

# Introducing Machine Learning

Machine Learning (ML) is a transformative technology that enables systems to learn from data, identify patterns, and make decisions with minimal human intervention. This document aims to provide an overview of machine learning, its types, applications, and the underlying principles that make it a powerful tool in various fields. As we delve into the world of machine learning, we will explore its significance in today's data-driven landscape and how it continues to shape the future of technology.

# What is Machine Learning?

Machine Learning is a subset of artificial intelligence (AI) that focuses on the development of algorithms that allow computers to learn from and make predictions based on data. Unlike traditional programming, where explicit instructions are given, ML algorithms improve their performance as they are exposed to more data over time.

# Machine Learning Hierarchy

## Machine Learning

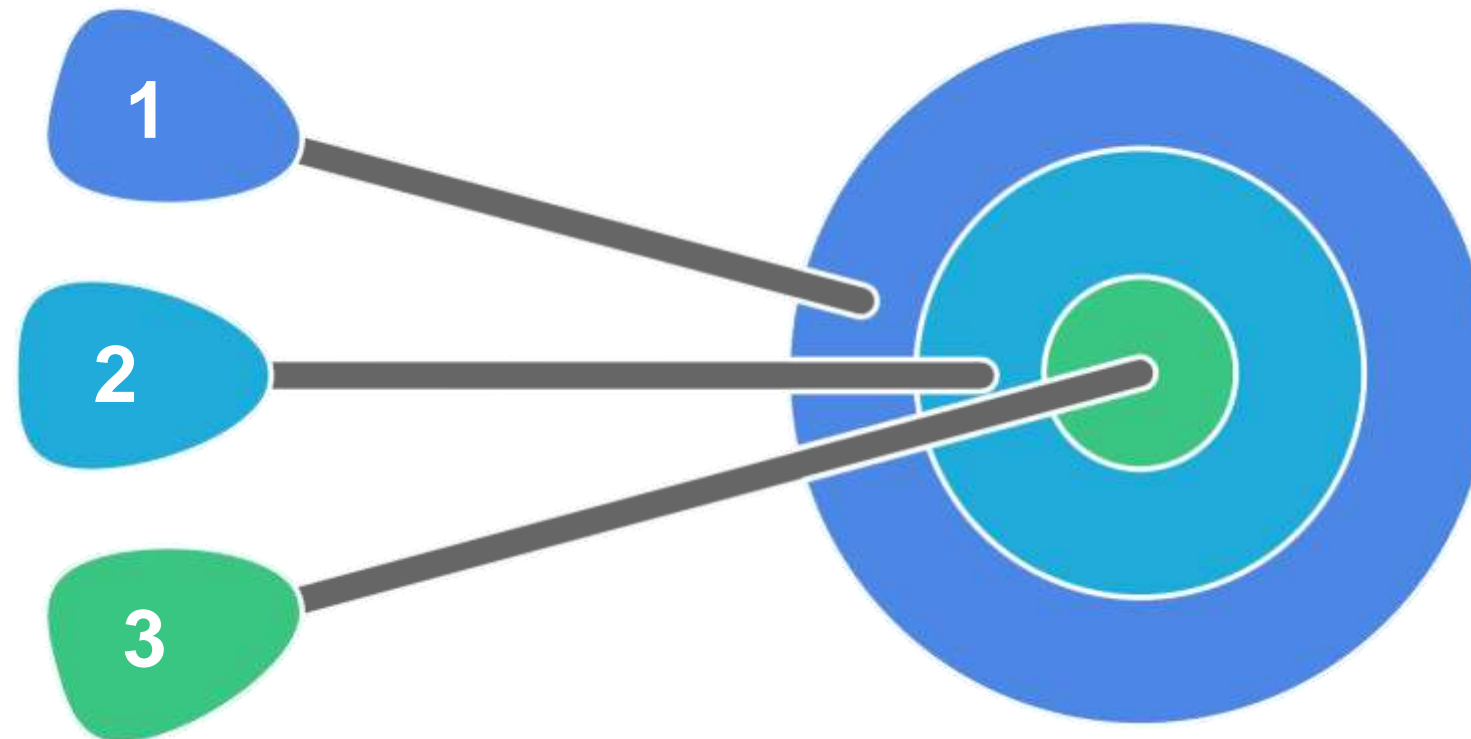
Algorithms learning from data

## Artificial Intelligence

Broad field of intelligent systems

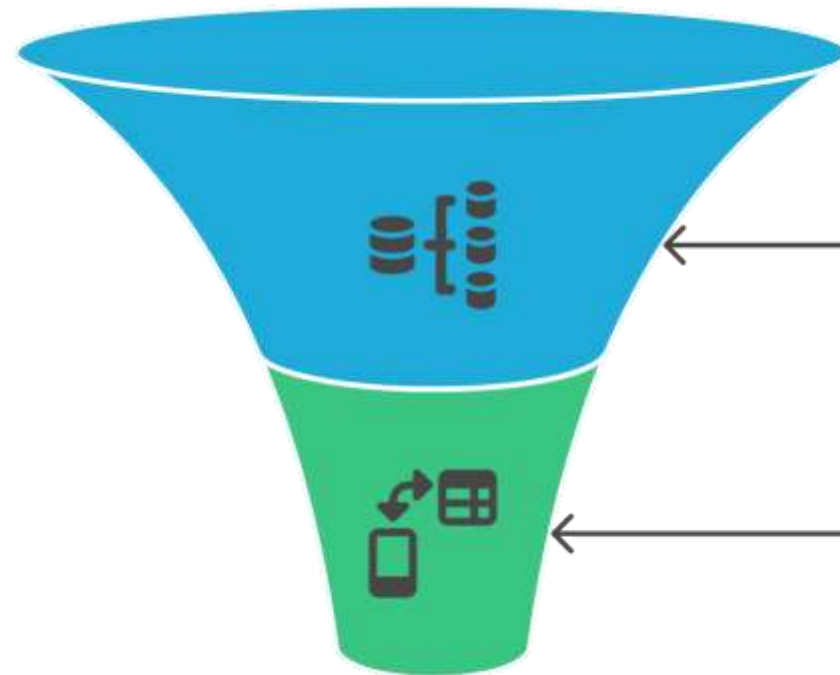
## Data

Foundation for learning and prediction



# Supervised Learning Process

Labeled Dataset

