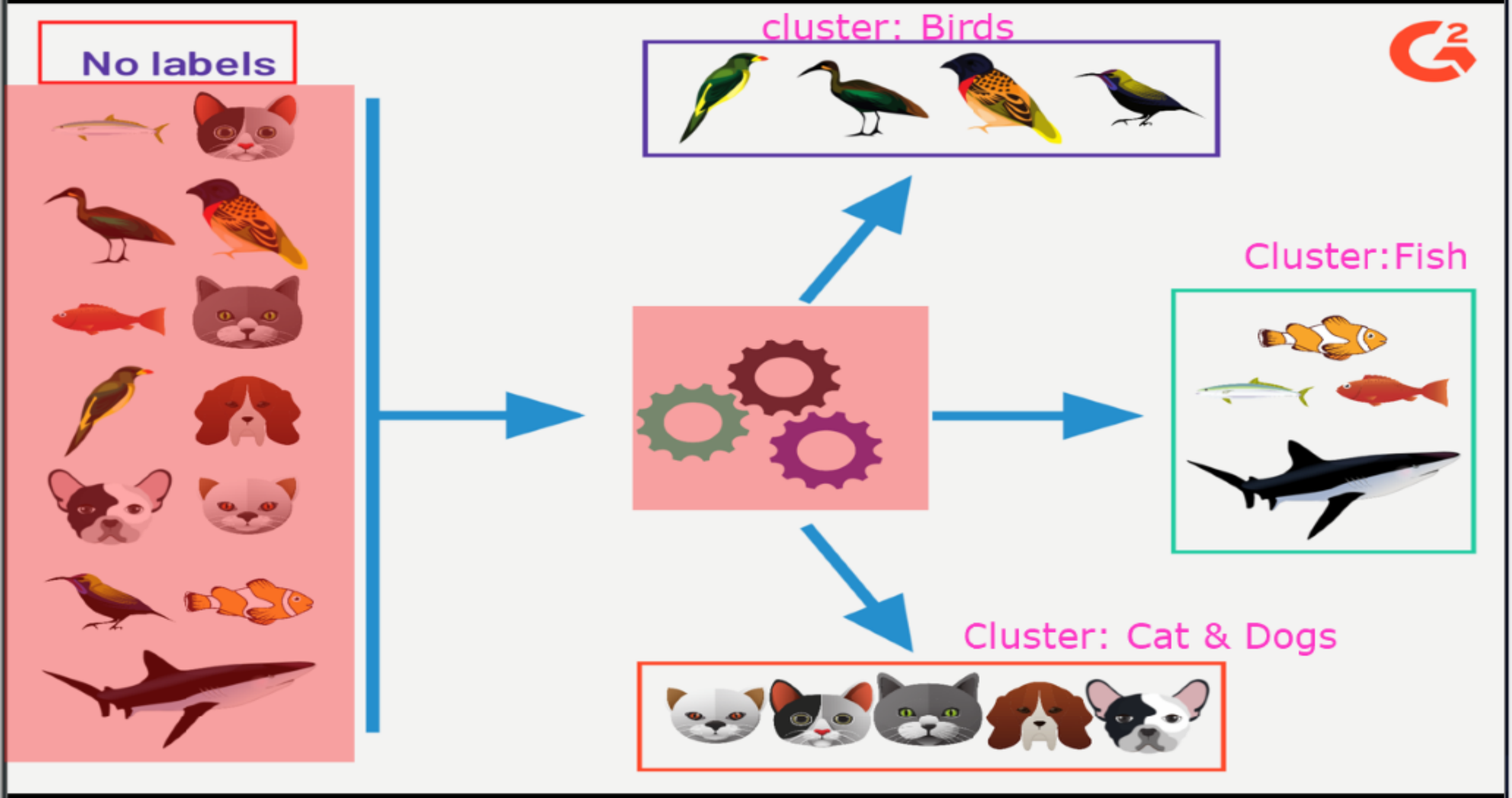
- Linear Regression
- Logistic Regression
- Desicision Tree
- Naive Bayes
- Support Vector Machine

