CS 286: Wearable AI and mHealth

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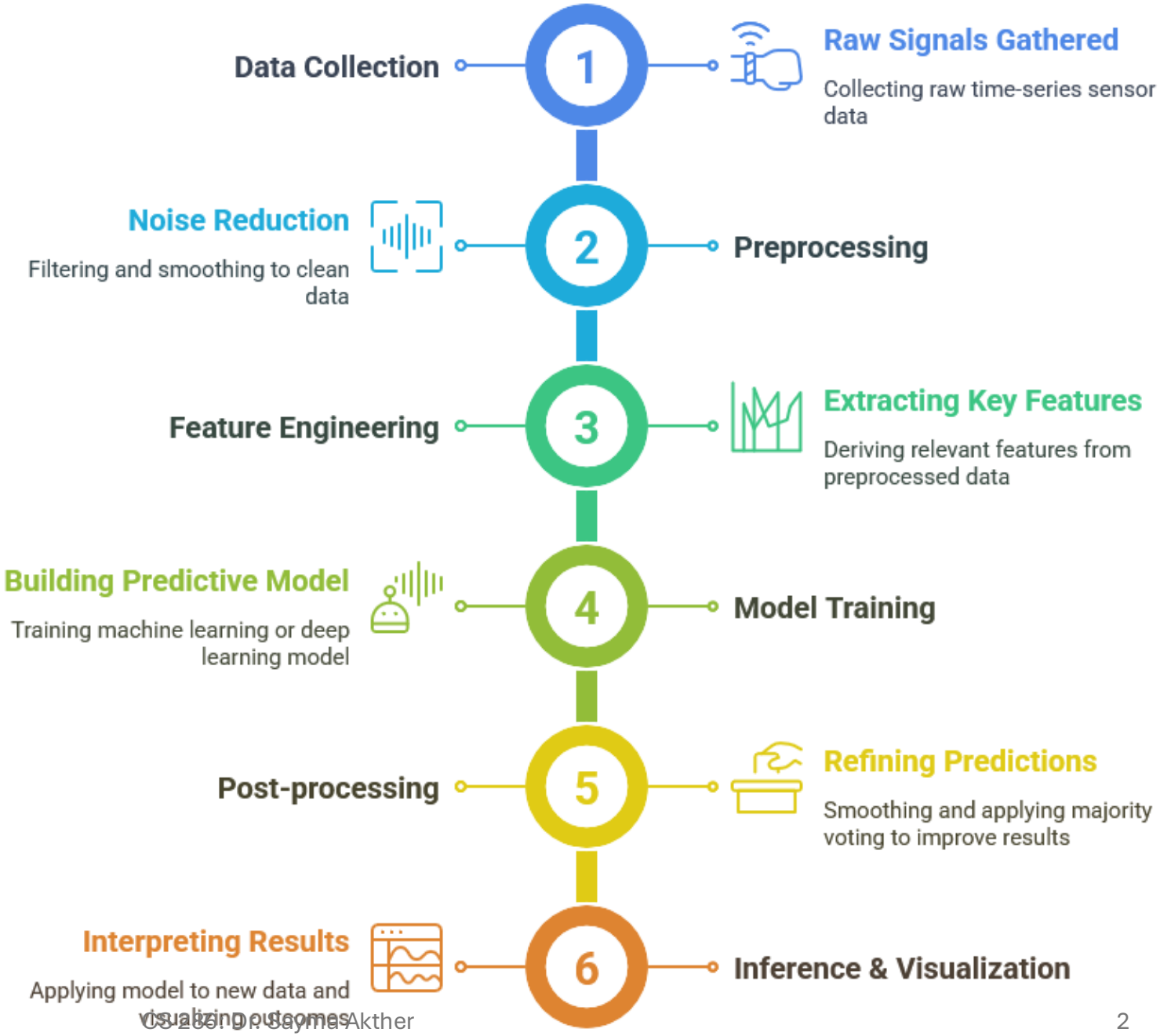
San José State University

HAR Detection Pipeline



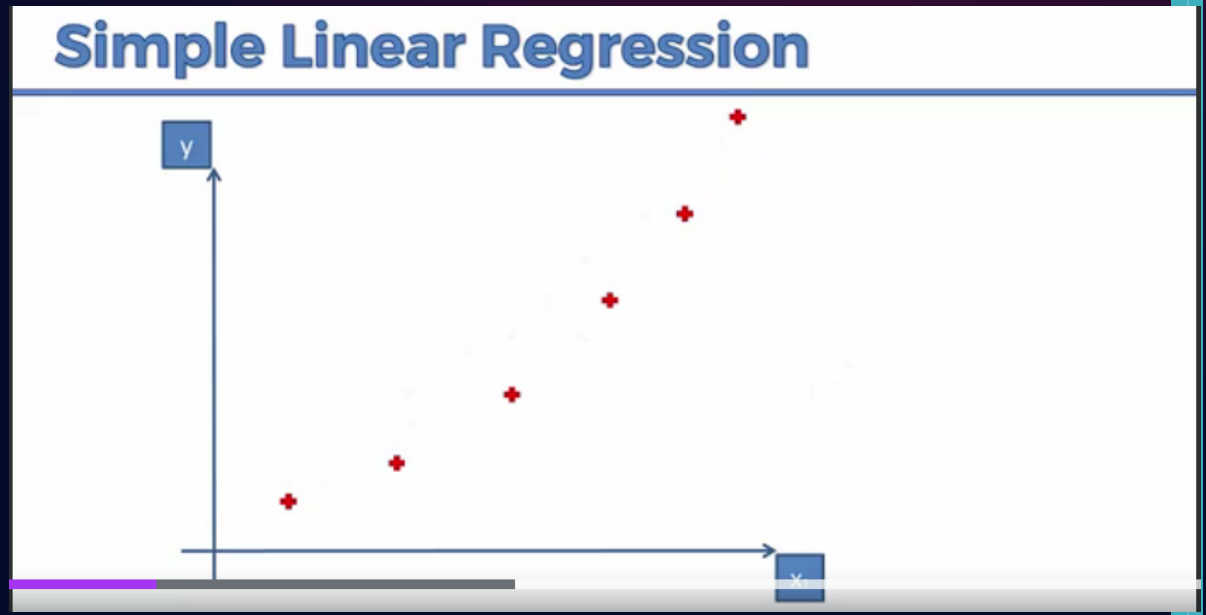
Machine Learning Regression Model: Polynomial Regression

01

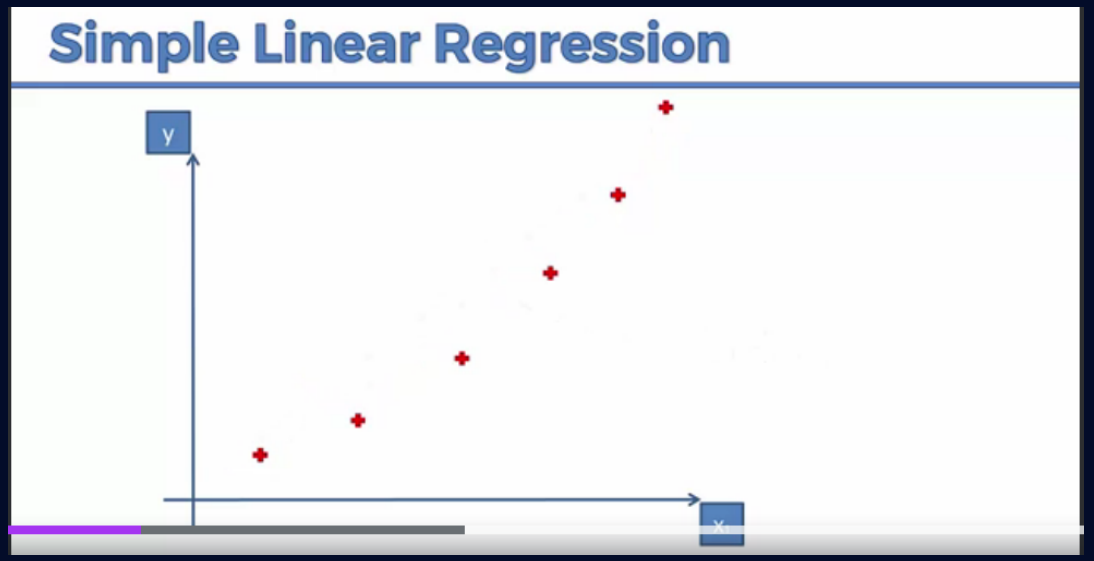
Polynomial Regression is a type of regression analysis approach in Machine Learning, which is similar to Multiple Linear Regression but with a few differences

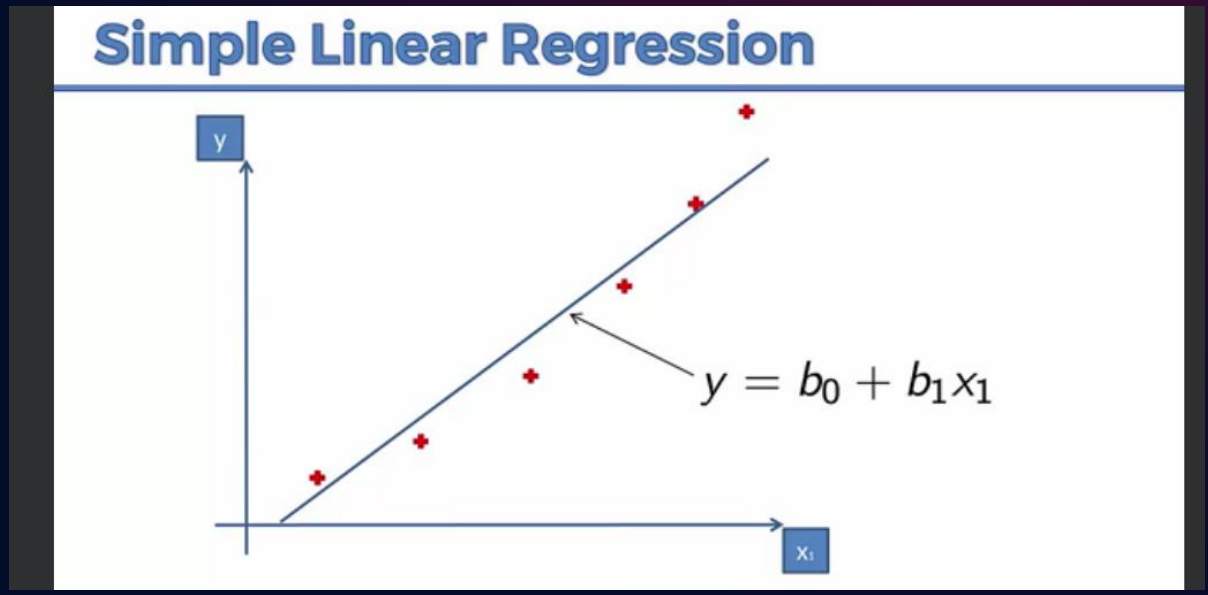
02

As an estimator, a linear model is used. The Least Mean Squared Method is also used in Polynomial Regression