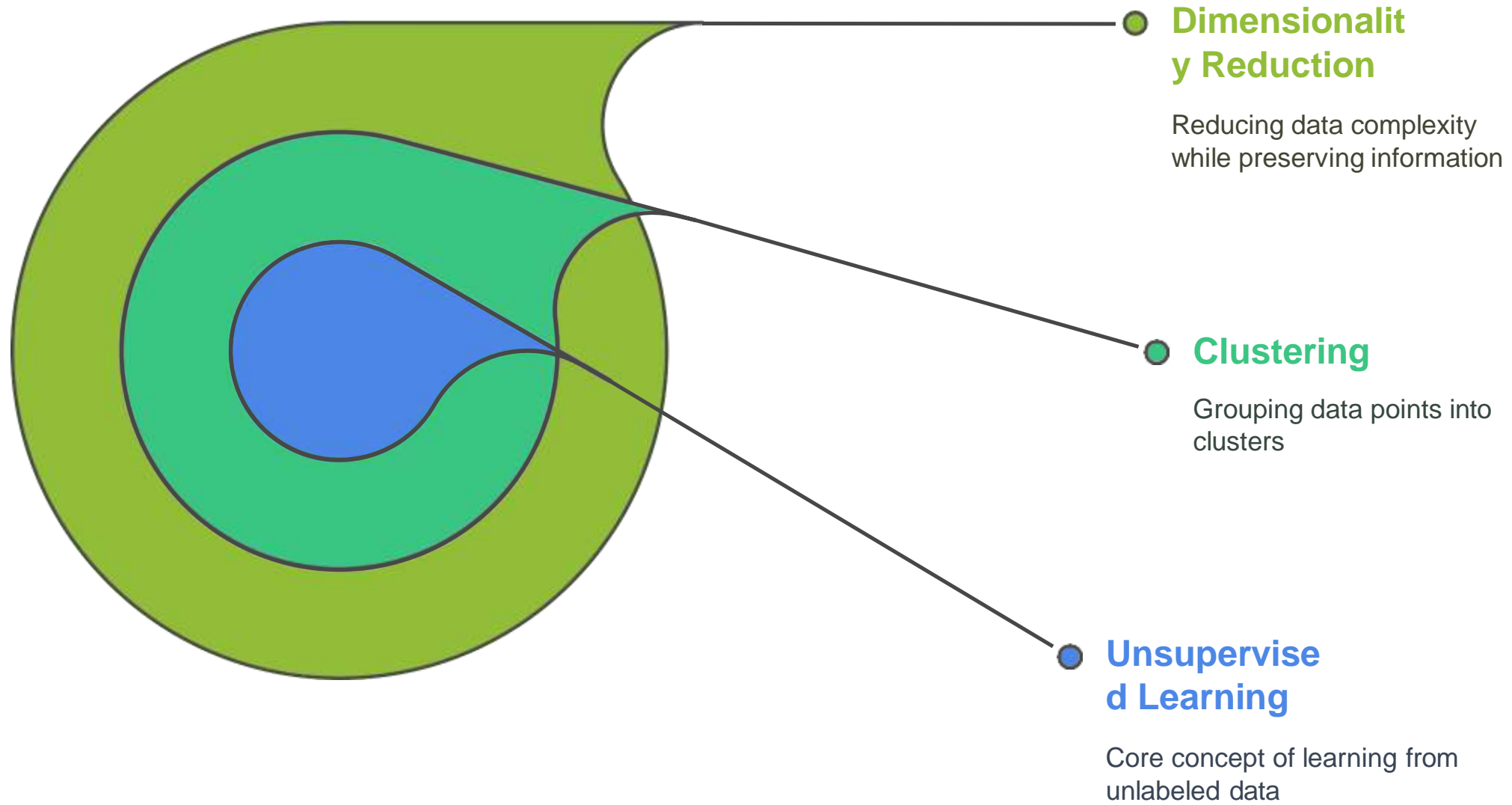


Model Training

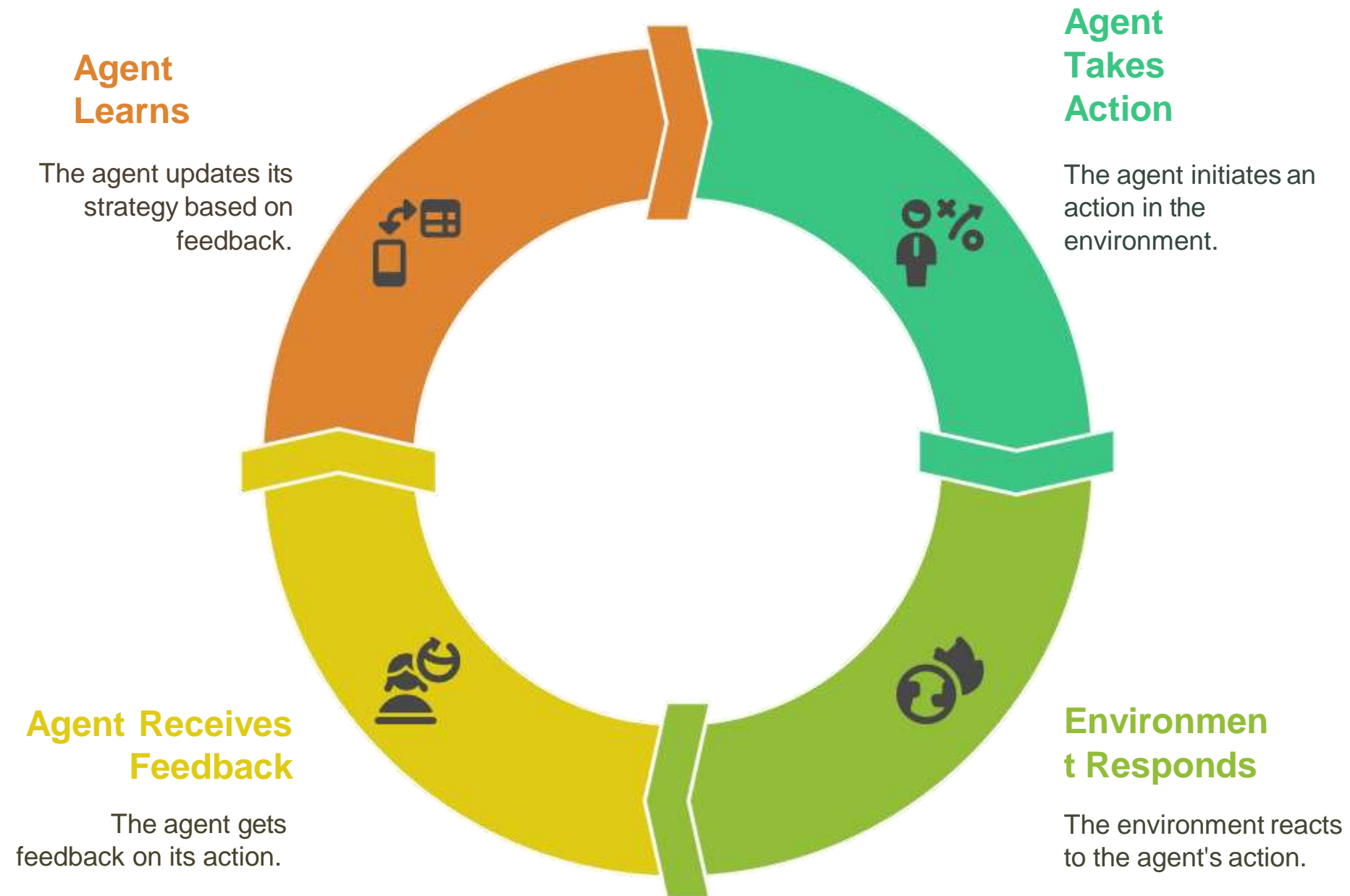
Prediction Making

Accurate Predictions

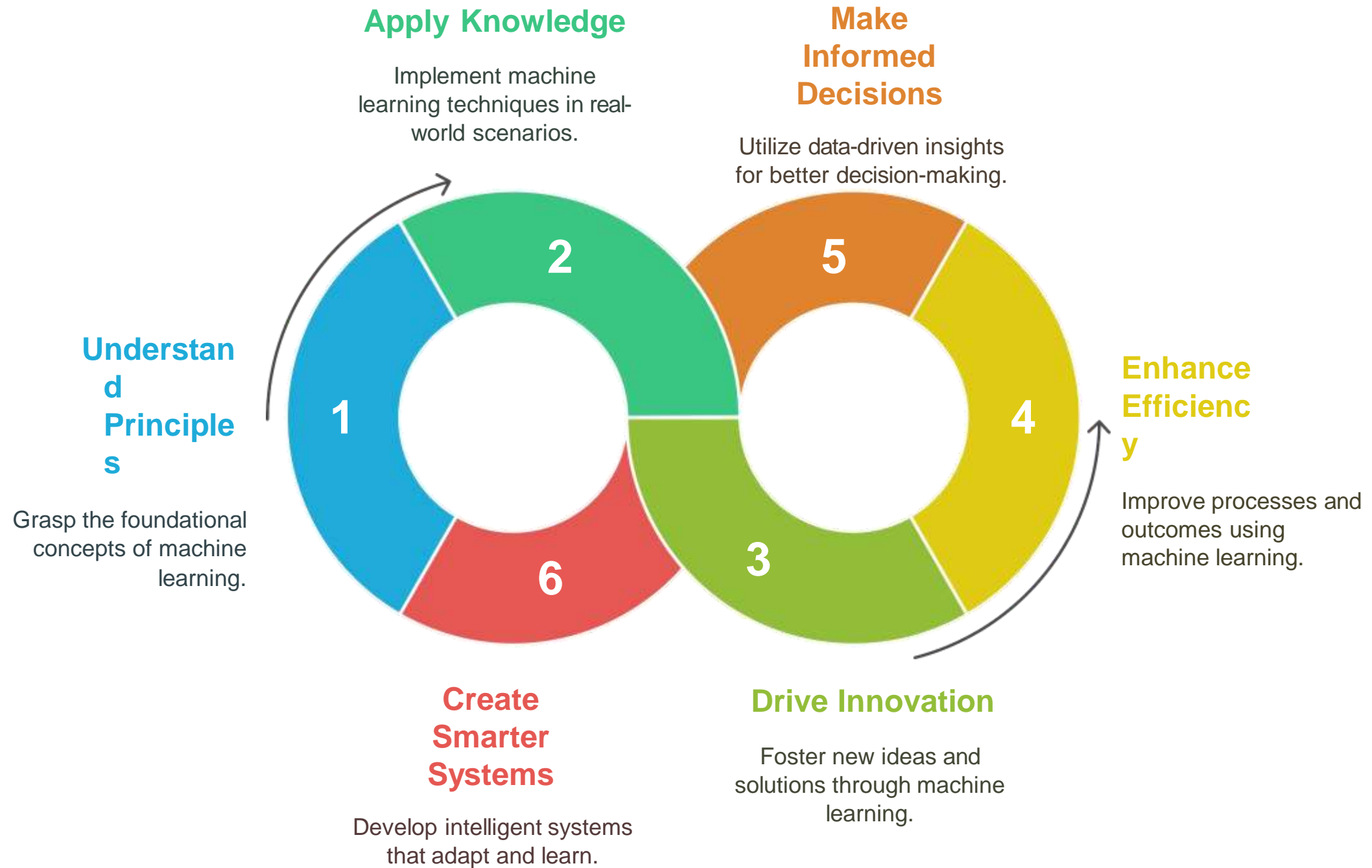
## Unsupervised Learning Tasks



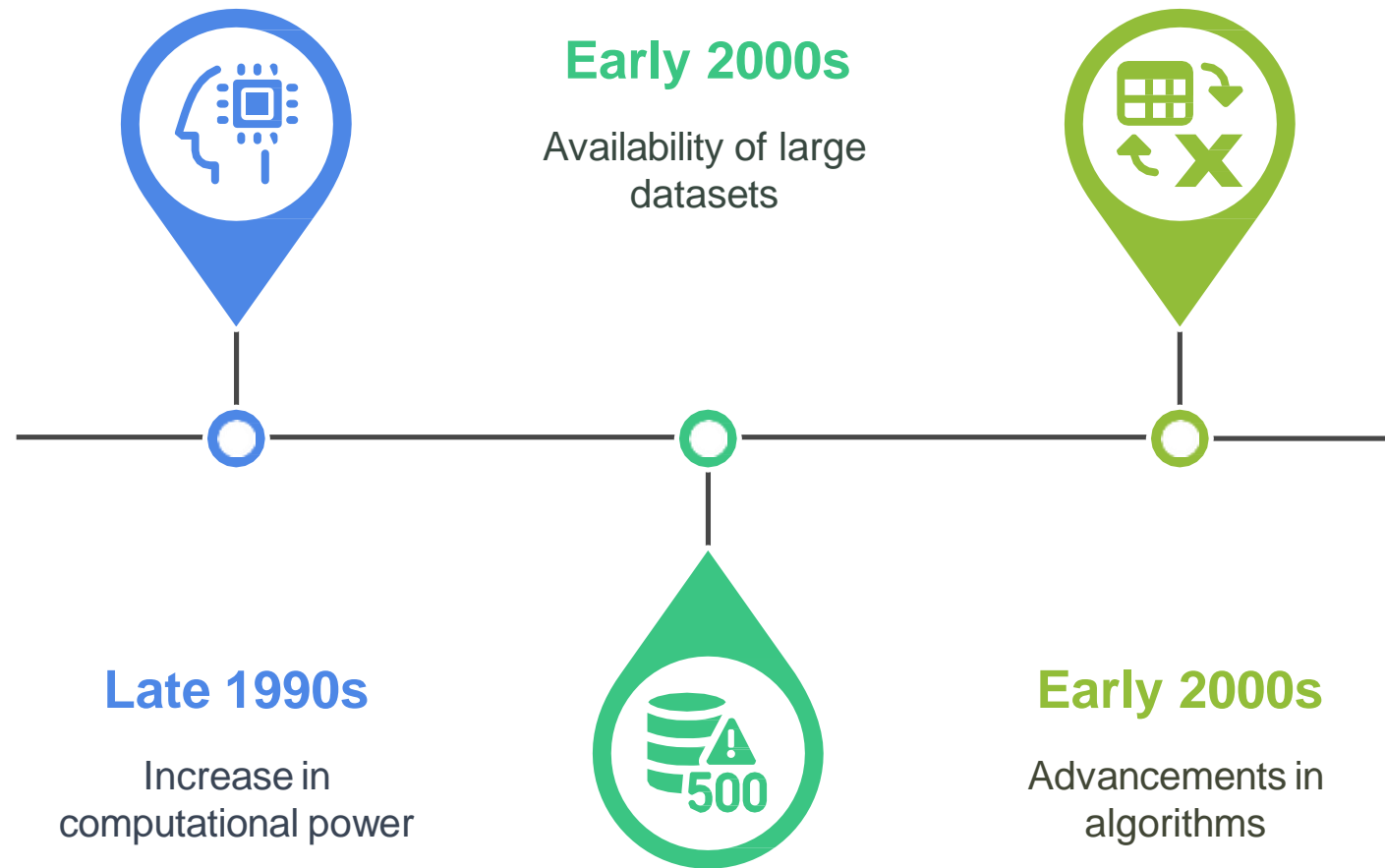
# Reinforcement Learning Cycle



# The Machine Learning Cycle

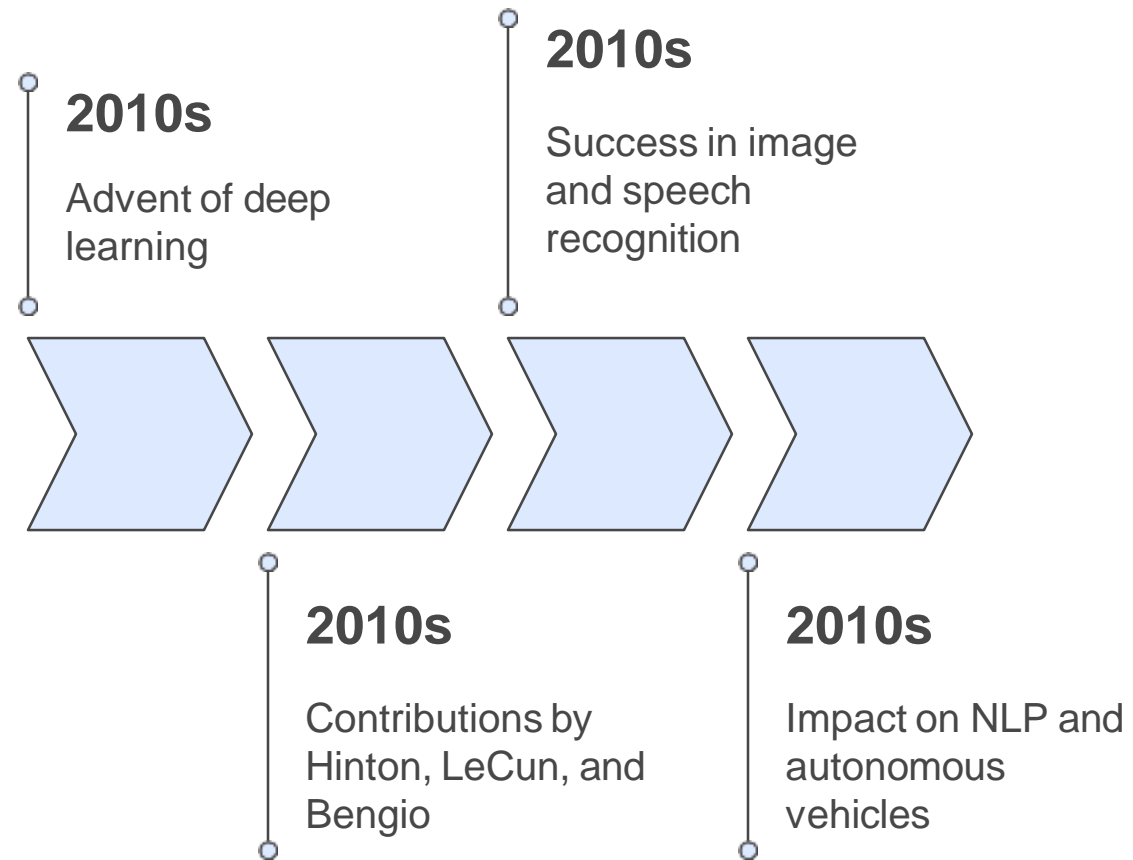


# The Resurgence of Machine Learning





# The Rise of Deep Learning in the 2010s



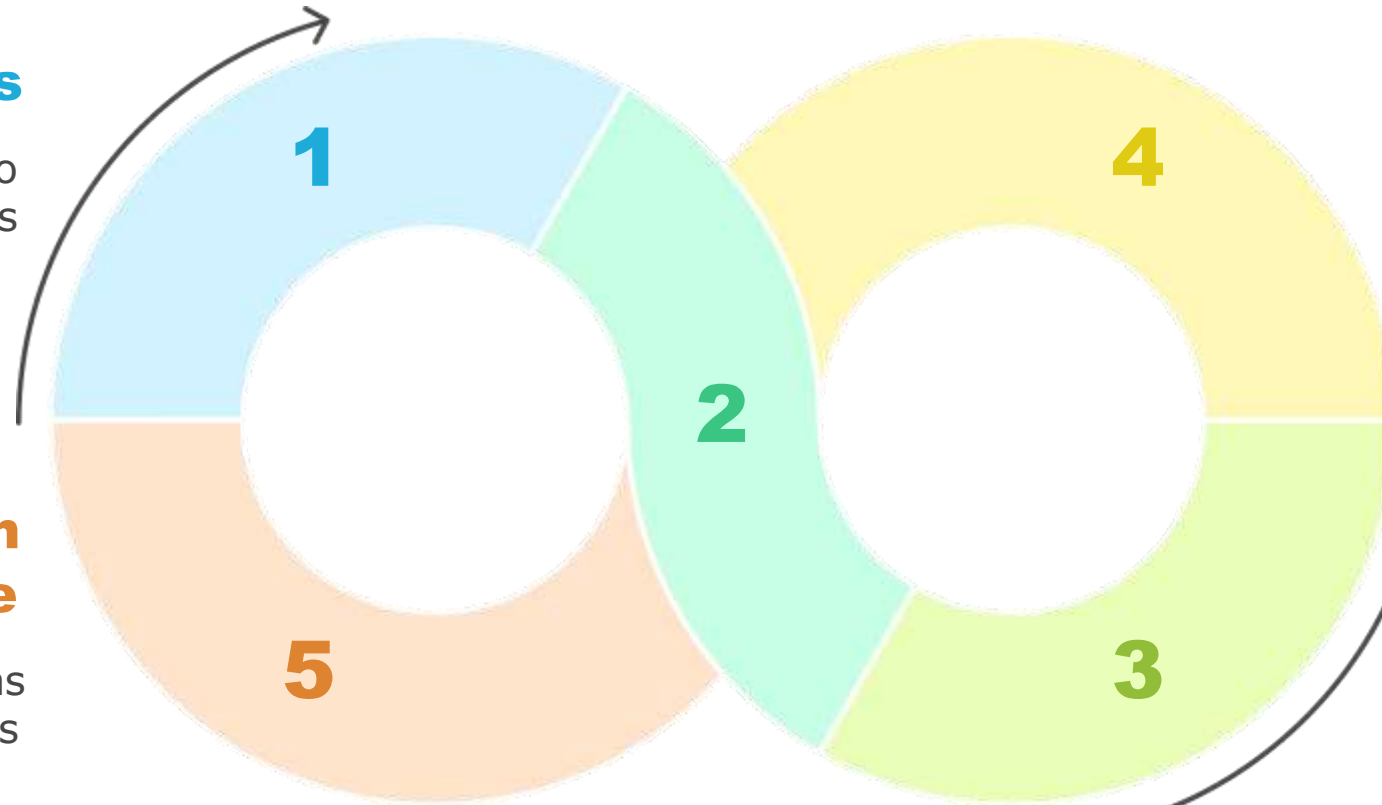
# The Cycle of Machine Learning Applications

## Data Analysis

Analyzing data to gain insights

## Innovation Drive

Fostering new ideas and solutions



