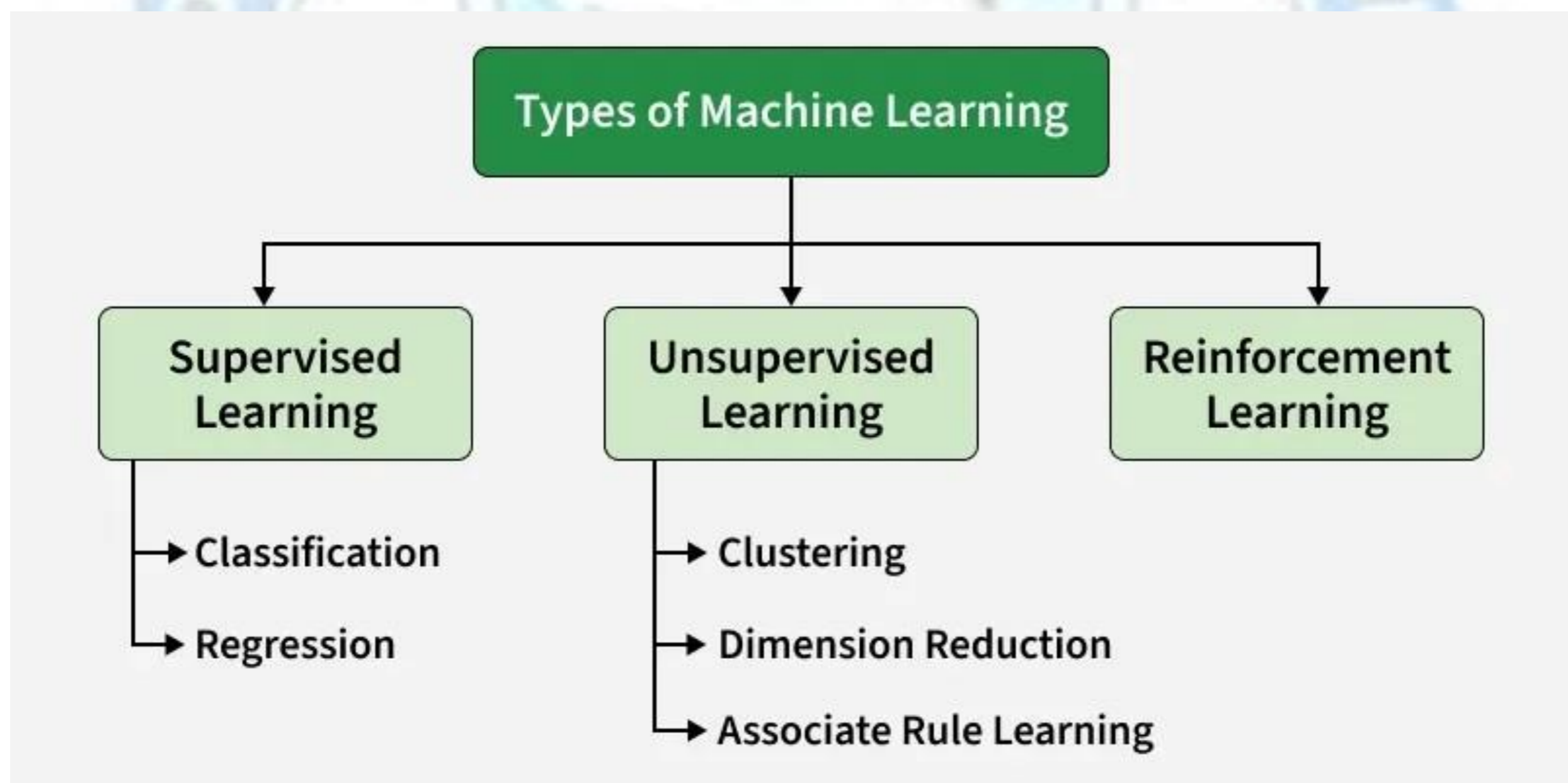