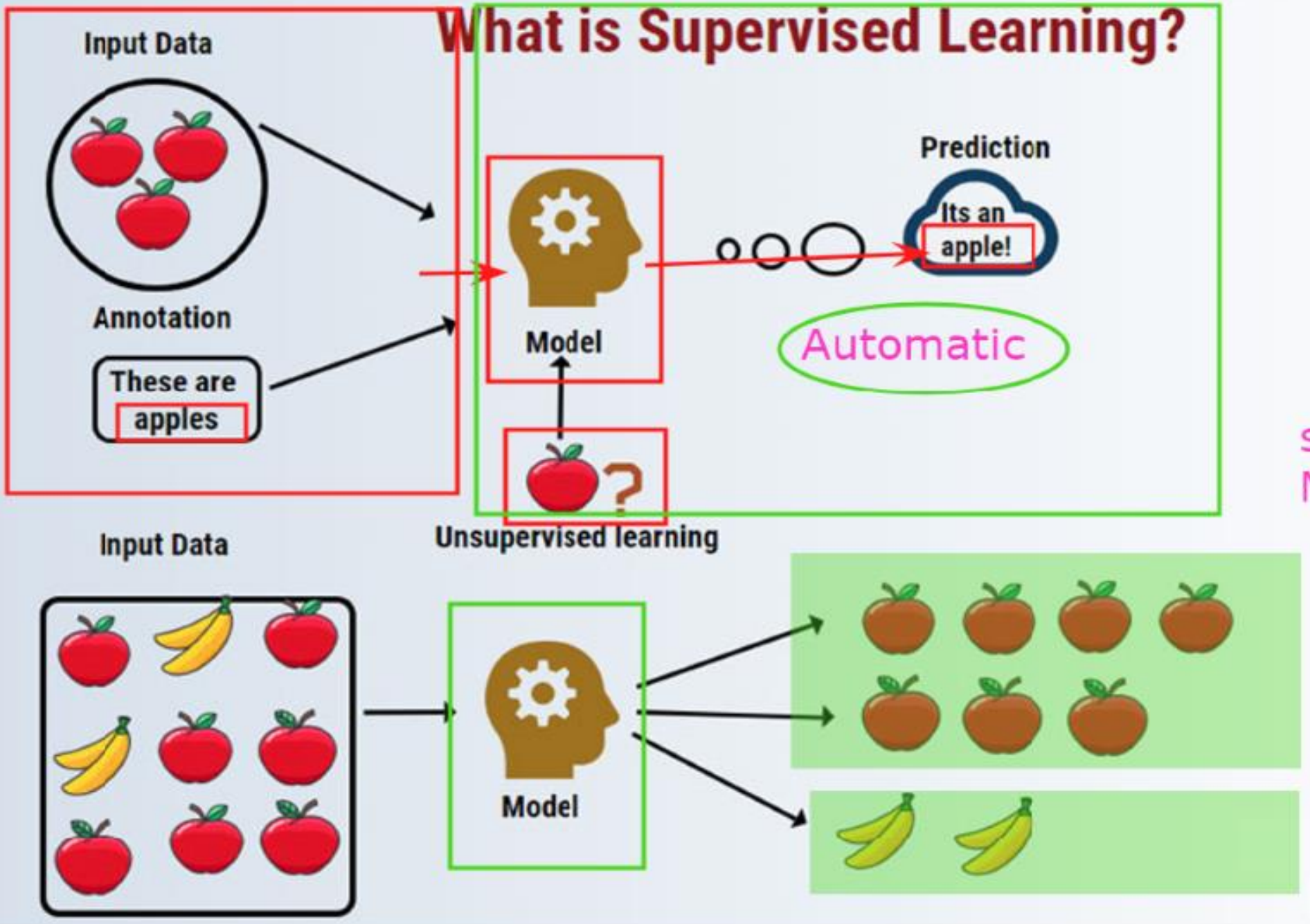
- Random forest
- AdaBoost
- Gradient Boosting

Prediction
Trends
Patterns

Unsupervised Learning

- Unsupervised Learning may be a machine learning technique during which the users don't got to **supervise the model**. Instead, it allows the model to figure on its own to get **patterns** and **knowledge** that was **previously undetected**. It mainly deals with the **unlabeled data**.
- In Unsupervised Learning, there is no labeled data. The algorithm identifies the **patterns** within the **dataset** and **learns** them. The algorithm groups the data into **various clusters** based on their **density.** Using it, one can perform **visualization** on **high dimensional data**.