2

4

3

1

5

## Decision Making

Using insights to make informed decisions

## Accuracy Improvement

Refining predictions and results

## Efficiency Enhancement

Improving processes and outcomes

# Machine Learning in Agriculture Cycle

## Allocate Resources

Efficient distribution of water and fertilizers.

## Make Informed Decisions

Farmers use insights to optimize planting.

## Analyze Soil Data

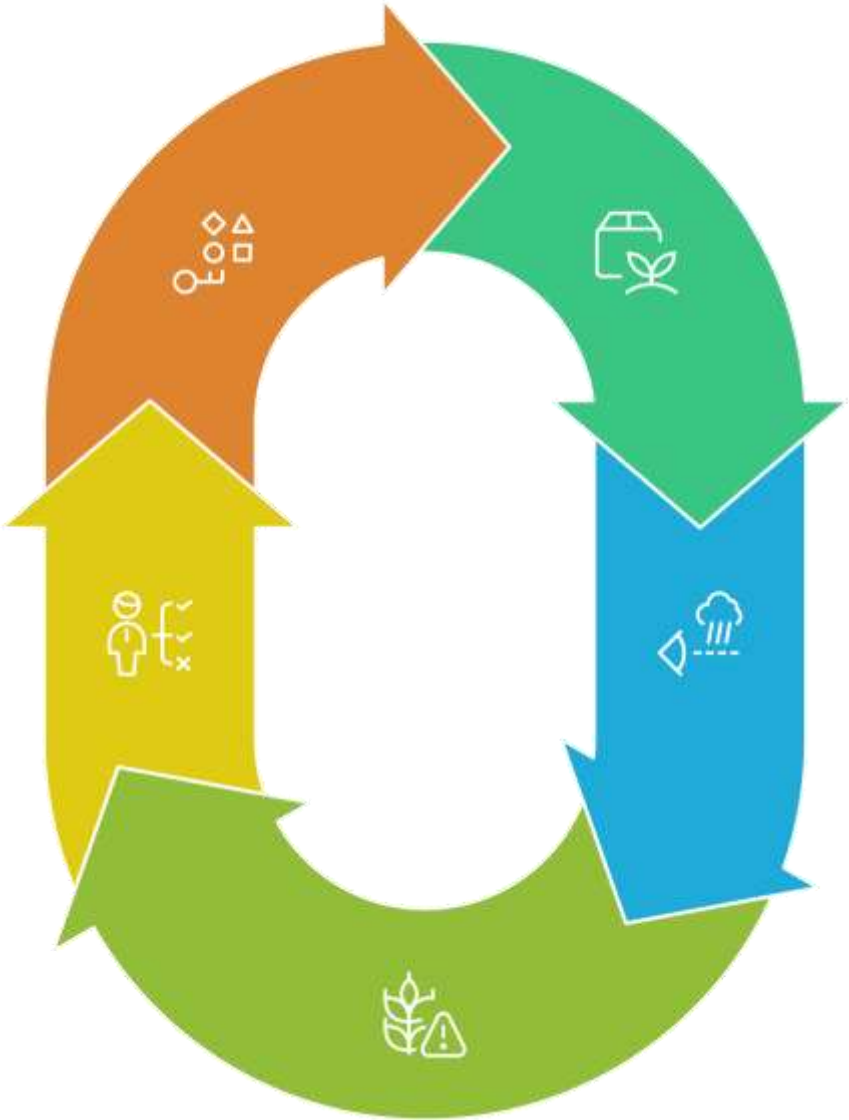
Farmers use ML to understand soil composition.

## Monitor Weather Patterns

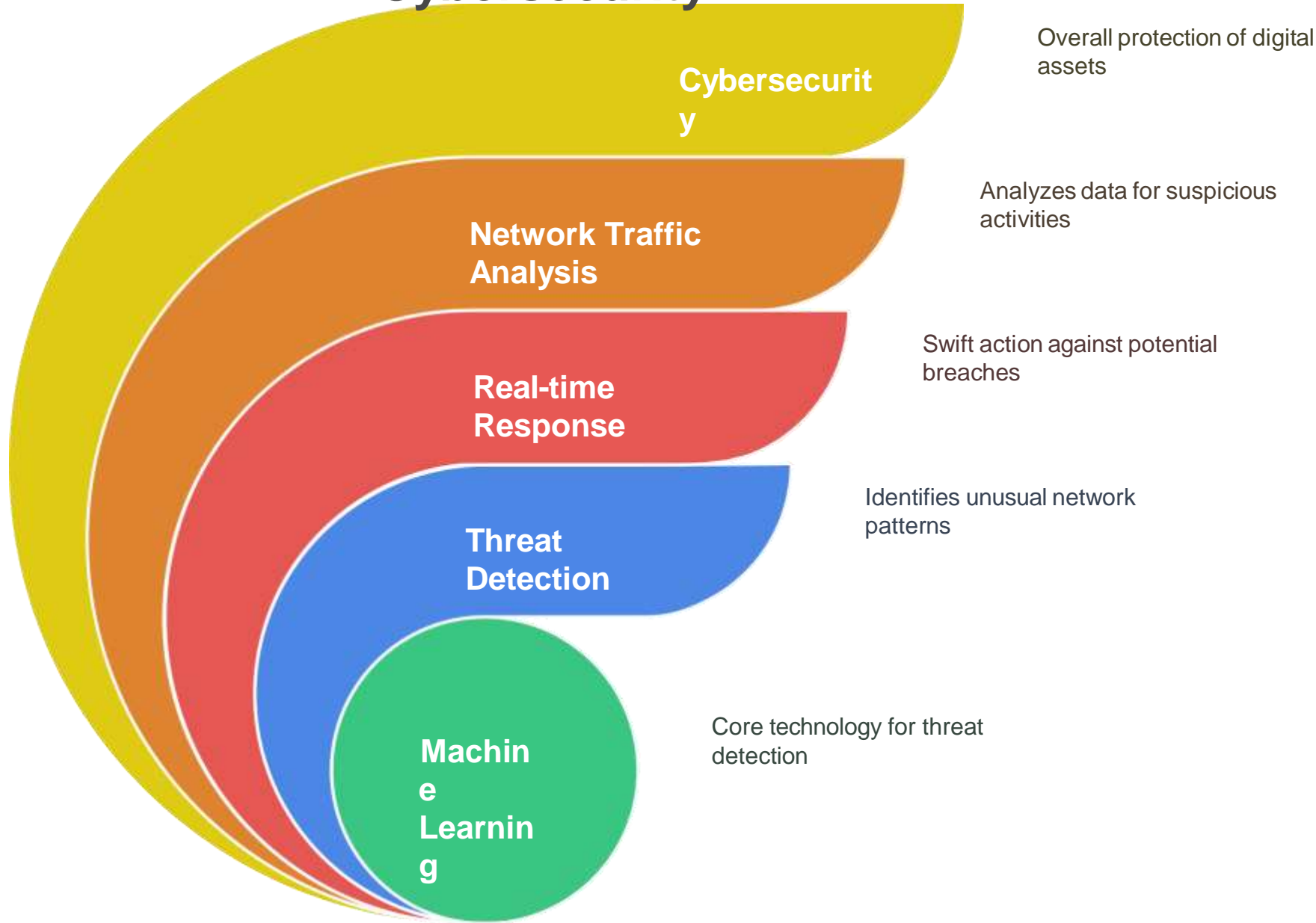
ML helps predict weather impacts on crops.