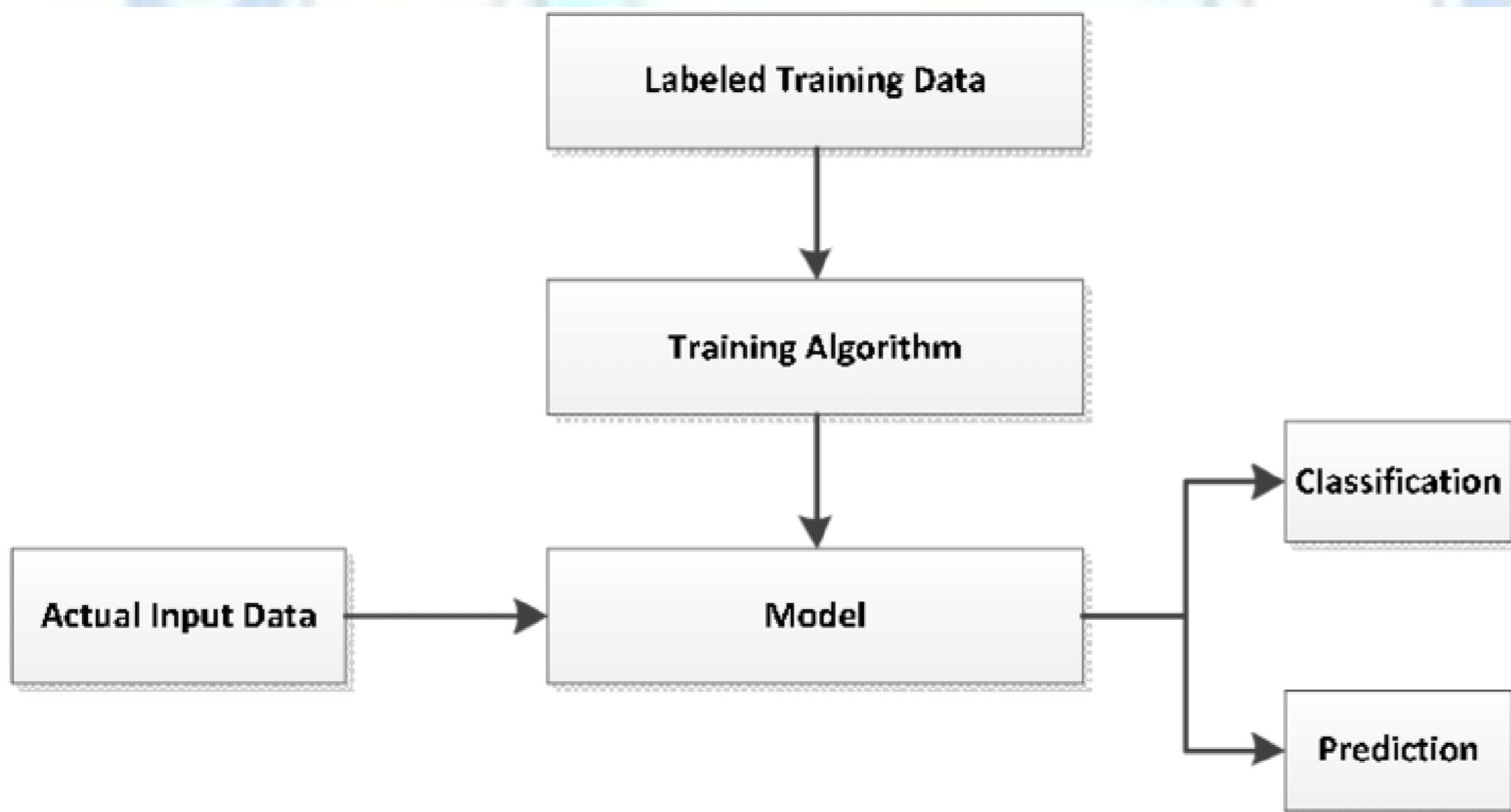