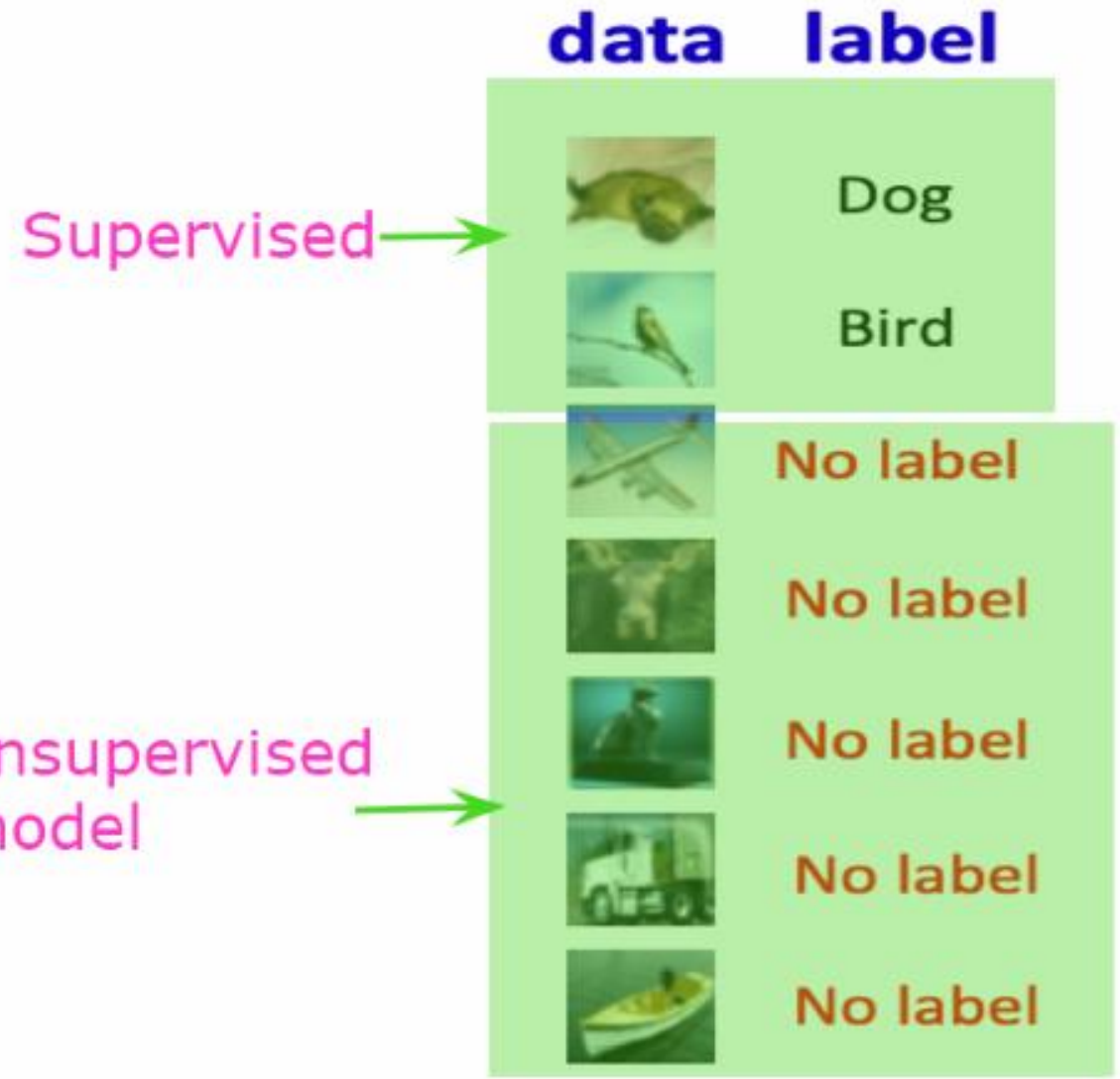

No labels
cluster: Birds
Cluster:Fish
Cluster: Cat & Dogs


What is Supervised Learning?
Input Data
Annotation
These are apples
Model
Prediction
Its an apple!
Automatic
Unsupervised learning
Input Data
Model
semi-supervised Modeling