Machine Learning Regression Model: Polynomial Regression





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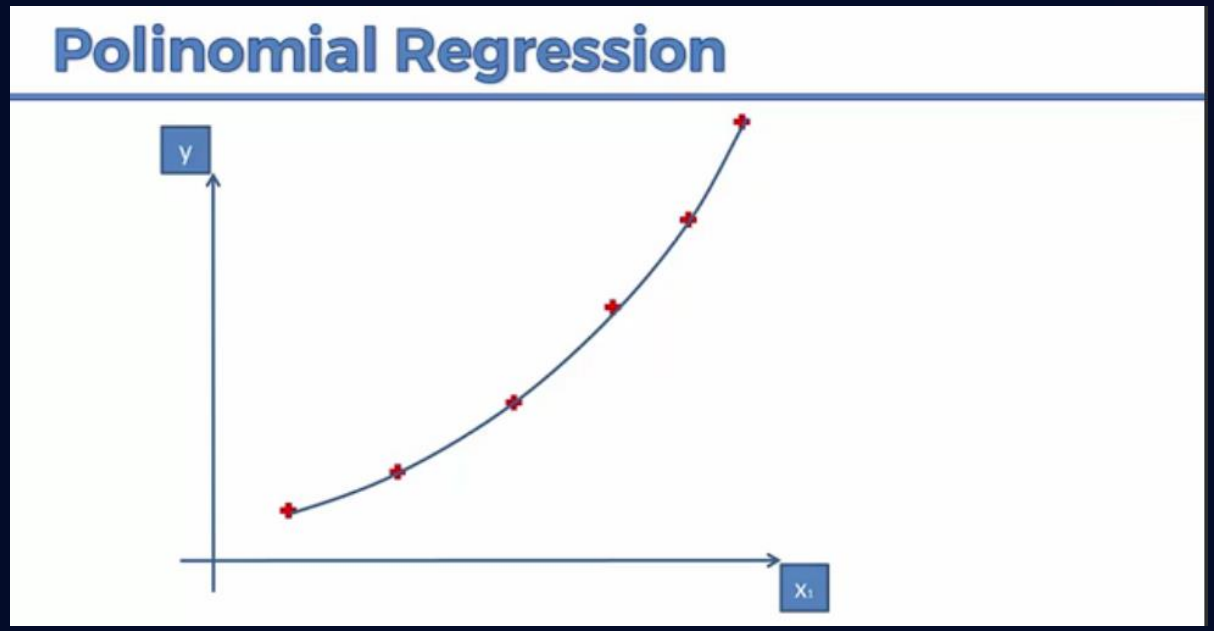
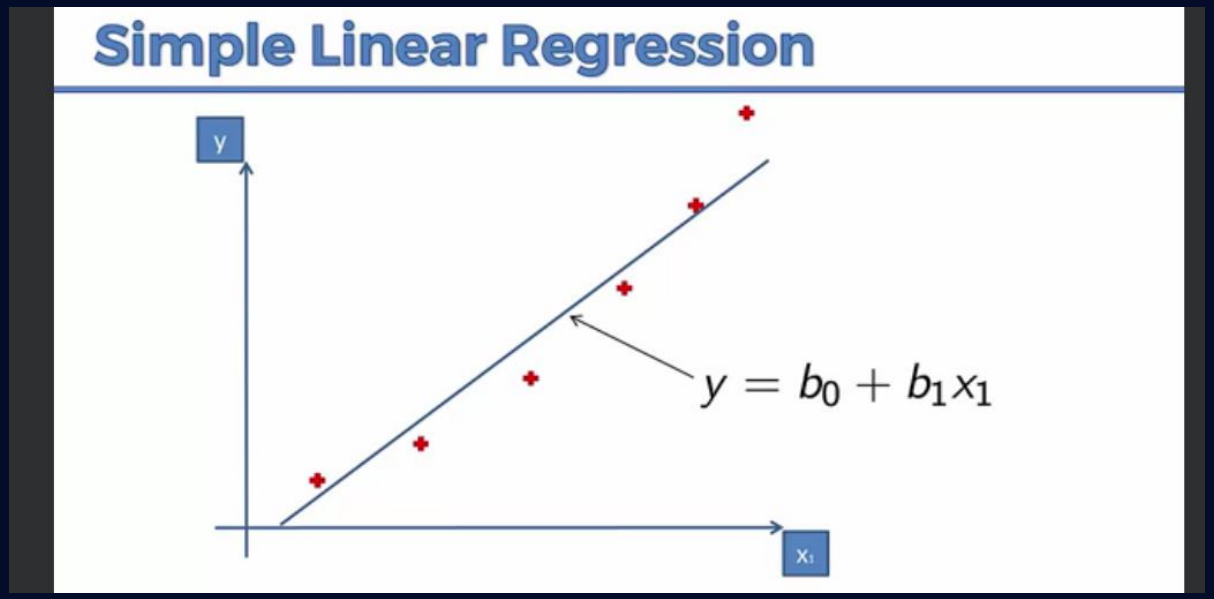


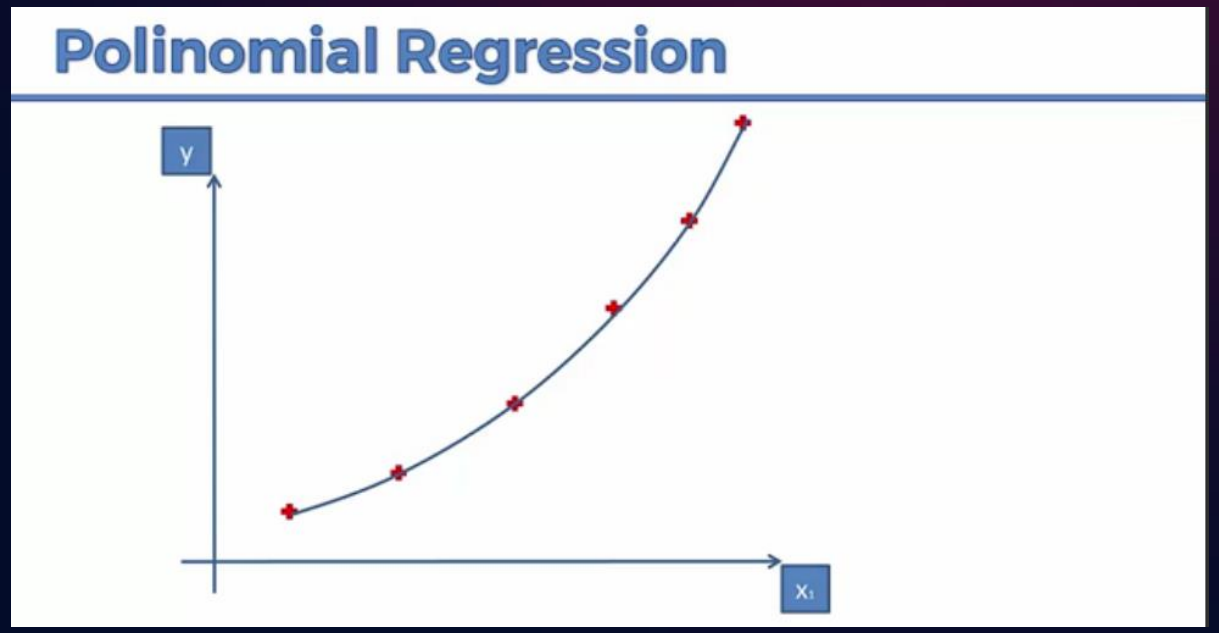
Polinomial Regression

Polynomial Linear Regression

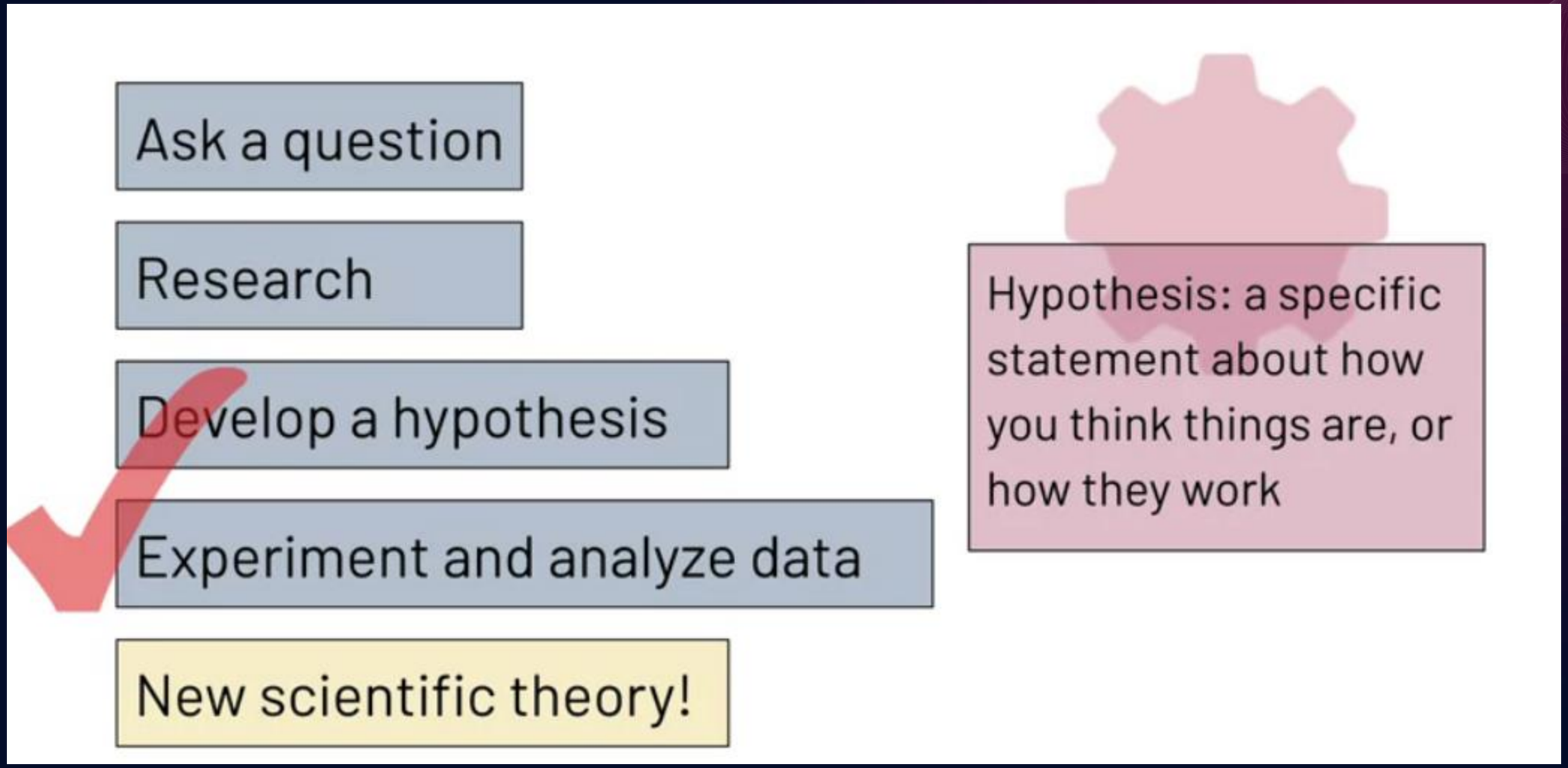
$$y = b_0 + b_1 x_1 + b_2 x_1^2 + \ldots + b_n x_1^n$$

Machine Learning Regression Model: Polynomial Regression





Classification Models in Machine Learning



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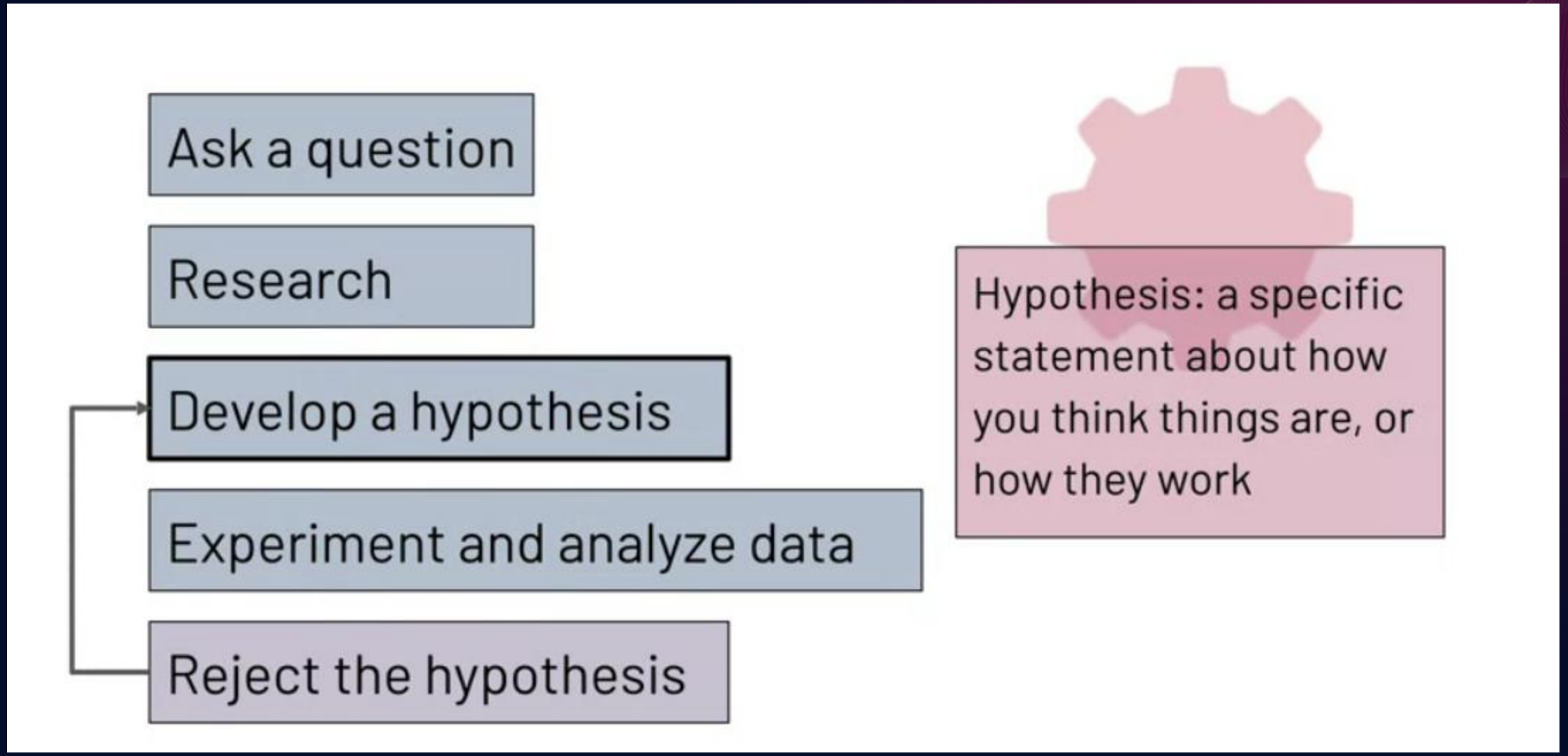

