**CART Algorithm (Classification and Regression Trees)**

The CART algorithm is used to build decision trees for classification or regression tasks by splitting the data into subsets based on the attribute that provides the best split.

1. **Input**:
   * A dataset with features (attributes) and corresponding target values (class labels for classification or continuous values for regression).
2. **Steps**:

**Step 1**: **Initialize the Tree**  
Start with the entire dataset as the root of the tree.

**Step 2**: **Evaluate Splits**  
For each attribute, determine the best way to split the dataset into two groups to maximize the separation of the target values (class purity for classification or variance reduction for regression).

**Step 3**: **Choose the Best Split**  
Select the attribute and split point that results in the most significant improvement in the target separation.

**Step 4**: **Split the Dataset**  
Divide the dataset into two subsets based on the chosen split.

**Step 5**: **Repeat for Subsets**  
Recursively apply the same process (Steps 2–4) to each subset until:

* + All data points in a subset belong to the same class (for classification) or the variance is minimal (for regression).
  + A stopping criterion is met (e.g., maximum depth, minimum number of samples per leaf).

1. **Stopping Conditions**:
   * No further splits improve the separation.
   * A predefined condition is met (e.g., a maximum tree depth or minimum number of samples in a node).
2. **Output**:
   * A decision tree where internal nodes represent attribute splits, branches represent split conditions, and leaf nodes represent predicted values (class labels or regression outputs).

**Conclusion**

The **CART (Classification and Regression Trees) algorithm** is a powerful and widely used machine learning technique for both **classification and regression tasks**. It constructs a **binary decision tree** by recursively splitting the dataset based on feature values, ensuring optimal decision boundaries.

**Key Strengths of CART:**

**Handles Both Classification & Regression** – Versatile for predictive modeling.  
**Interpretable & Explainable** – Provides a clear decision-making structure.  
**Works with Large Datasets** – Efficient with numerical and categorical data.  
**Feature Selection** – Automatically selects the most important attributes.

However, **CART has limitations**, such as its **tendency to overfit** and its **sensitivity to small data variations**. These issues can be addressed using **pruning** and **ensemble methods like Random Forest and Gradient Boosting**.

CART is a **foundational algorithm in artificial intelligence**, offering a **simple yet effective** approach to decision-making. Its interpretability, robustness, and ability to handle complex data make it a core technique in **pattern recognition, medical diagnosis, financial modeling, and many other AI-driven applications**.