## Assess Crop Health

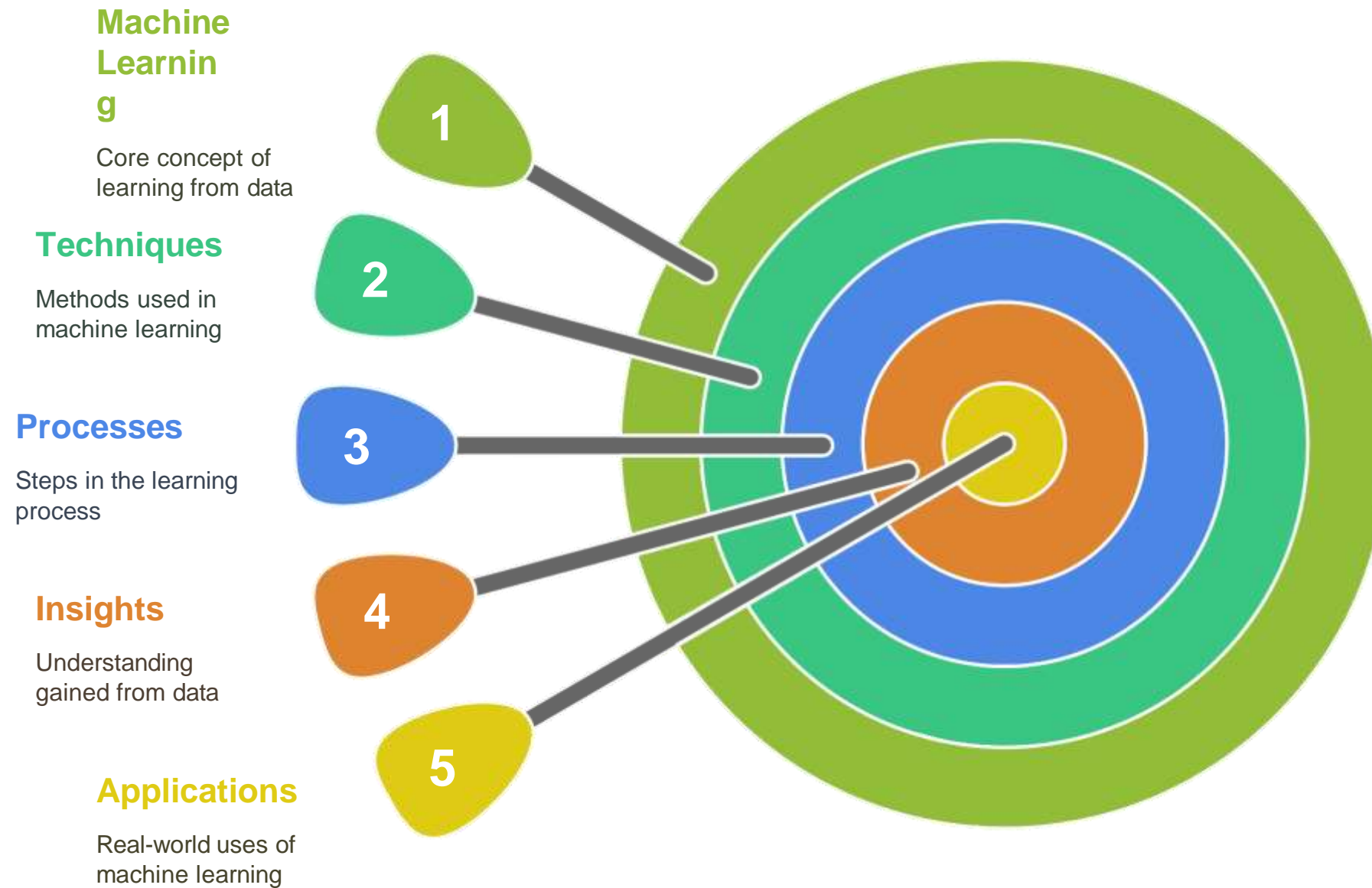
ML identifies potential health issues in crops.