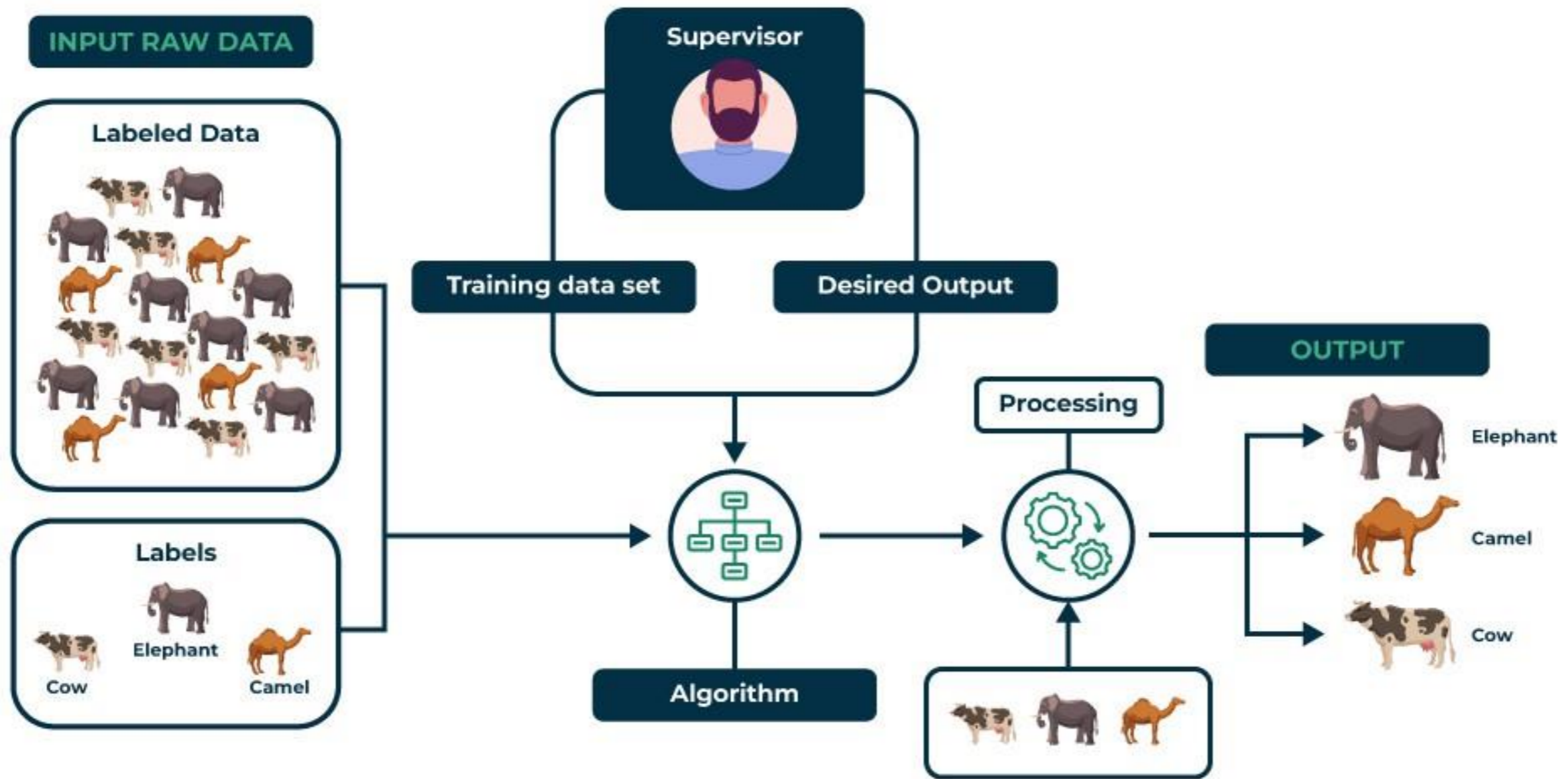
TYPES OF ML