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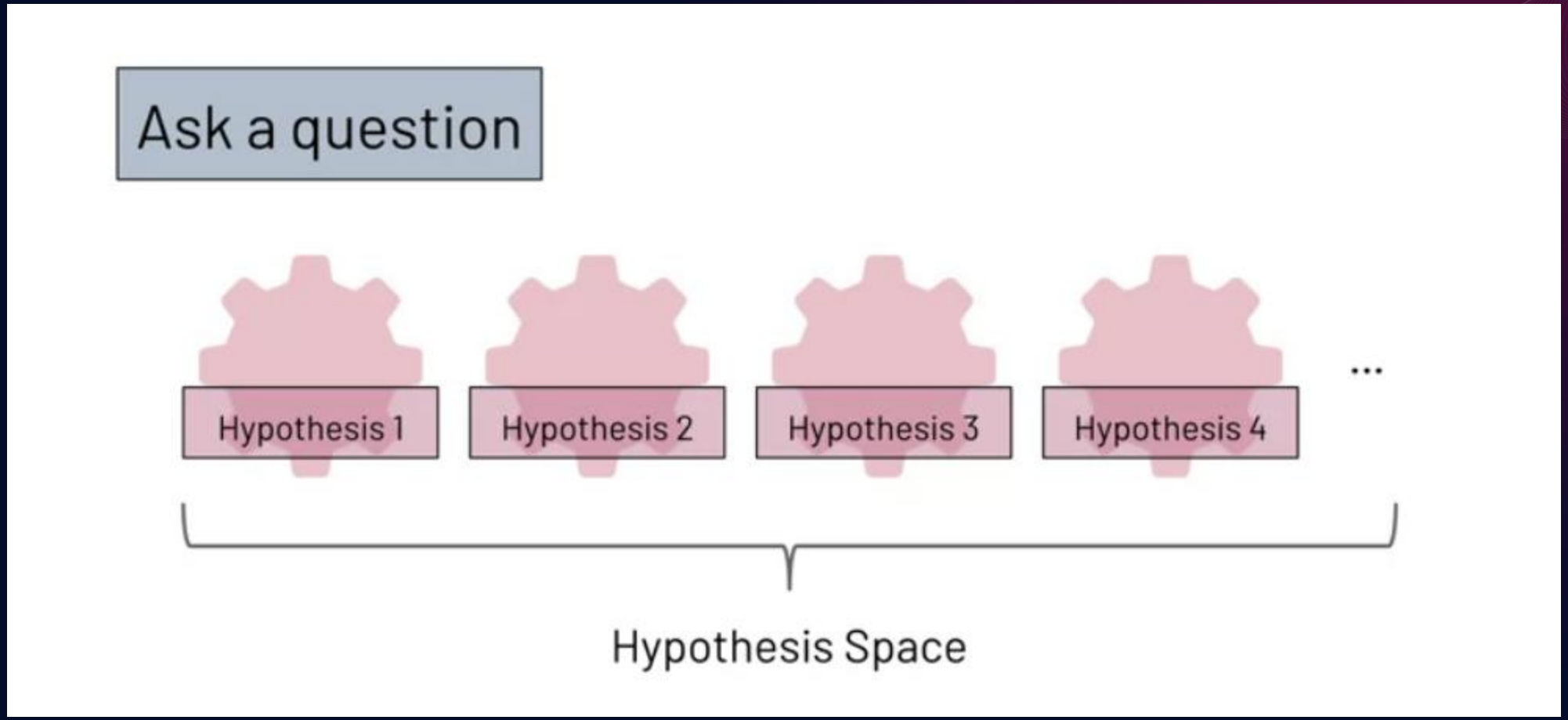

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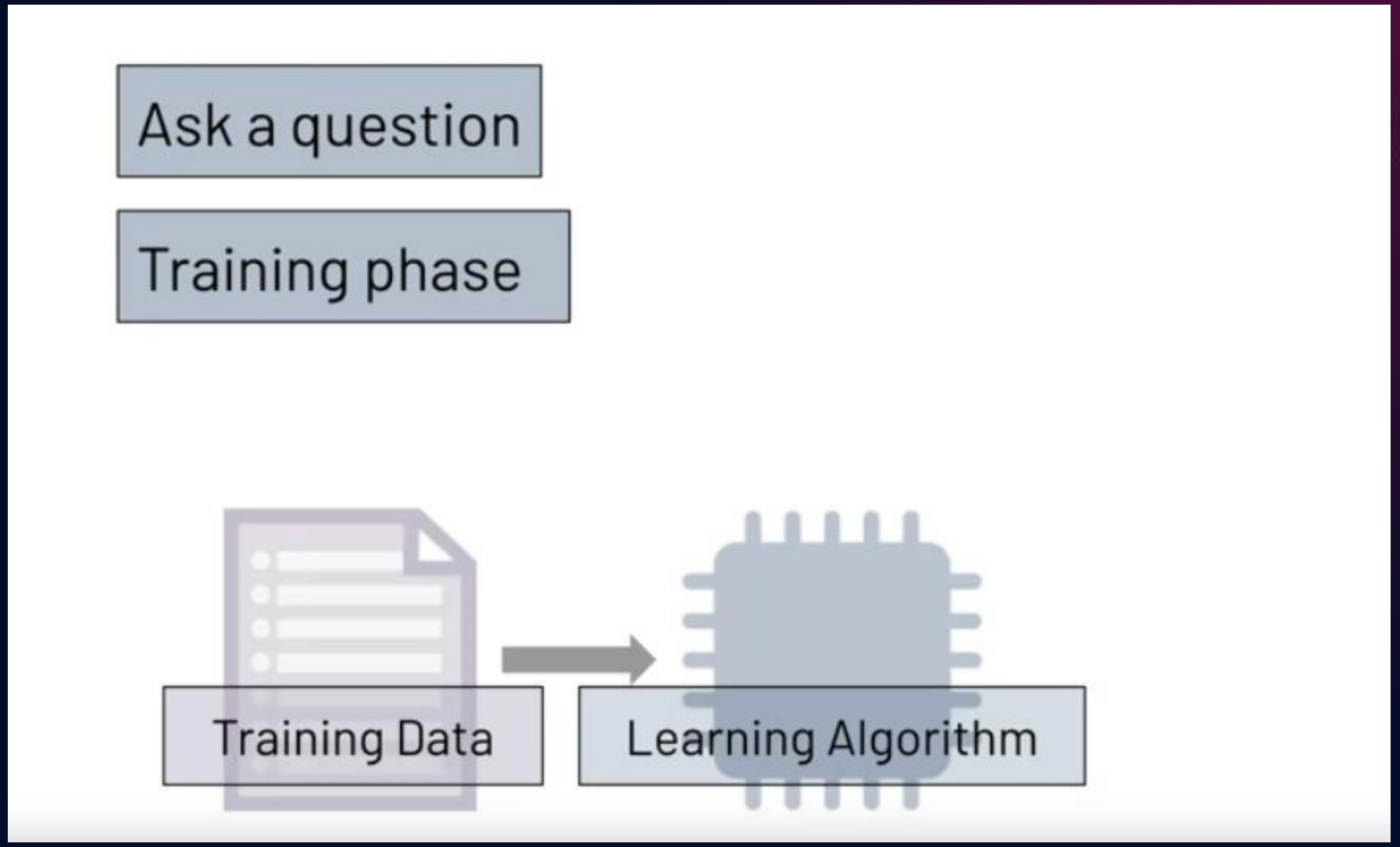

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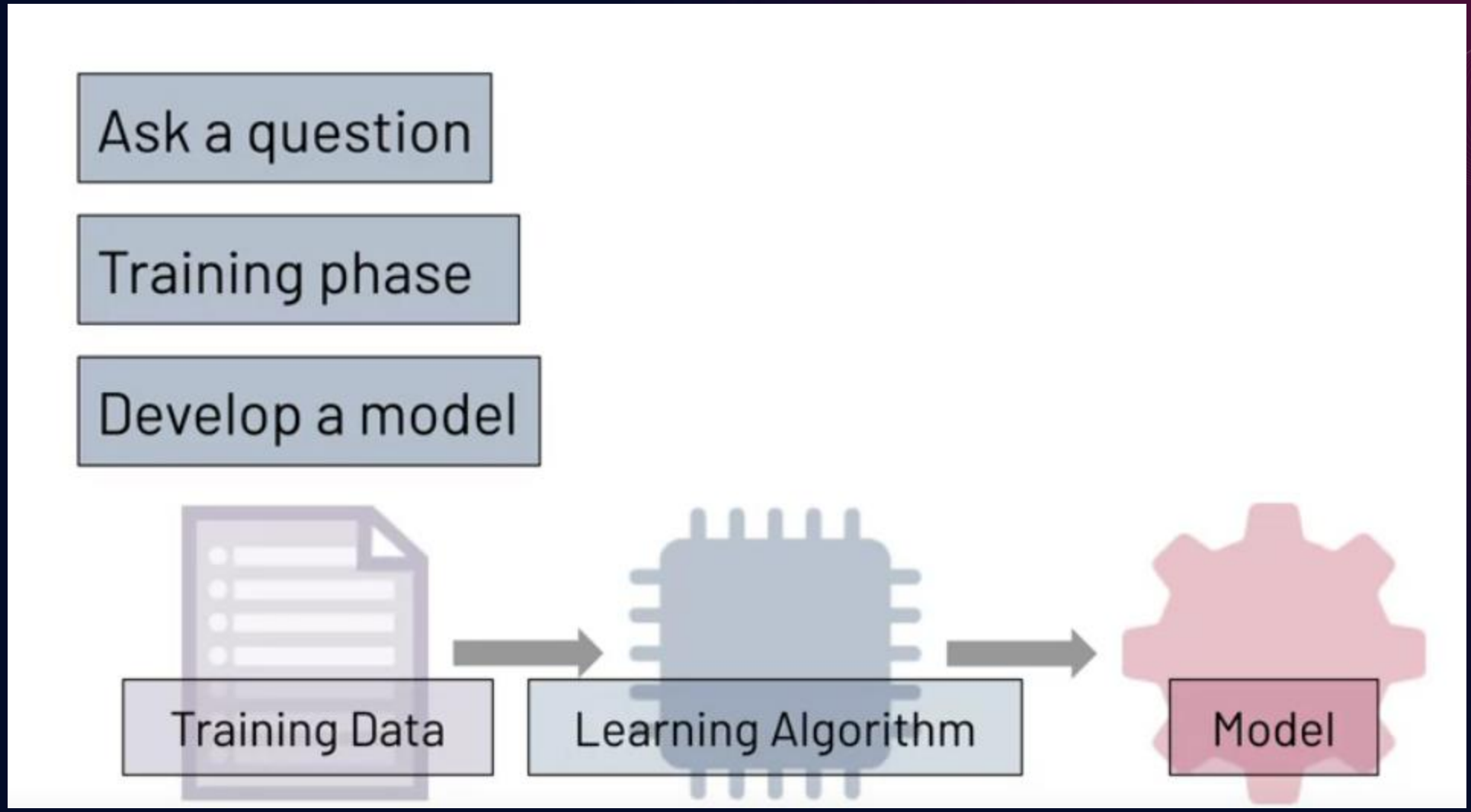

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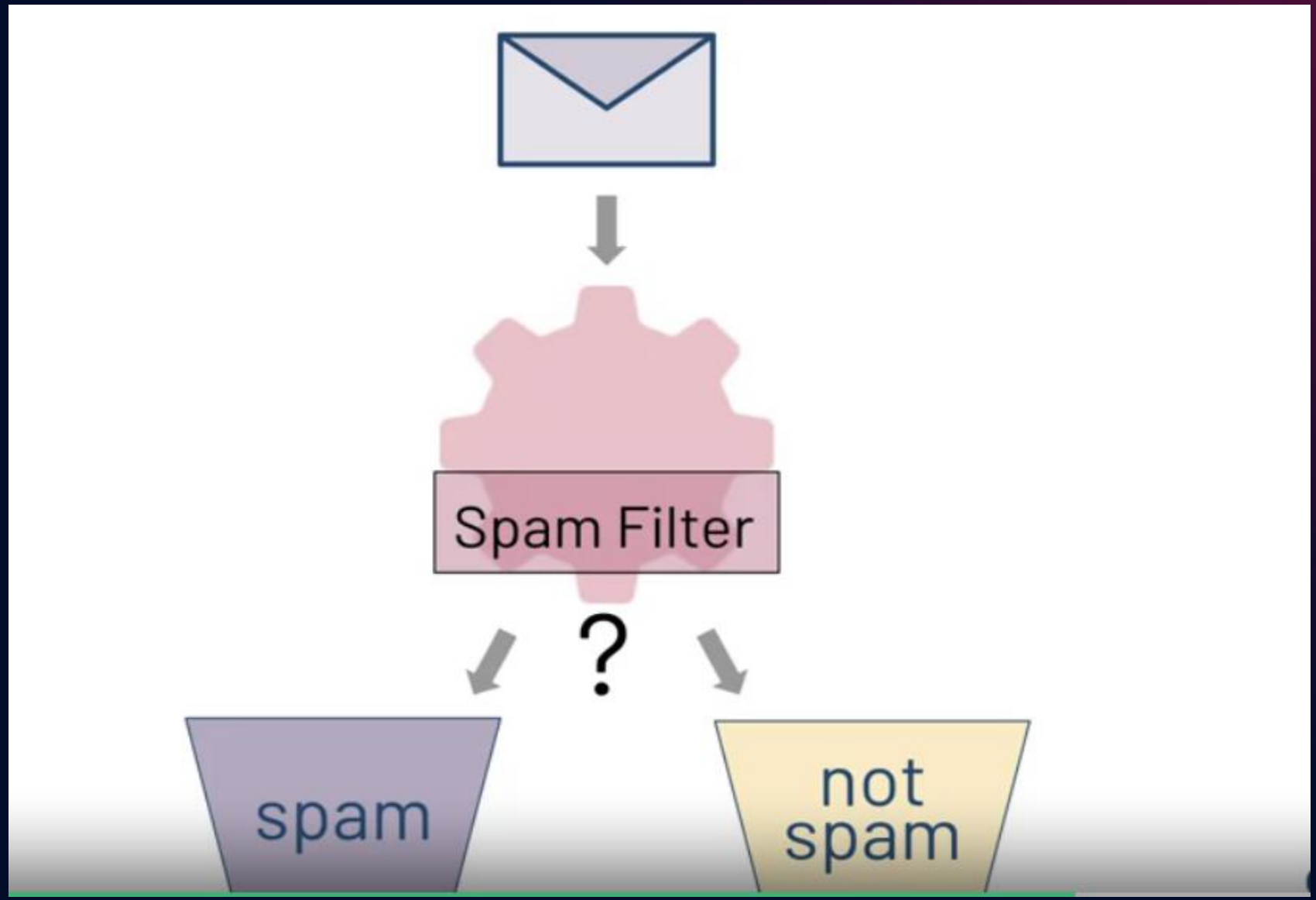