Supervised Learning

data	label
	Dog
	Bird
	Airplane
	Deer
	Cat
	Truck
	Ship

Semi-Supervised Learning

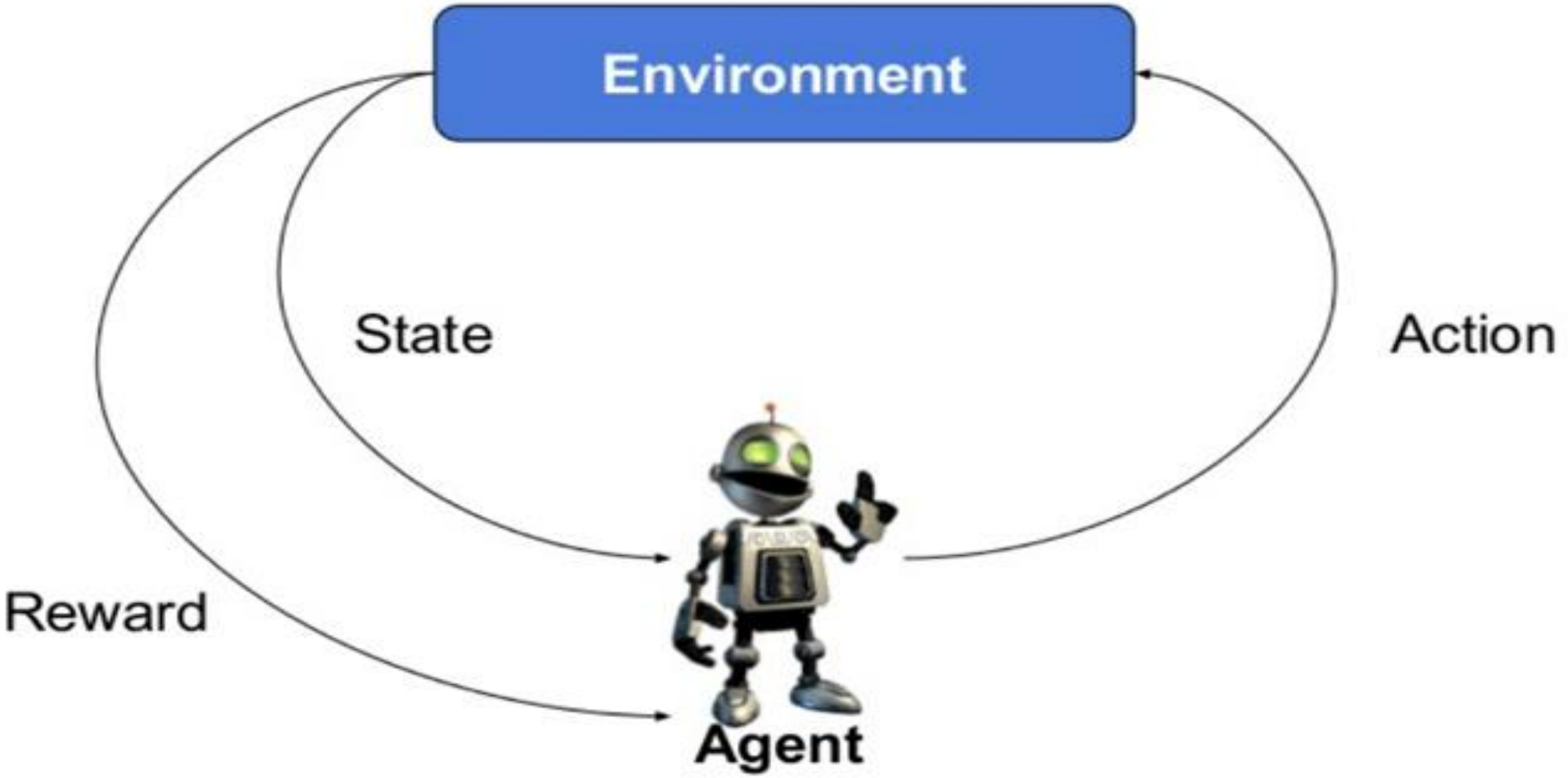