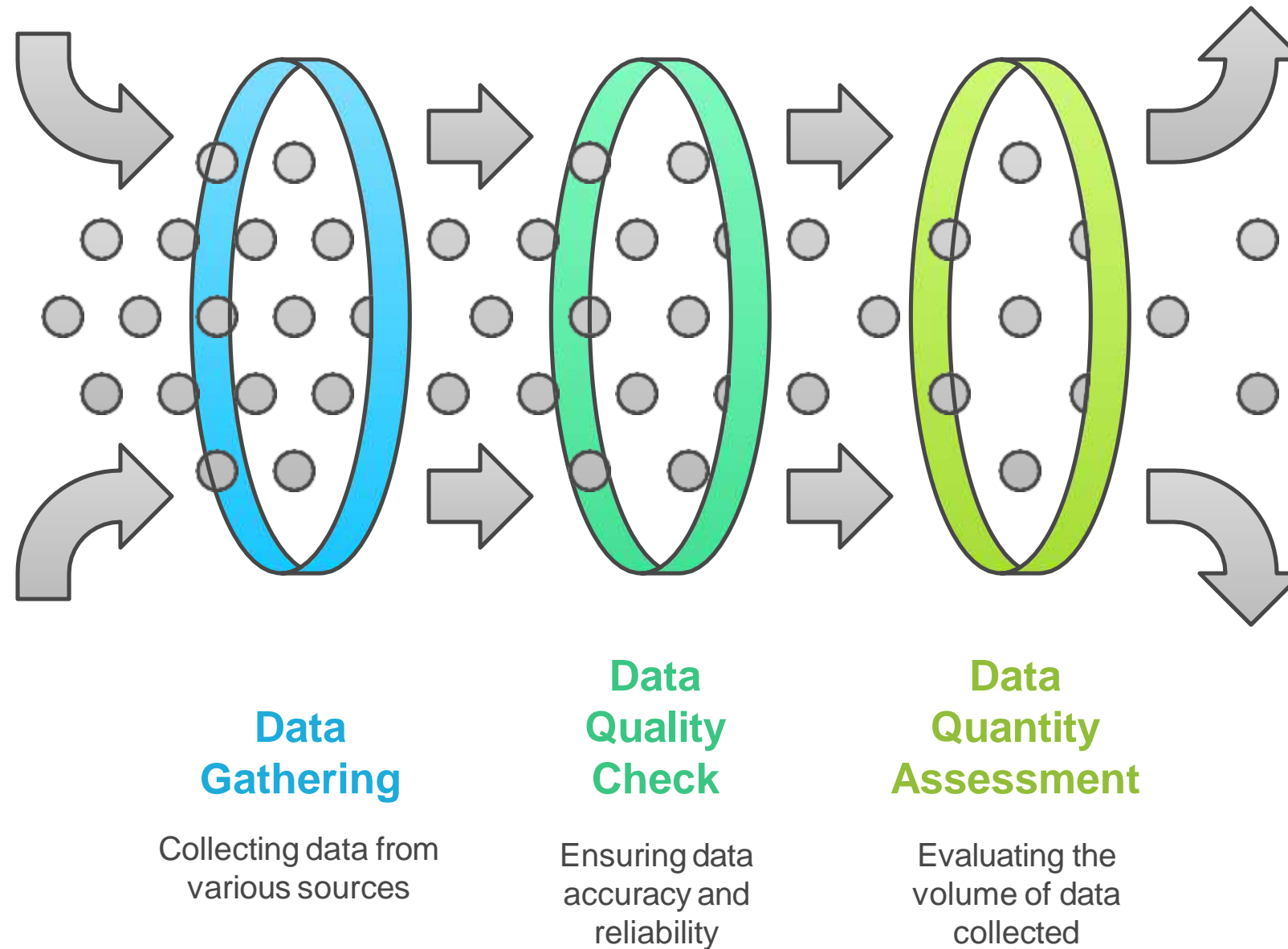
# Machine Learning in Cybersecurity



# How Do Machines Learn

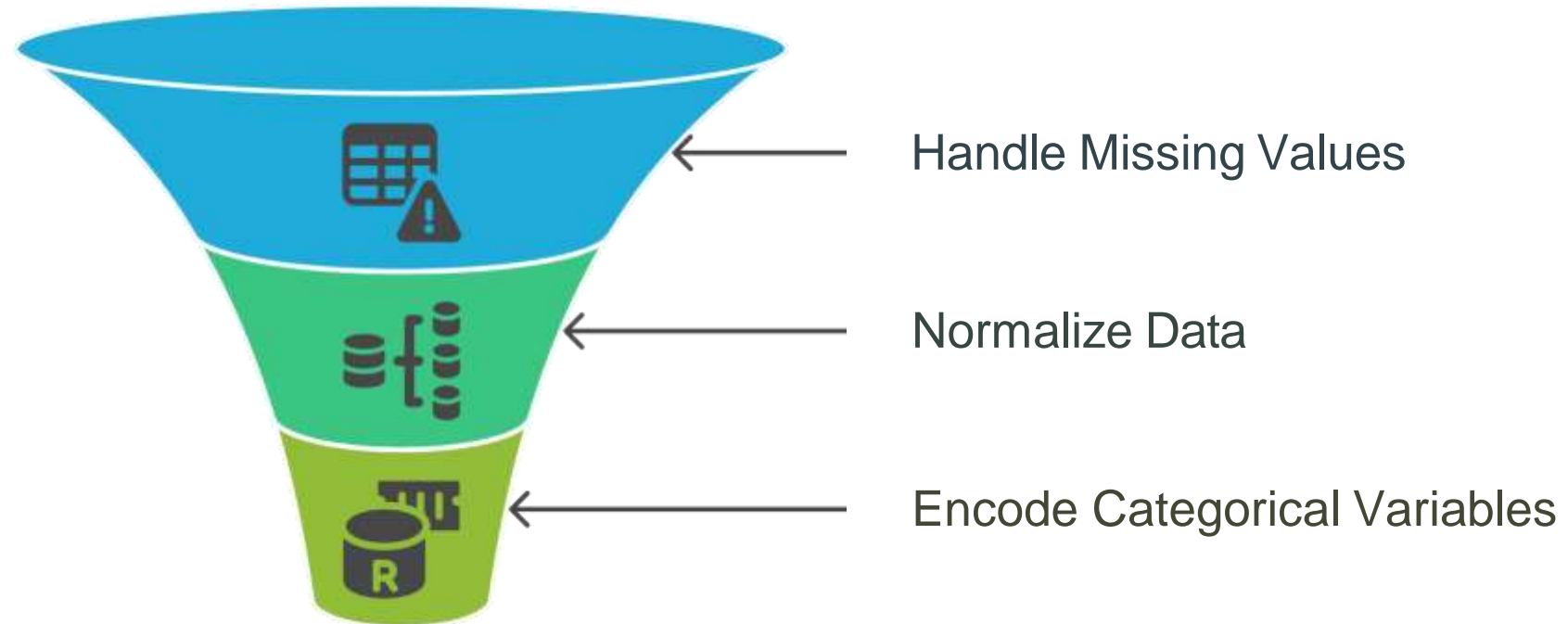


# Data Collection Process for Machine Learning



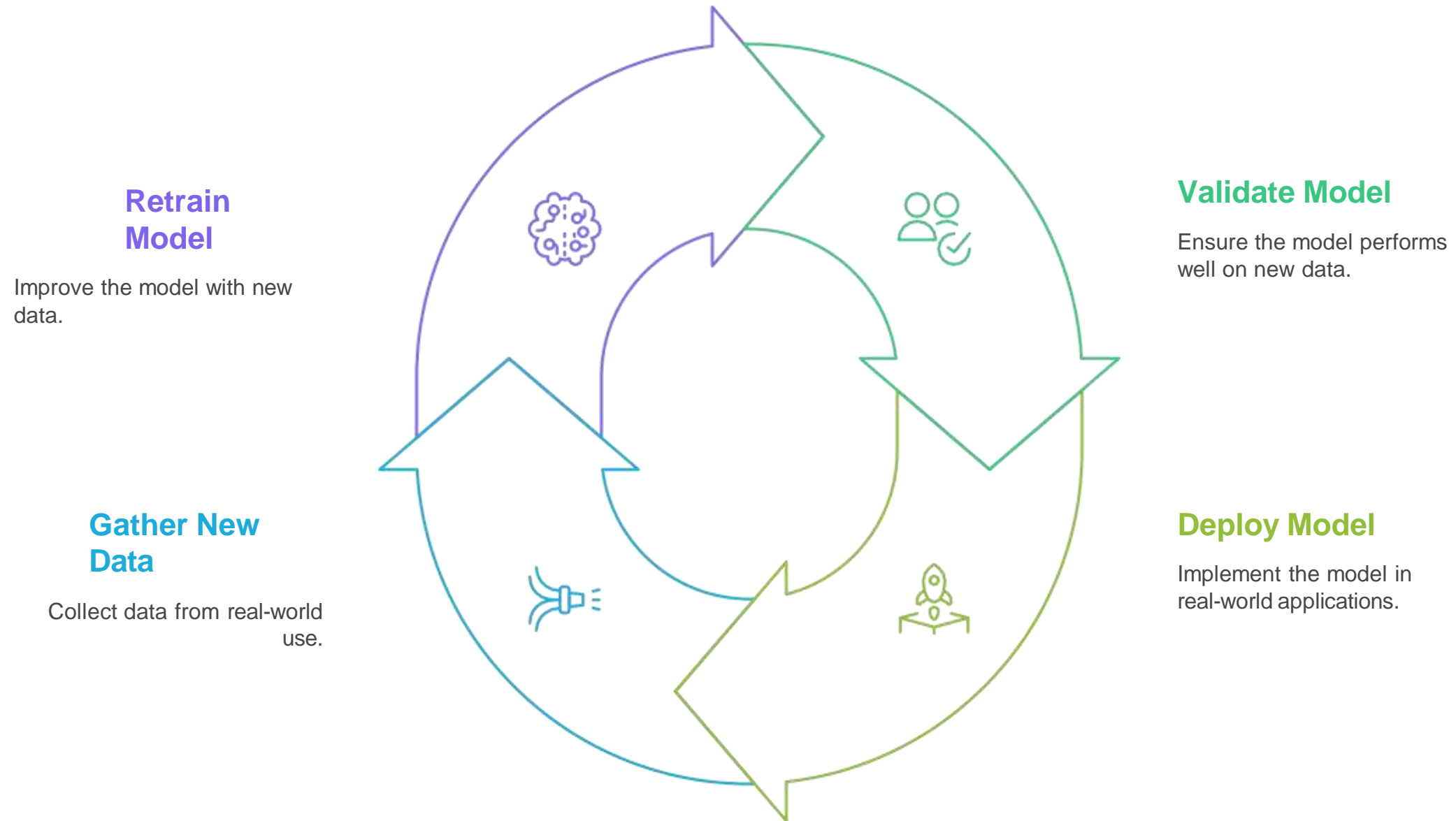
## Data Preprocessing Funnel

Raw Data



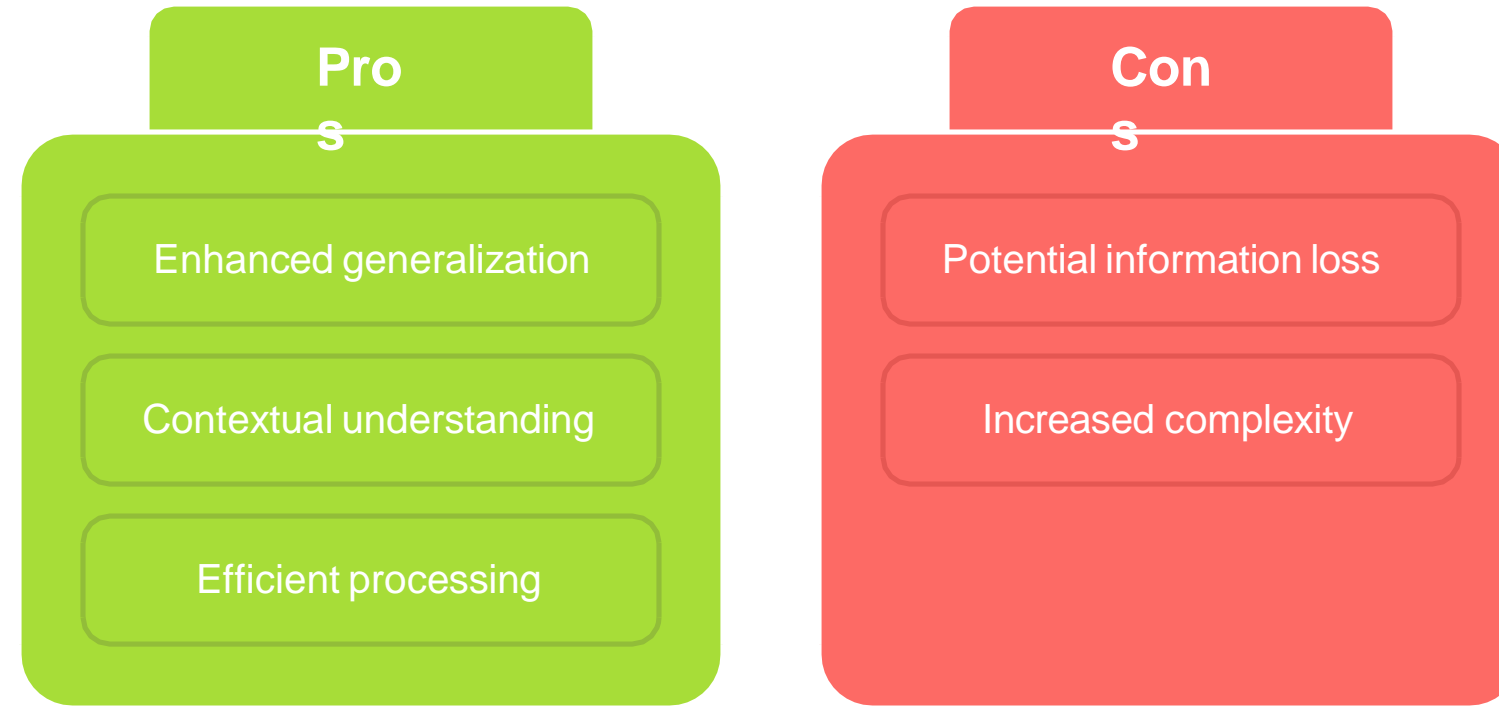