Supervised, unsupervised learning, semi-supervised and reinforced learning are 4 fundamental approaches of machine learning:

- ▶ **Supervised Learning Builds a model based labelled data.**
- ▶ **Unsupervised Learning Builds a model based on a unlabelled data.**
- ▶ **Semi-Supervised Learning Build s a m odel ba sed on a m ix of lab elled and unlab elled d ata. Th is sits b etw een sup ervised and unsp ervised learning ap proaches.**
- ▶ **Reinforcement Learning This is a feed ba ck-b ased lea rnin g m eth od , b ased on a system of rewards and punishments for correct and incorrect actions respectively. The aim is for the “ learning agent” to receive maxim um reward and hence improve its perform ance.**



Supervised Learning



Example: If you train a model using labeled images of cats and dogs, it learns the features of each. When shown a new image, it predicts whether it's a cat or a dog.

There are two main categories of supervised learning that are mentioned below :

1 . Classification

classification algorithms:

- **Logistic Regression**
- **Decision Tree**
- **Random Forest**
- **K-Nearest Neighbors (KNN)**
- **Naive Bayes**
- **Support Vector Machine**

2. Regression

regression algorithms:

- **Linear Regression**
- **Polynomial Regression**
- **Ridge Regression**
- **Lasso Regression**
- **Decision tree**
- **Random Forest**

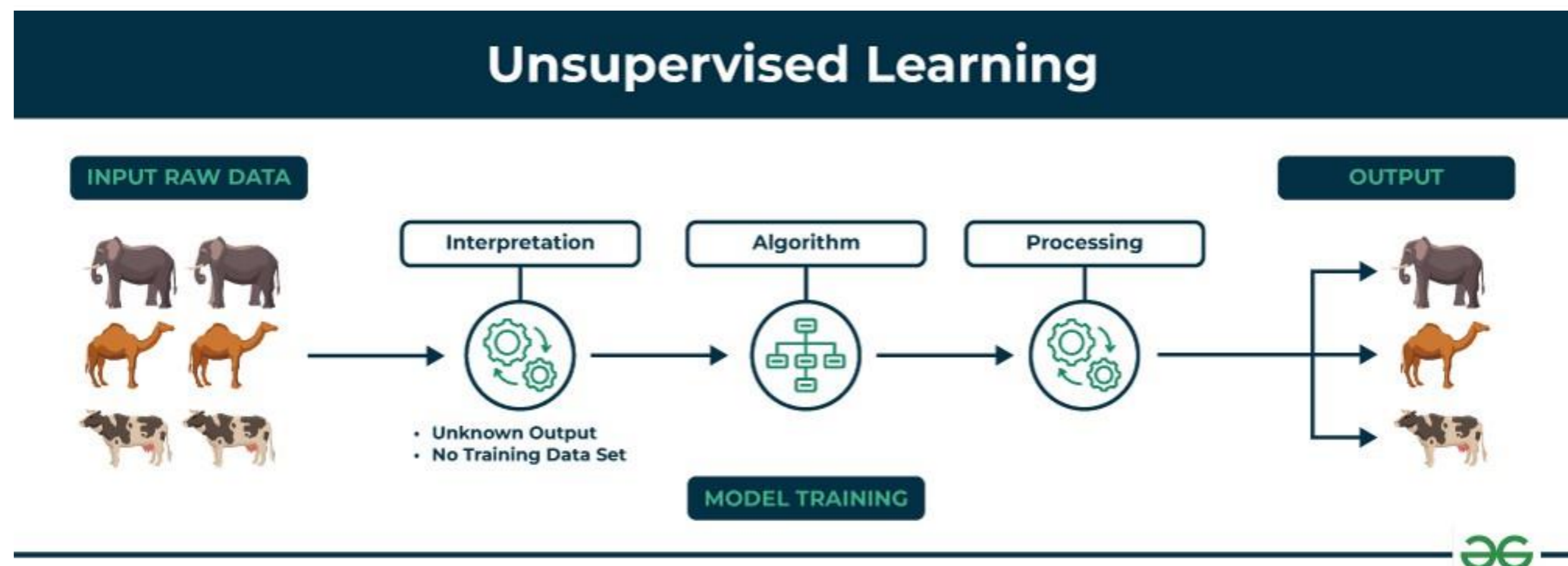
Applications

Supervised learning is used in a wide variety of applications, including:

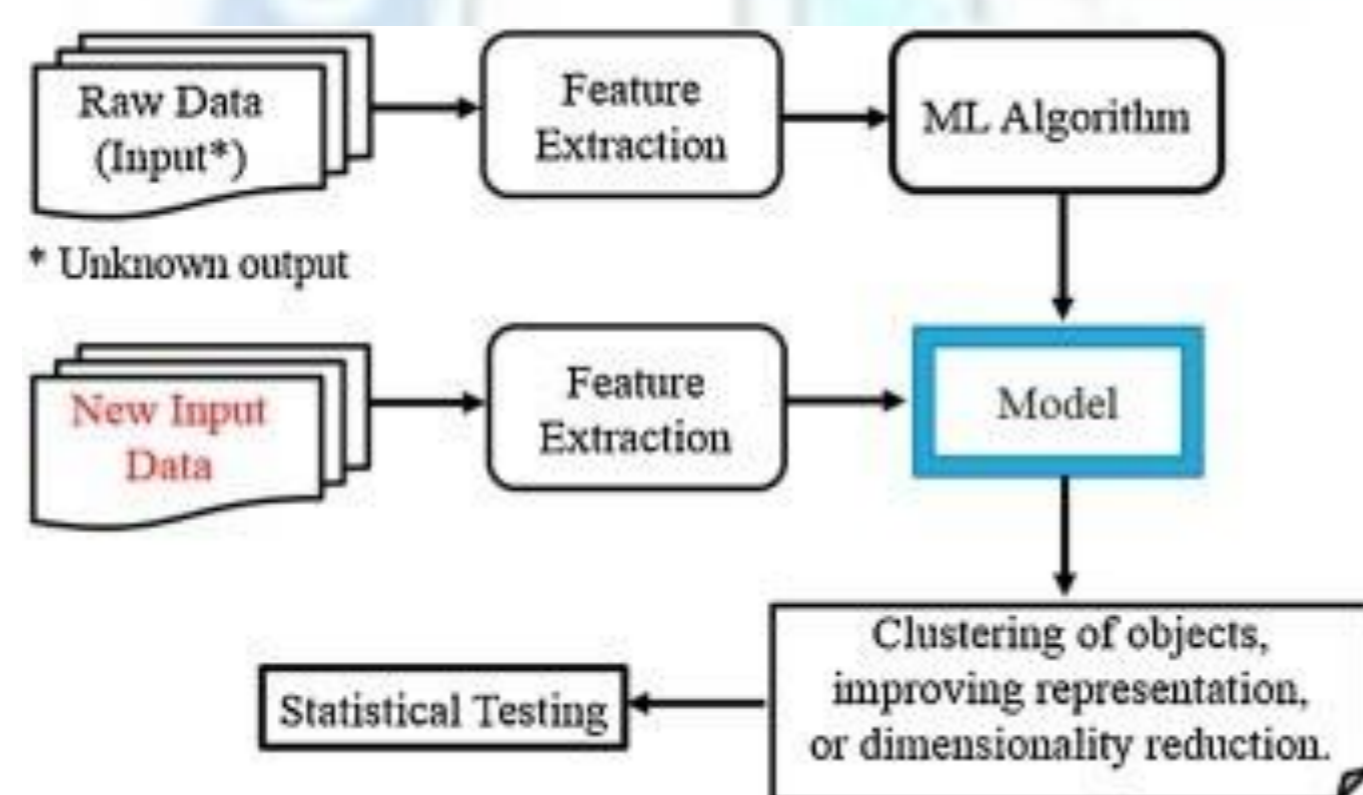
- **Image, speech and text processing:** For tasks like image classification, speech recognition and sentiment analysis.
- **Predictive analytics:** To forecast sales, customer churn, stock prices and weather conditions.
- **Recommendation and personalization:** Powering systems that suggest products, movies or content.
- **Healthcare and finance:** Used for medical diagnosis, fraud detection and credit scoring.
- **Automation and control:** In autonomous vehicles, manufacturing quality checks and gaming AI.



2. Unsupervised Machine Learning



Example: If you have customer data without labels, the algorithm can group similar customers based on purchase behavior useful for segmentation and marketing.



1. Clustering

Common techniques include:

- K-Means
- DBSCAN
- Mean-shift

2. Dimensionality Reduction Techniques

Common techniques include:

- Principal Component Analysis
- Independent Component Analysis

3. Association Rule Learning

Common techniques include:

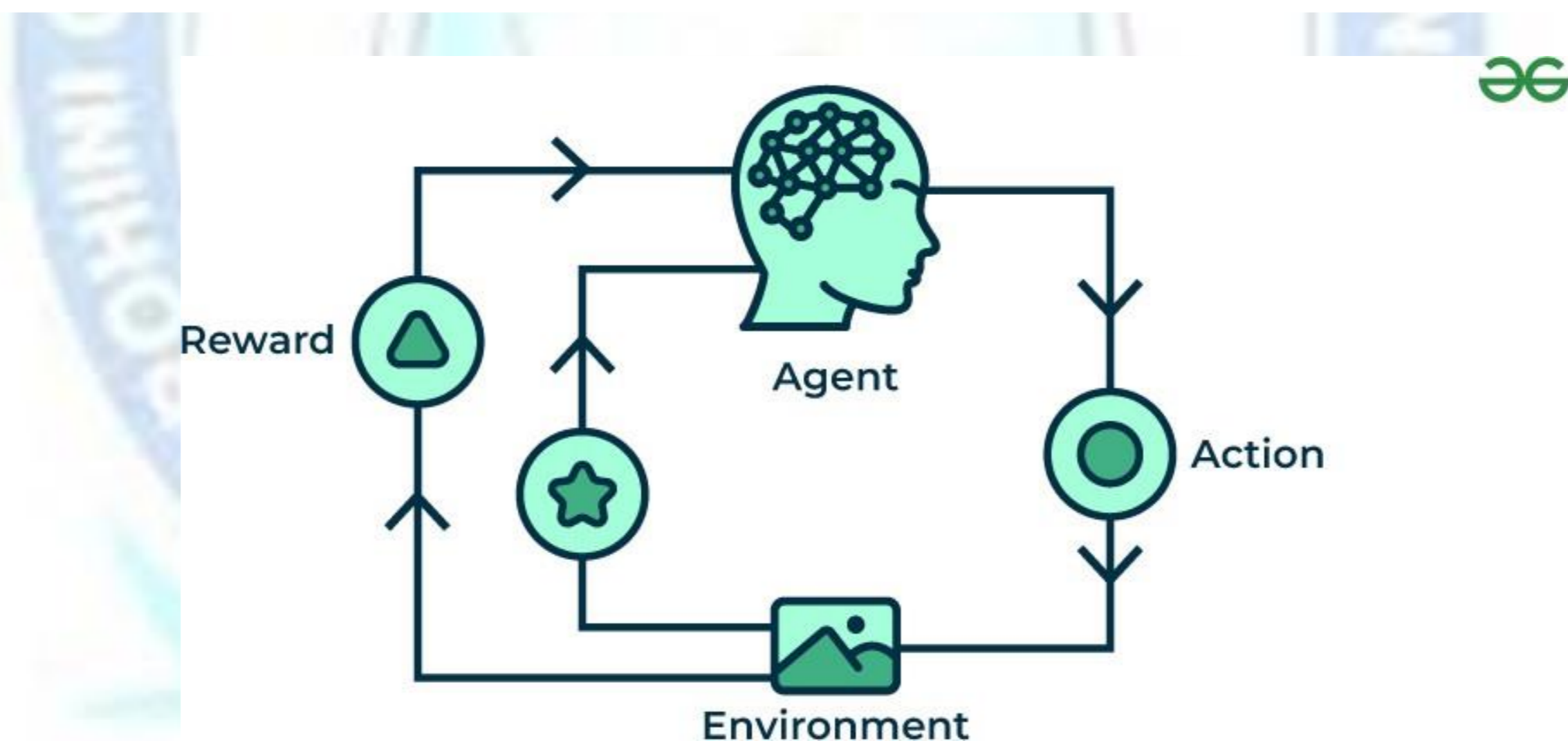
- Apriori
- FP-growth
- Eclat

Applications of Unsupervised Learning

Here are some common applications of unsupervised learning:

- Clustering and segmentation: Group similar data points, customers or images.
- Anomaly detection: Spot unusual patterns or outliers in data.
- Dimensionality reduction: Simplify large data sets while retaining key information.
- Recommendation and marketing: Identify user preferences and improve product suggestions.
- Data preprocessing and analysis: Clean data, detect patterns and support exploratory data analysis (EDA).

3. Reinforcement Learning



Example: An AI agent learning to play chess gets positive feedback for good moves and negative for poor ones.



reinforcement learning algorithms:

- Q-learning: Learns the best action for each state based on expected rewards.
- SARSA (State-Action-Reward-State-Action): Similar to Q-learning but uses values for the action actually taken.
- Deep Q-learning: Uses neural networks to handle complex state-action relationships