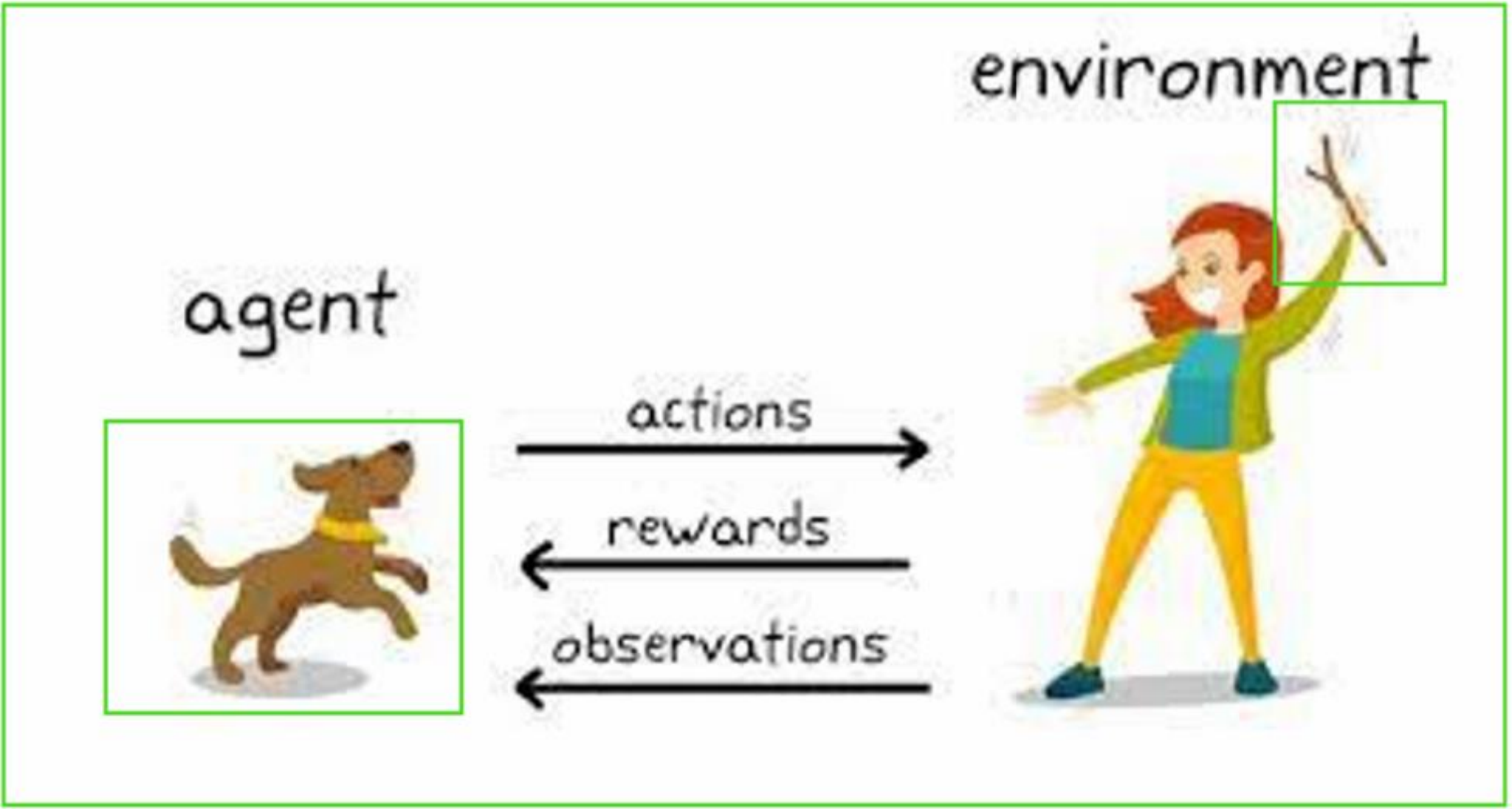
https://www.cs.toronto.edu/~kriz/cifar.html

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.