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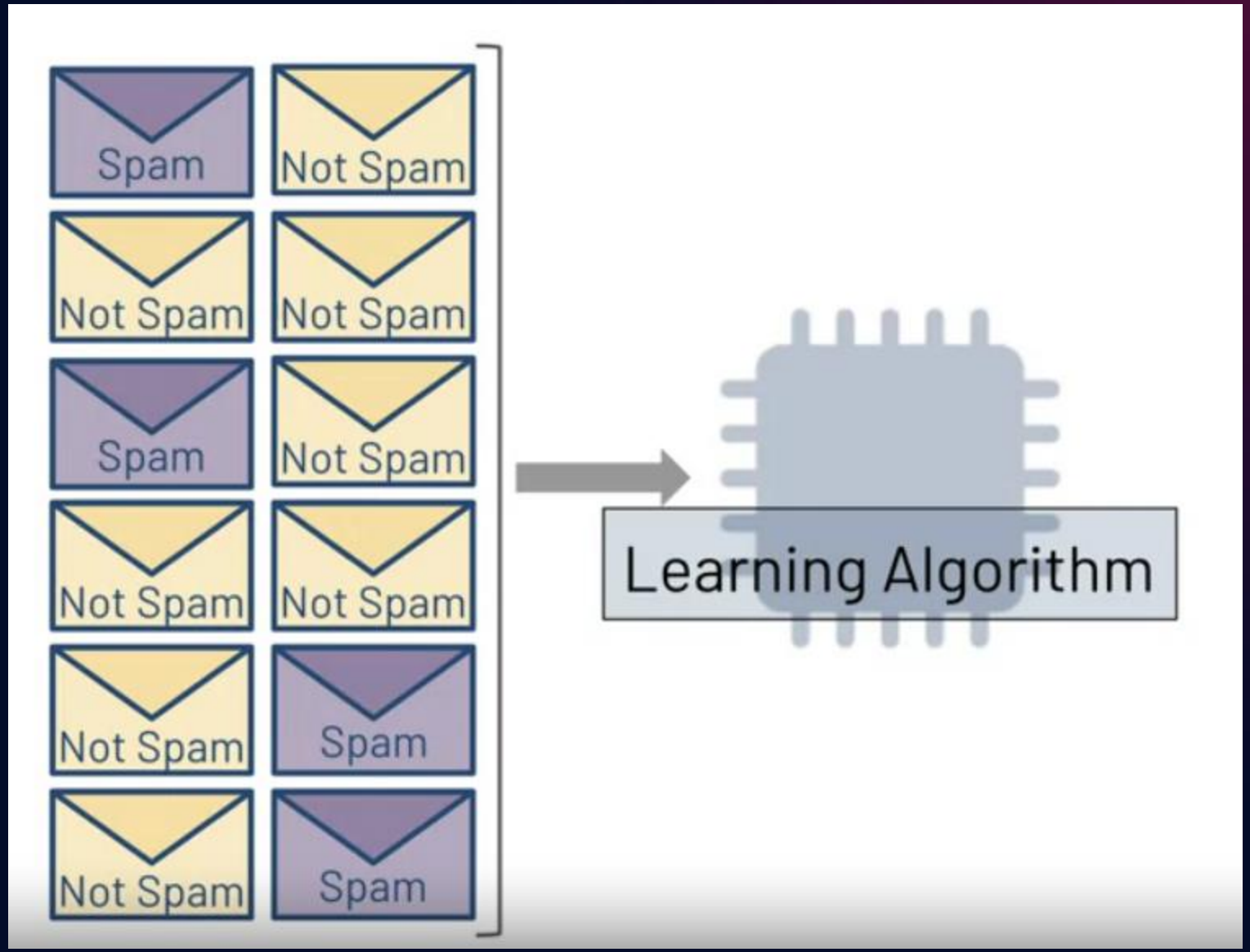

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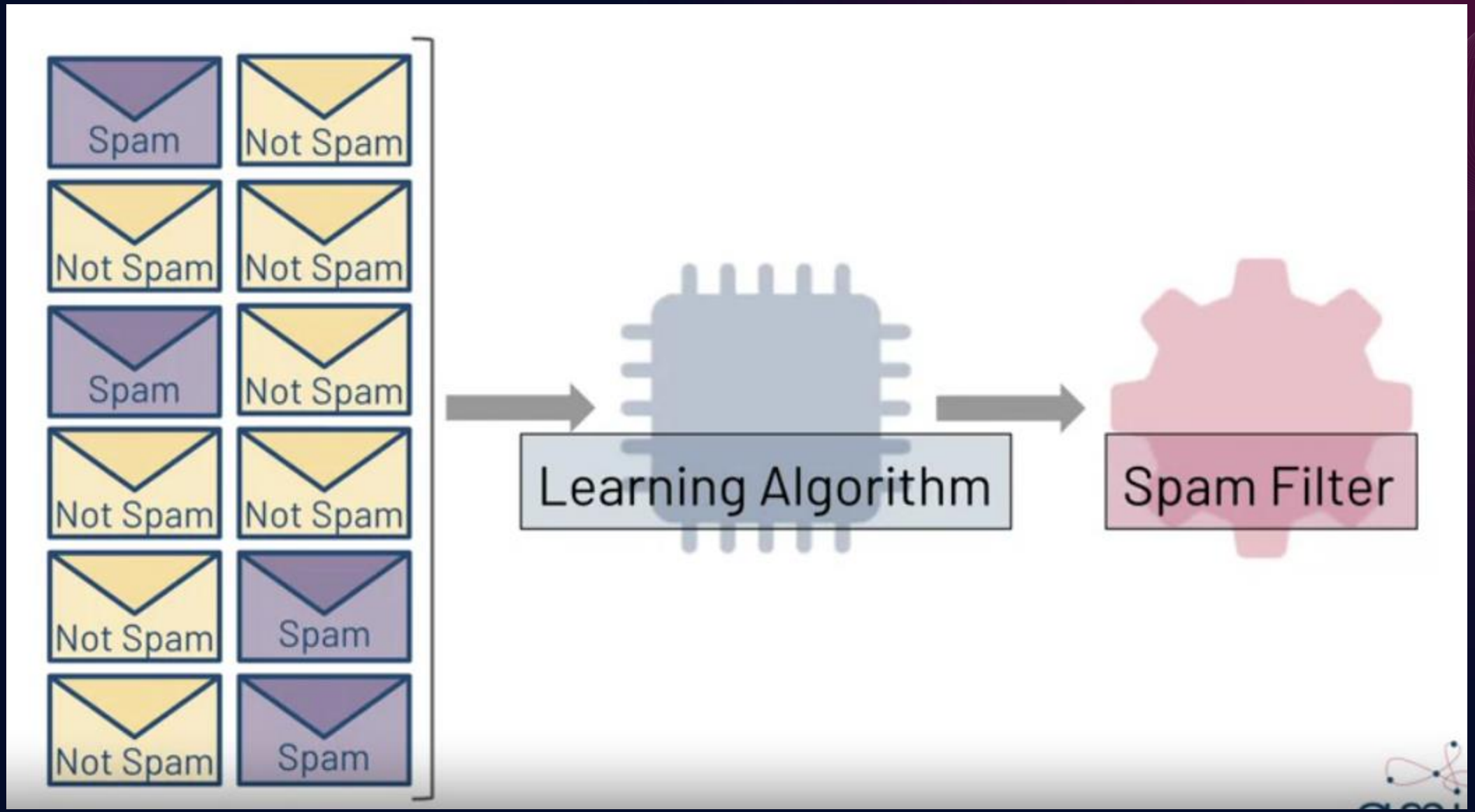
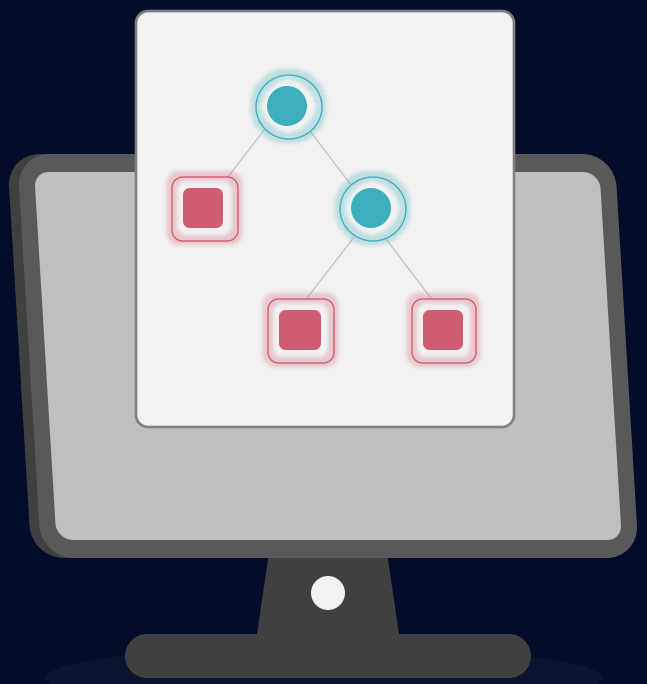


Decision Tree

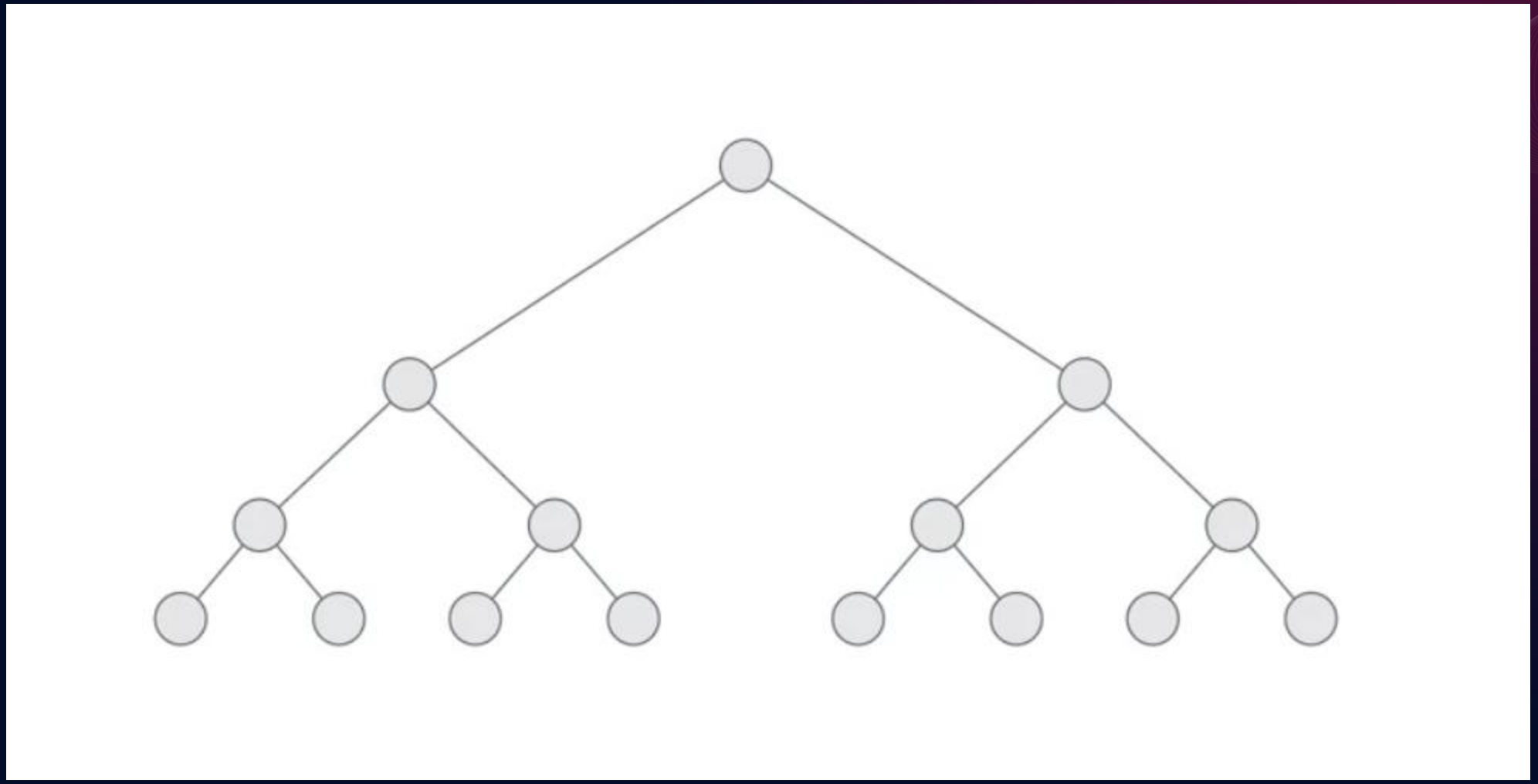


It is a handy tool with many applications. Decision trees can be used to solve classification and regression issues