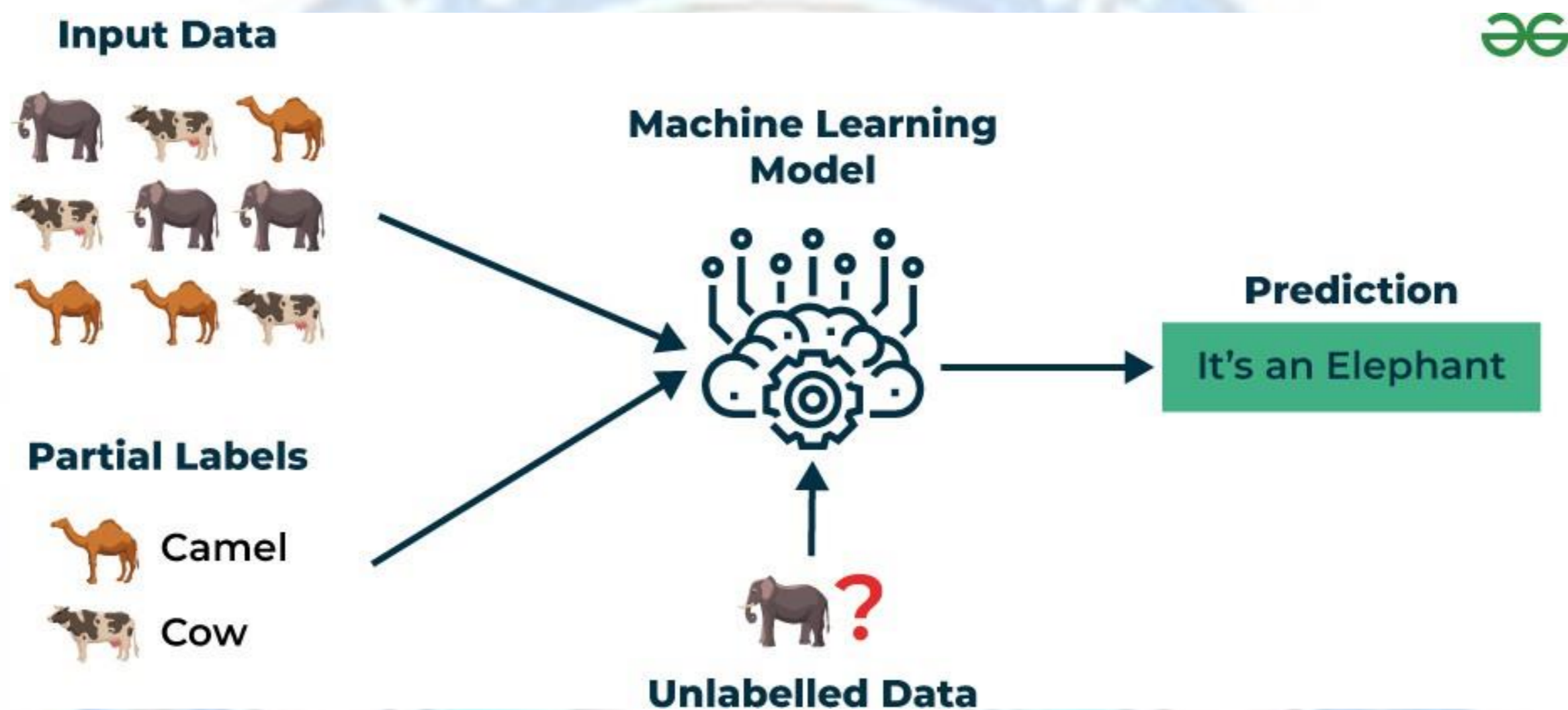
Applications of Reinforcement Learning

Here are some applications of reinforcement learning:

- Gaming and simulation: Teaching agents or NPCs to play and adapt intelligently.
- Robotics and automation: Enabling robots to perform tasks autonomously.
- Autonomous vehicles: Helping self-driving cars make real-time decisions.
- Healthcare and finance: Optimizing treatment plans, trading and resource allocation.
- Recommendation and personalization: Improving user experience through adaptive suggestions.
- Industrial and energy management: Optimizing control systems and energy use.

4. Semi-Supervised Learning: Supervised + Unsupervised Learning:

Semi-Supervised learning combines both Supervised and Unsupervised approaches. It uses a small set of labeled data and a large set of unlabeled data for training useful when labeling is costly or time-consuming.



Popular Techniques

- **Graph-based Learning:** Spreads label information through data relationships.
- **Label Propagation:** Iteratively assigns labels to unlabeled data.
- **Co-training:** Uses two models to train and label each other's data.
- **Self-training:** Uses model predictions as pseudo-labels.
- **Generative Adversarial Networks (GANs):** Generates synthetic data to improve learning.

Applications

- **Image Classification:** Combine small labeled and large unlabeled image datasets to improve accuracy.
- **Natural Language Processing (NLP):** Enhance language models by using a mix of labeled and vast unlabeled text data.