Typical RL scenario




environment
agent
actions
rewards
observations

Machine learning models cheat sheet

Supervised learning

Data scientists provide input, output and feedback to build model (as the definition)

EXAMPLE ALGORITHMS:

Linear regressions

- sales forecasting
- risk assessment

Support vector machines

- image classification
- financial performance comparison

Decision tree

- predictive analytics
- pricing

Unsupervised learning

Use deep learning to arrive at conclusions and patterns through unlabeled training data.

EXAMPLE ALGORITHMS:

Apriori

- sales functions
- word associations
- searcher

K-means clustering

- performance monitoring
- searcher intent

Semi-supervised learning

Builds a model through a mix of labeled and unlabeled data, a set of categories, suggestions and exampled labels.

EXAMPLE ALGORITHMS:

Generative adversarial networks

- audio and video manipulation
- data creation

Self-trained Naïve Bayes classifier

- natural language processing

Reinforcement learning

Self-interpreting but based on a system of rewards and punishments learned through trial and error, seeking maximum reward.

EXAMPLE ALGORITHMS:

Q-learning

- policy creation
- consumption reduction

Model-based value estimation

- linear tasks
- estimating parameters

Artificial Intelligence

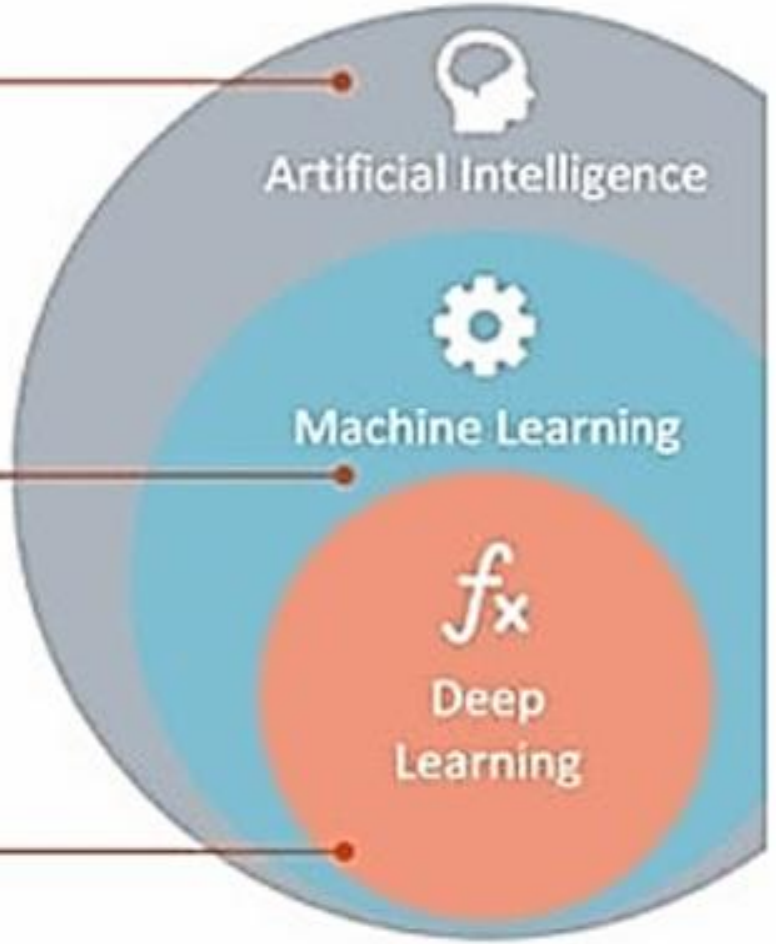
Any technique which enables computers to mimic human behavior.

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.



ANN: Artificial Neural network → Modeling