The name indicates that it displays the predictions coming from a series of feature-based splits using a flowchart-like tree structure

It all starts with a root node and ends with a leaf choice

Classification Models: Decision Tree



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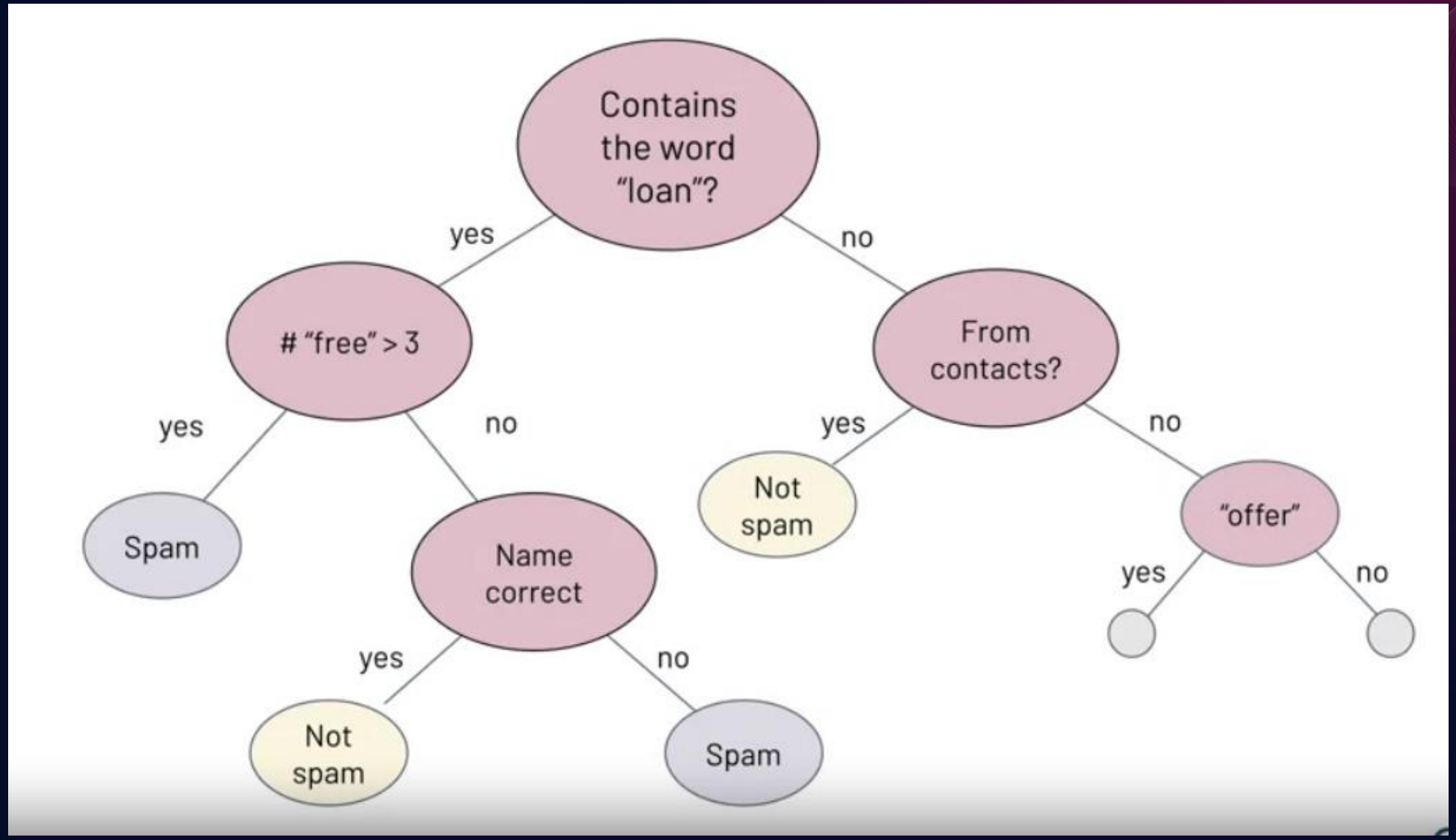

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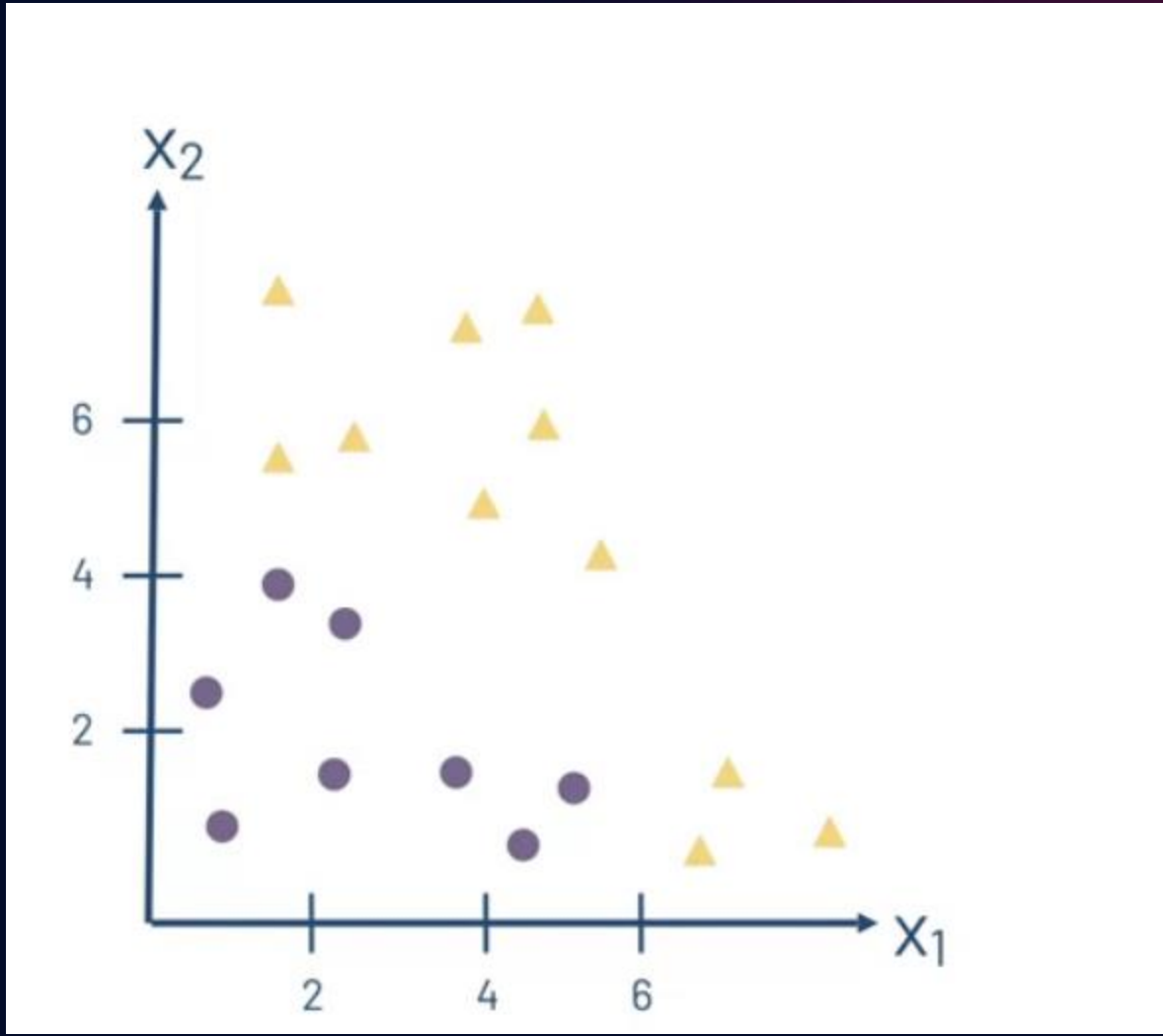

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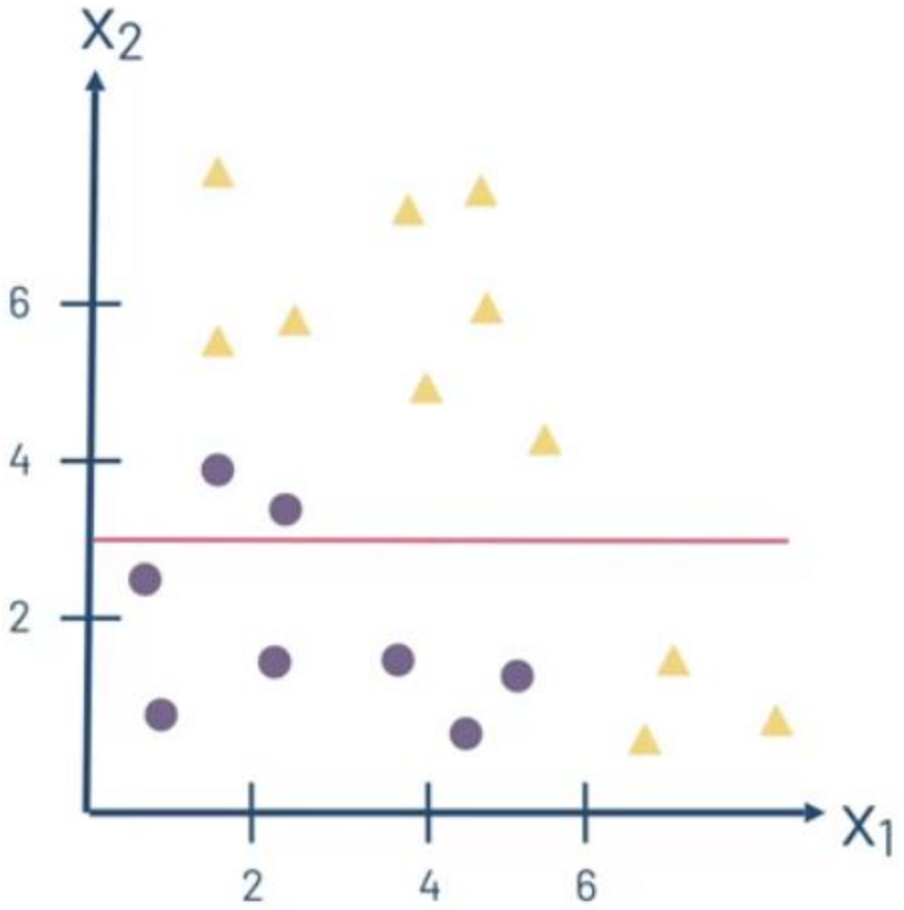

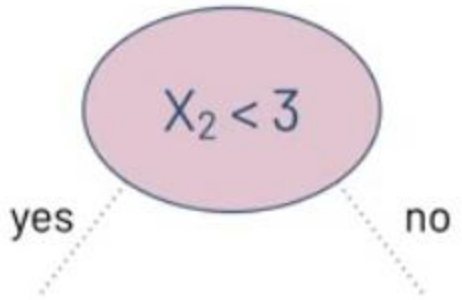

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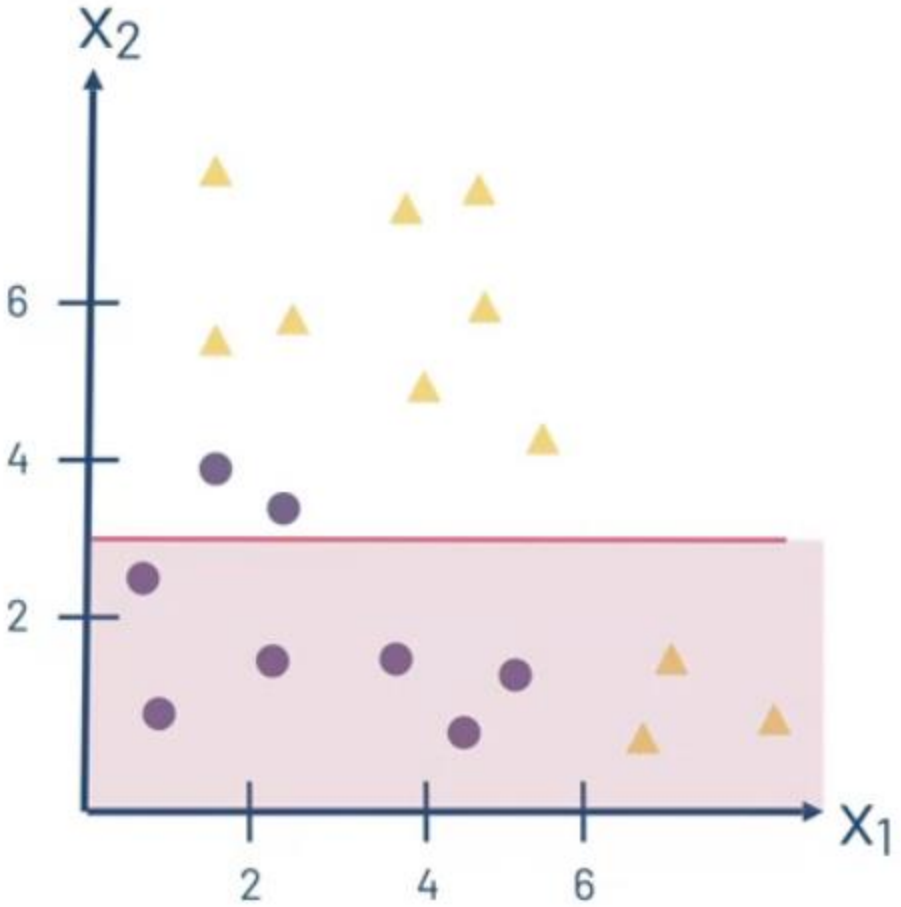

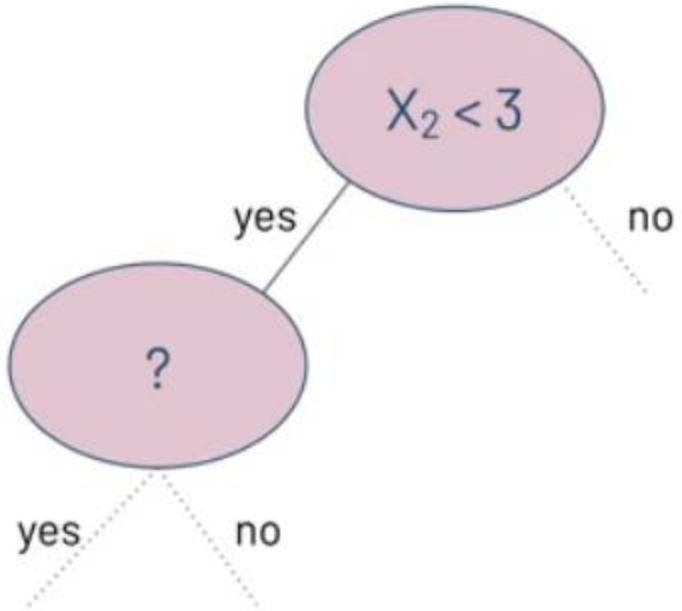

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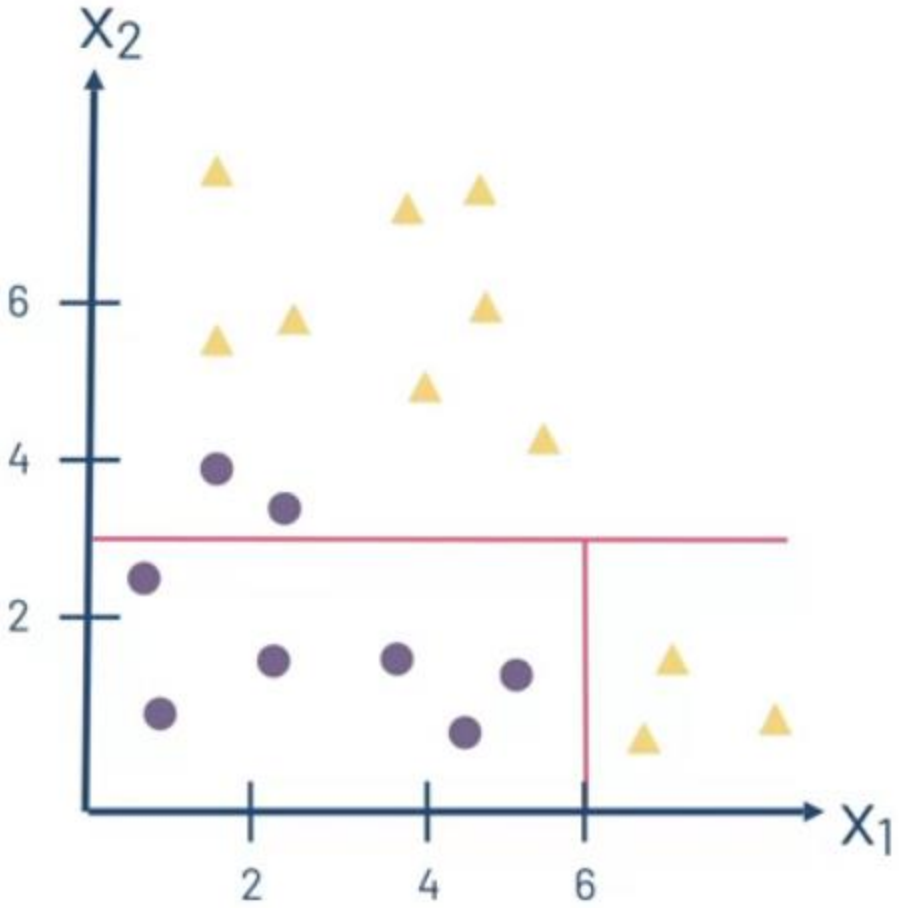

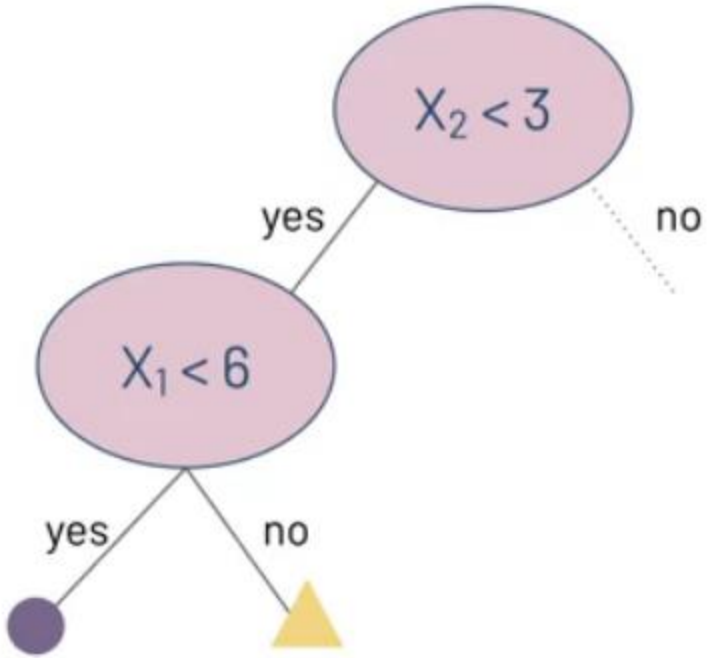

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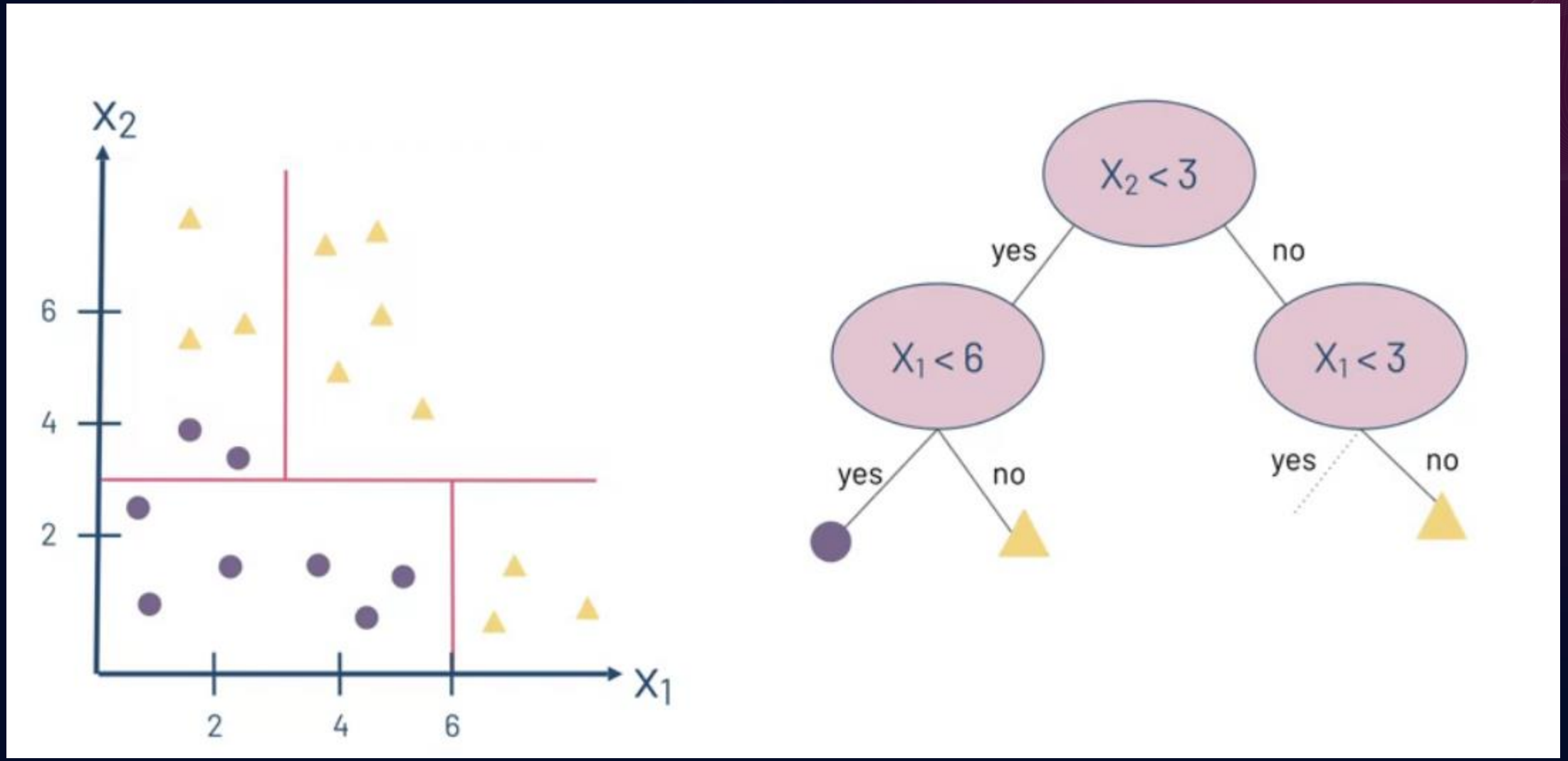

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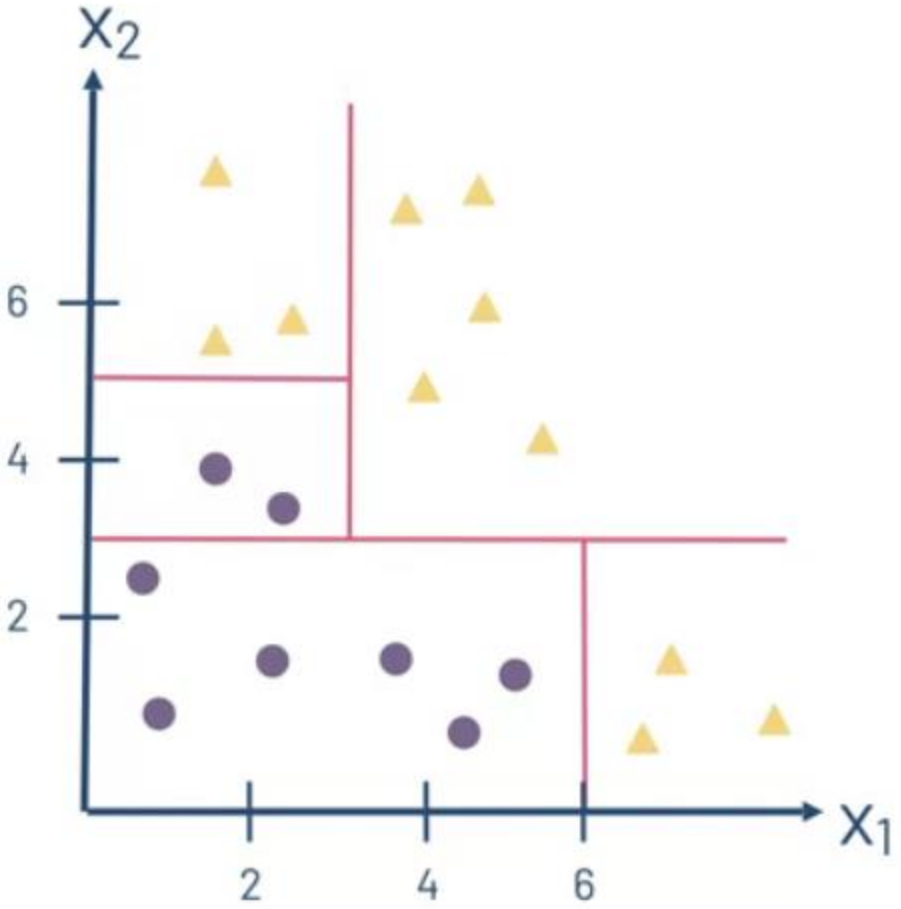

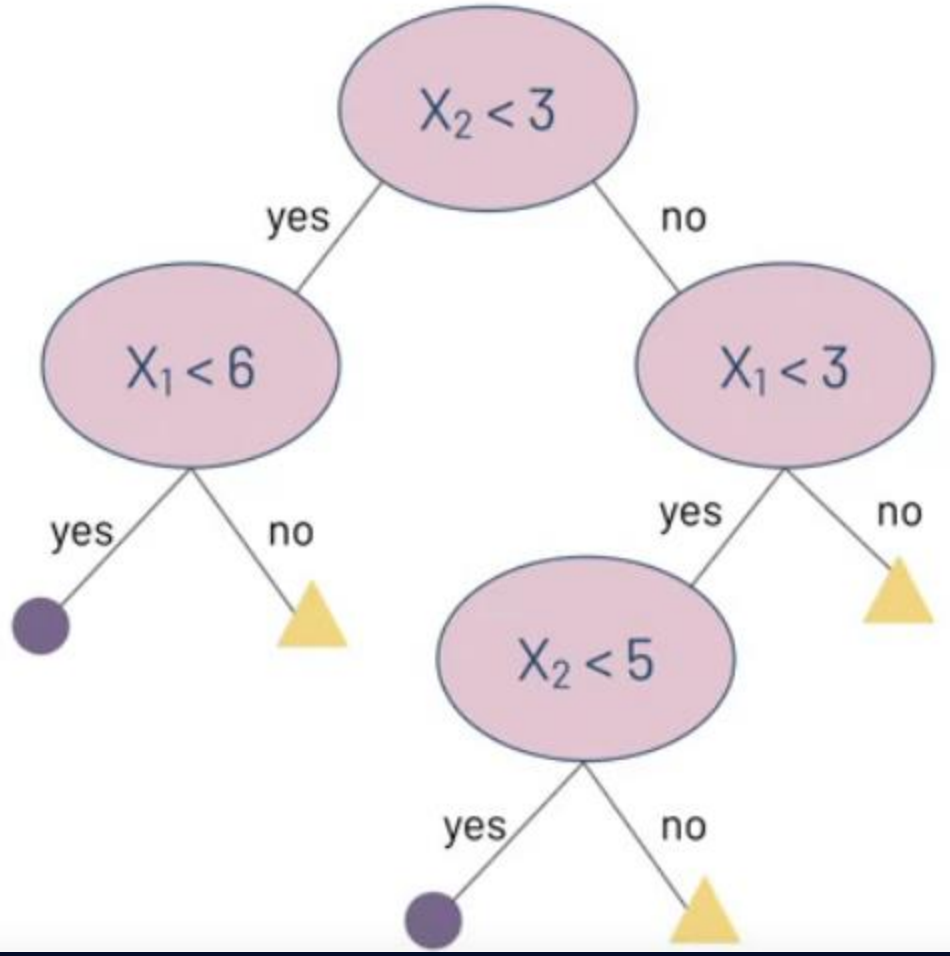

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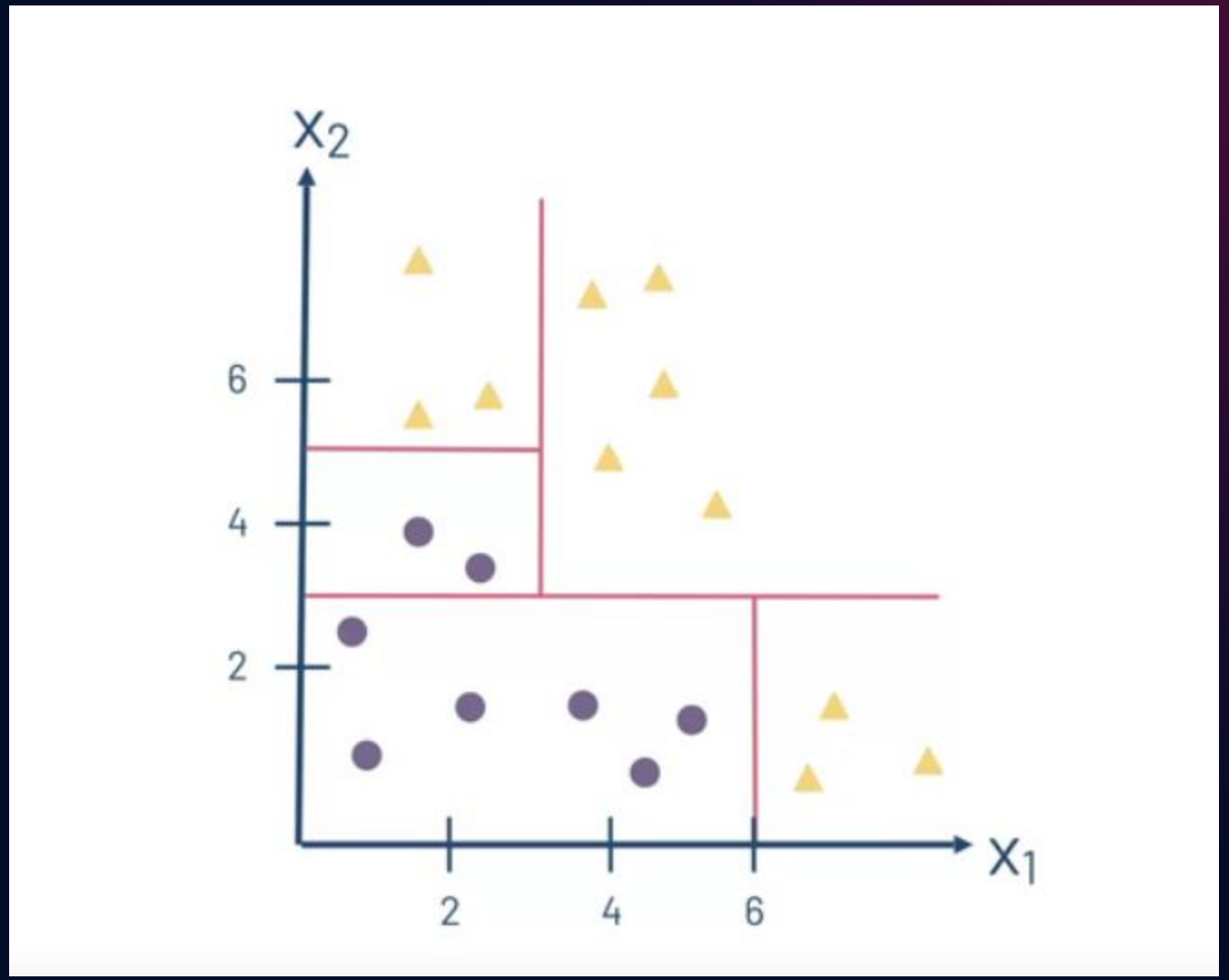

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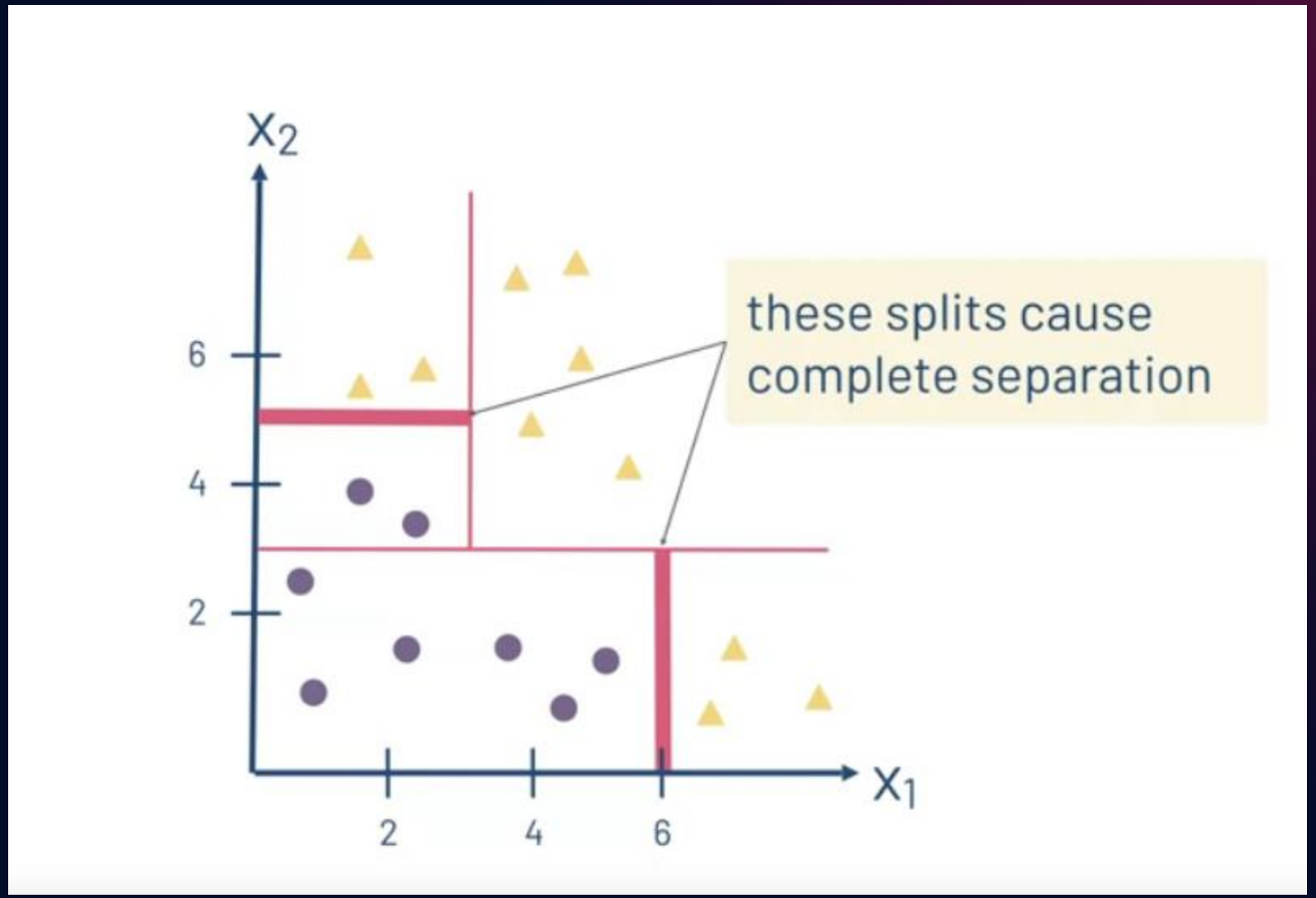
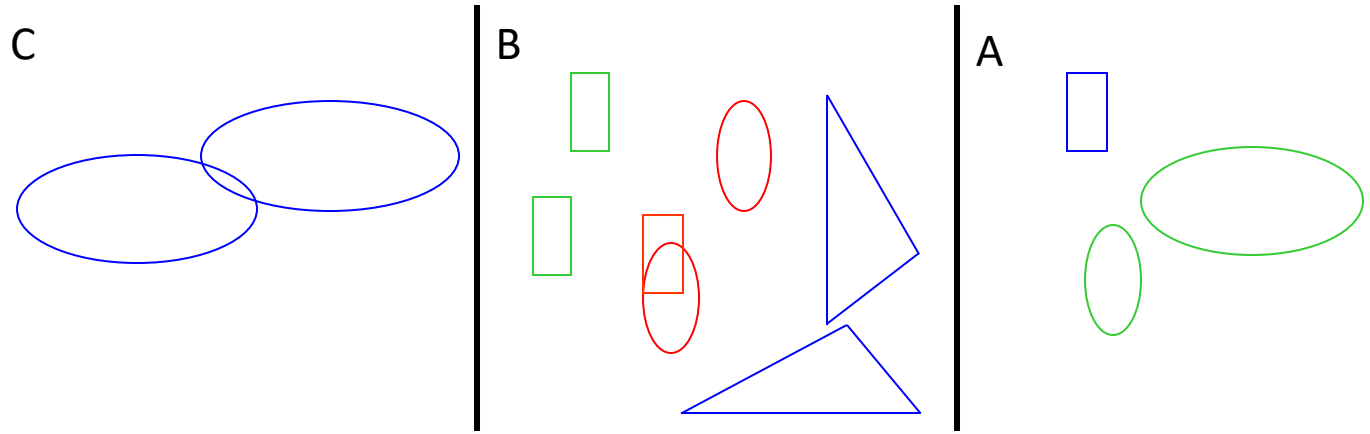


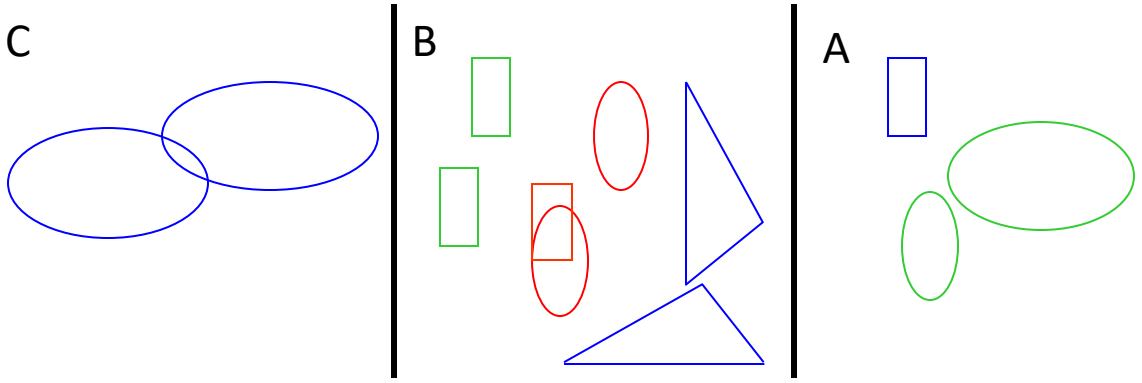
Decision Trees

- A hierarchical data structure that represents data by implementing a divide and conquer strategy
- Can be used as a non-parametric classification and regression method
- Given a collection of examples, learn a decision tree that represents it.
- Use this representation to classify new examples



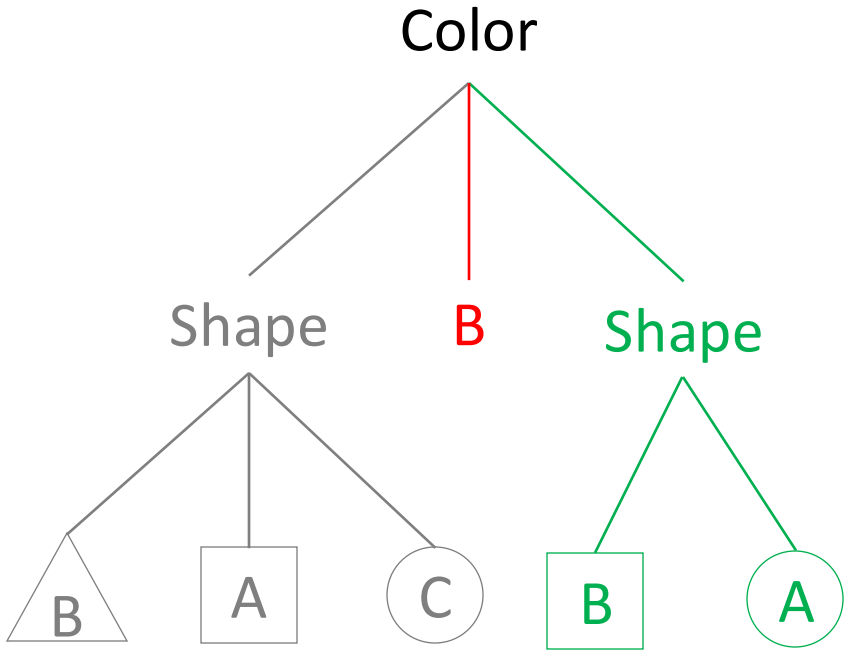
The Representation

- Decision Trees are classifiers for instances represented as feature vectors
  - color={red, blue, green} ; shape={circle, triangle, rectangle} ; label= {A, B, C}
- Nodes are tests for feature values
- There is one branch for each value of the feature
- Leaves specify the category (labels)
- Can categorize instances into multiple disjoint categories

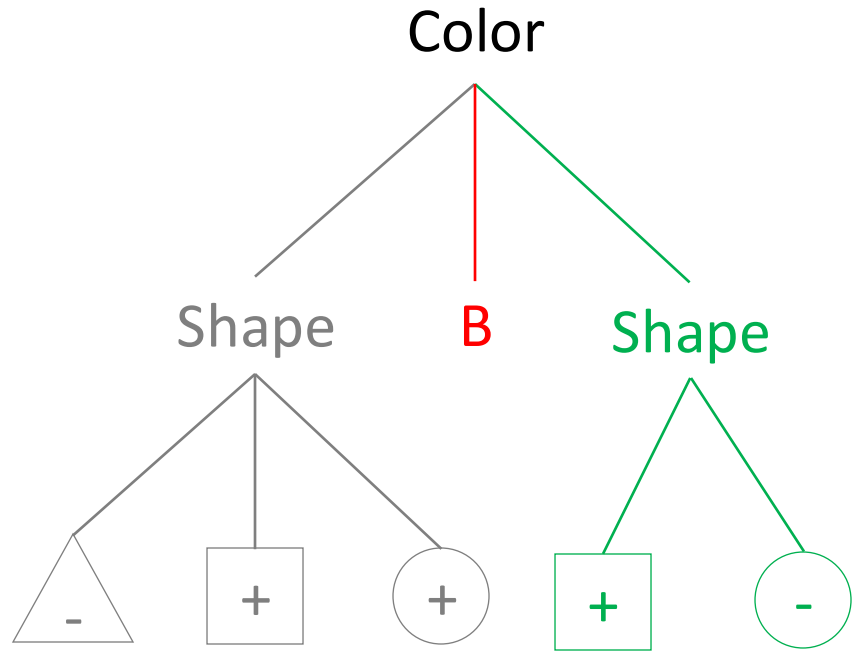


Evaluation of a Decision Tree

Learning a Decision Tree

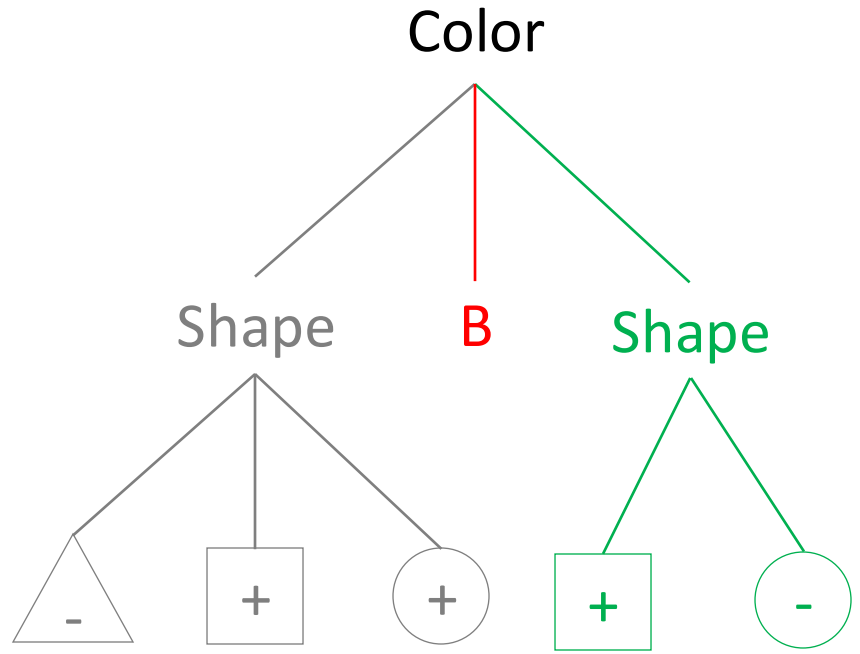


Expressivity of Decision Trees



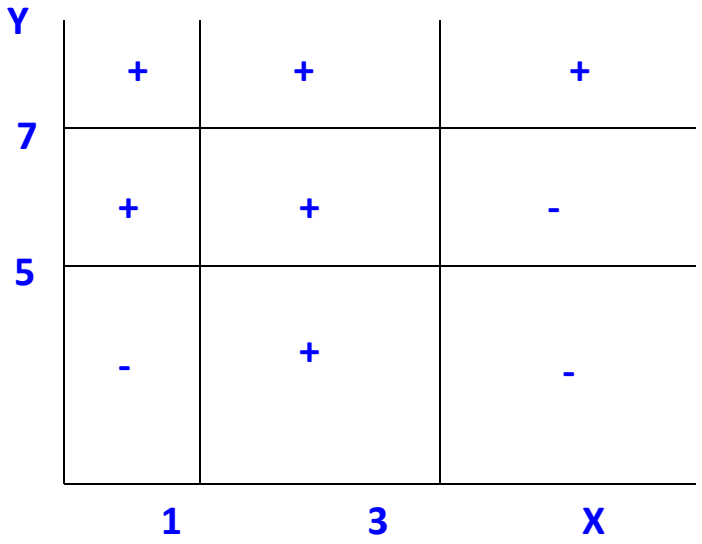
Decision Trees

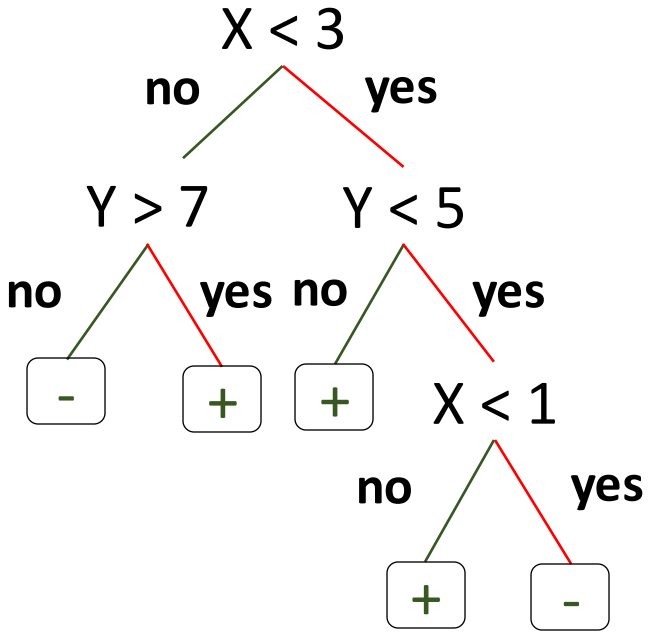
- Output is a discrete category. Real valued outputs are possible (regression trees)
- There are efficient algorithms for processing large amounts of data (but not too many features)
- There are methods for handling **noisy data** (classification noise and attribute noise) and for handling missing attribute values

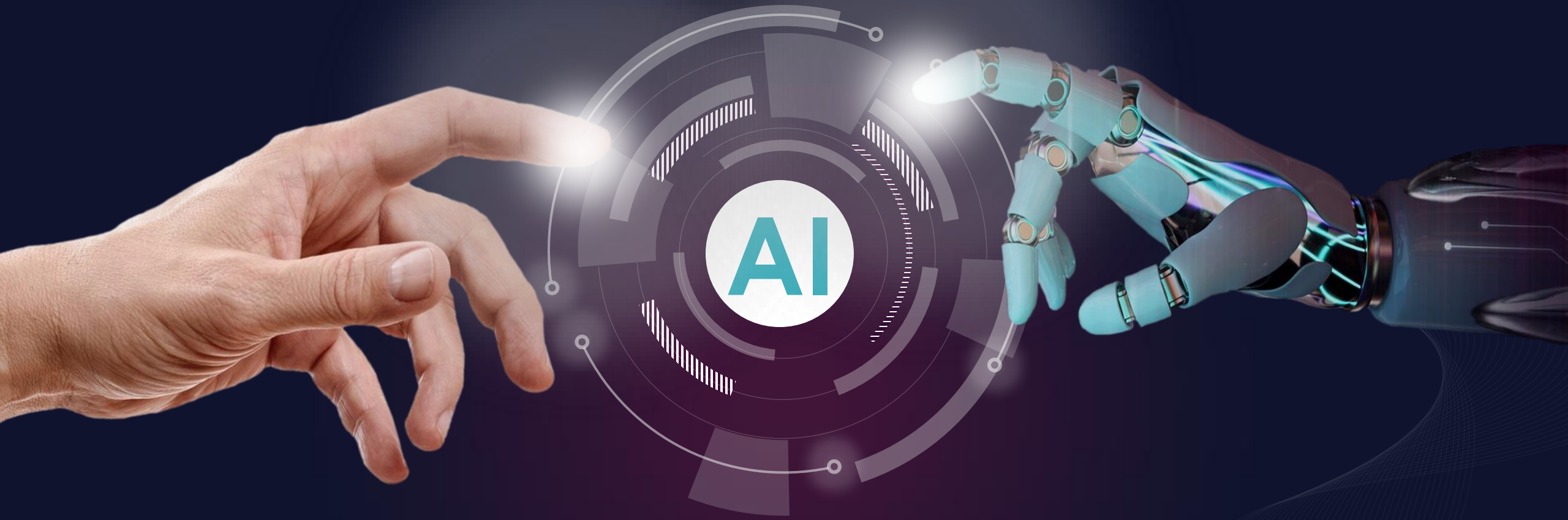


Decision Boundaries

- Usually, instances are represented as attribute-value pairs (color=blue, shape = square, +)
- Numerical values can be used either by discretizing or by using thresholds for splitting nodes
- In this case, the tree divides the features space into axis-parallel rectangles, each labeled with one of the labels







Learning decision trees (ID3 algorithm