Processed Data

# Machine Learning Deployment Cycle

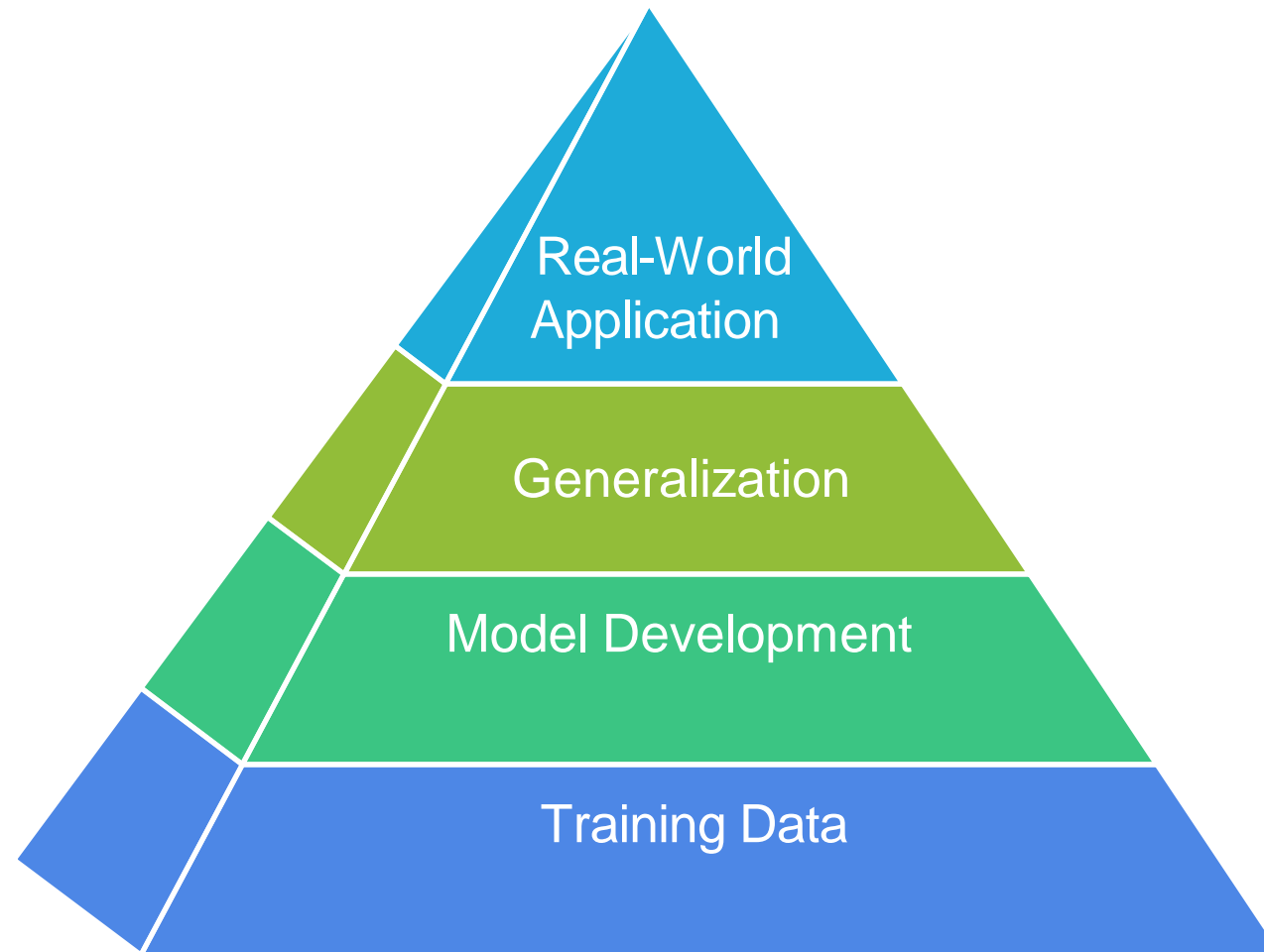




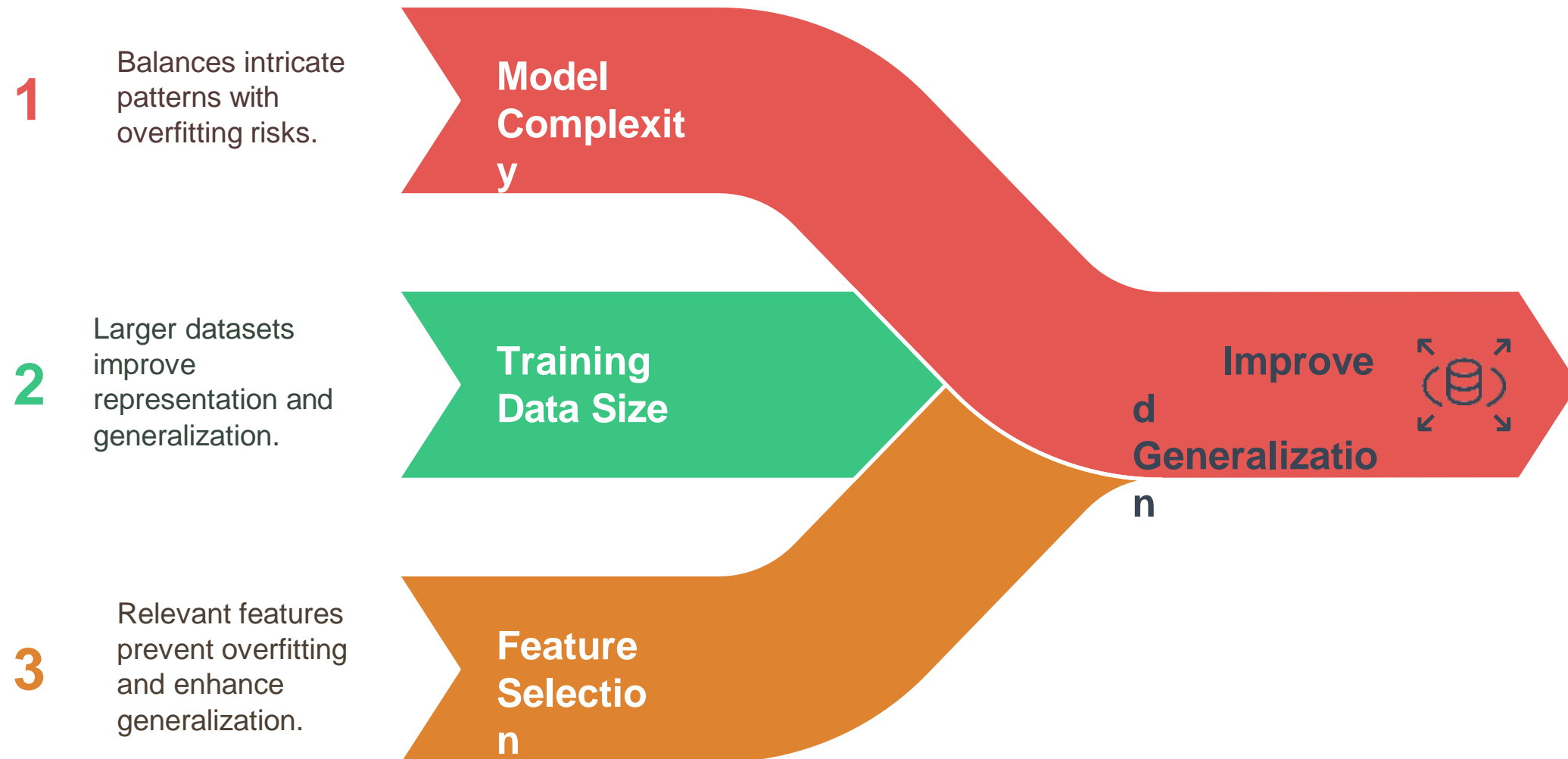
# Data abstraction in ML



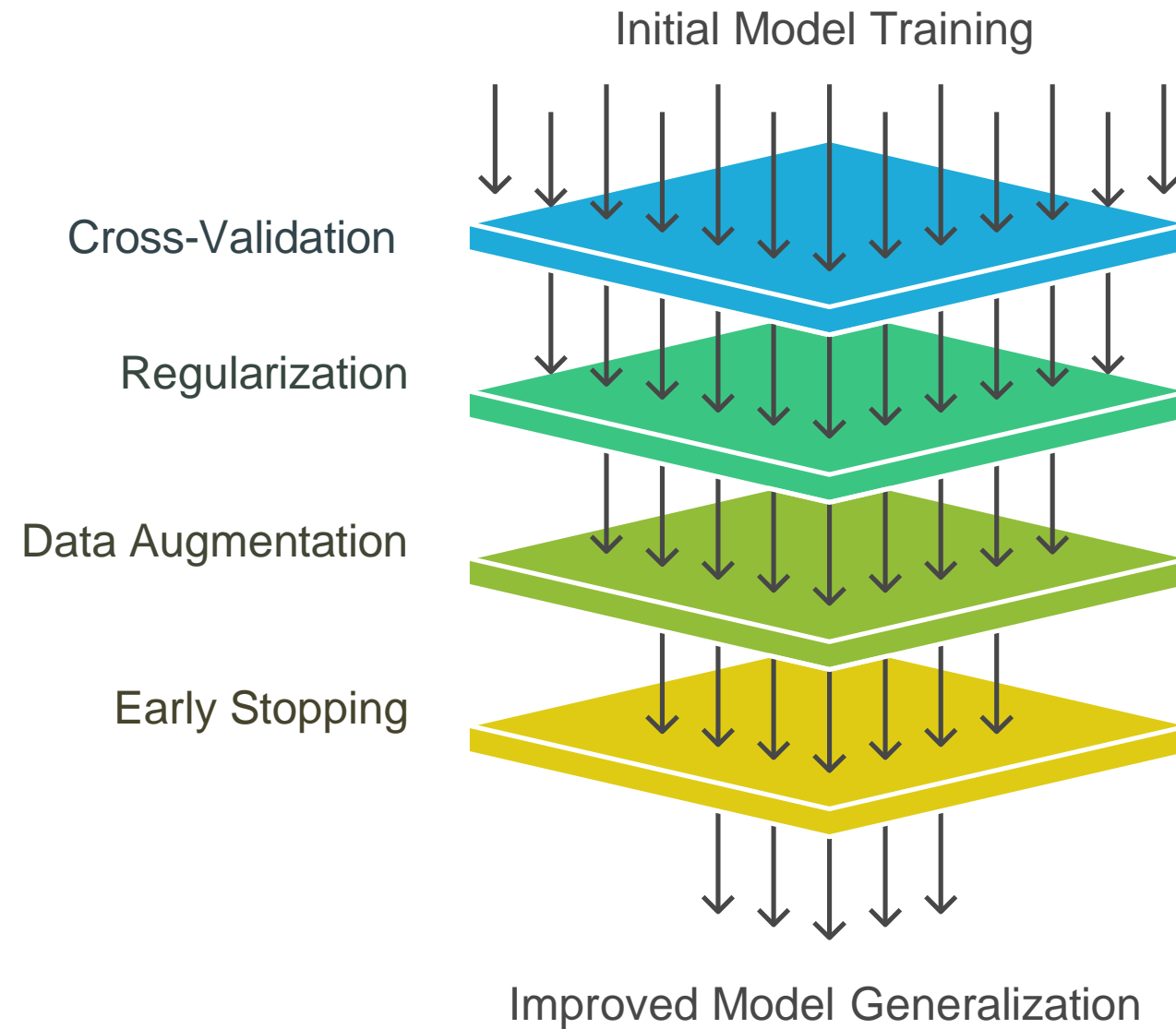
# Generalization in Machine Learning



# Factors Affecting Generalization



# Enhancing Model Generalization



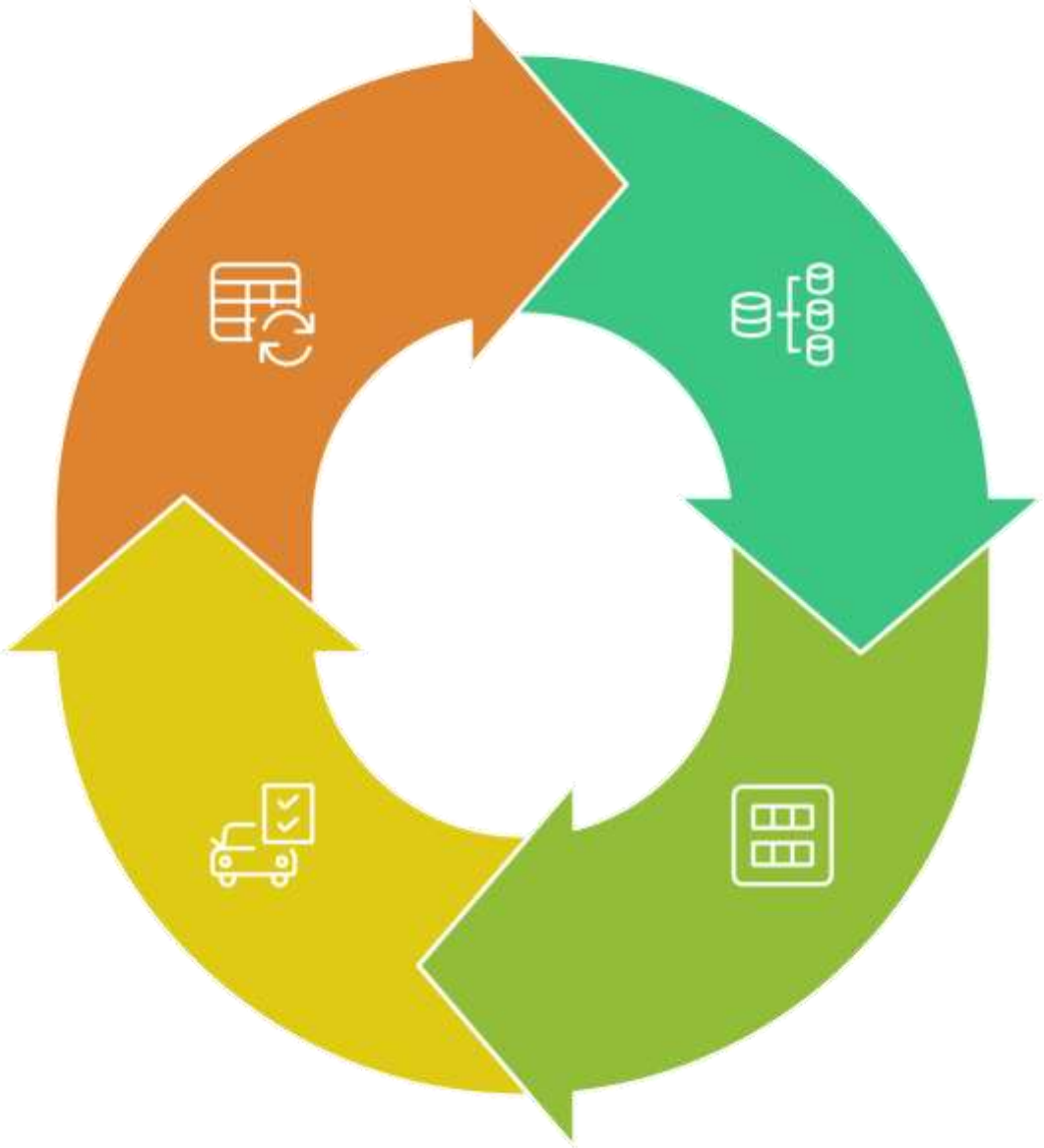
# Cross-Validation Cycle

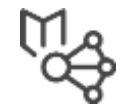
**Iterate Process**  
Repeat the process with different subsets

**Test Model**  
Evaluate the model on testing subsets

**Partition Data**  
Divide the dataset into subsets

**Train Model**  
Train the model on training subsets

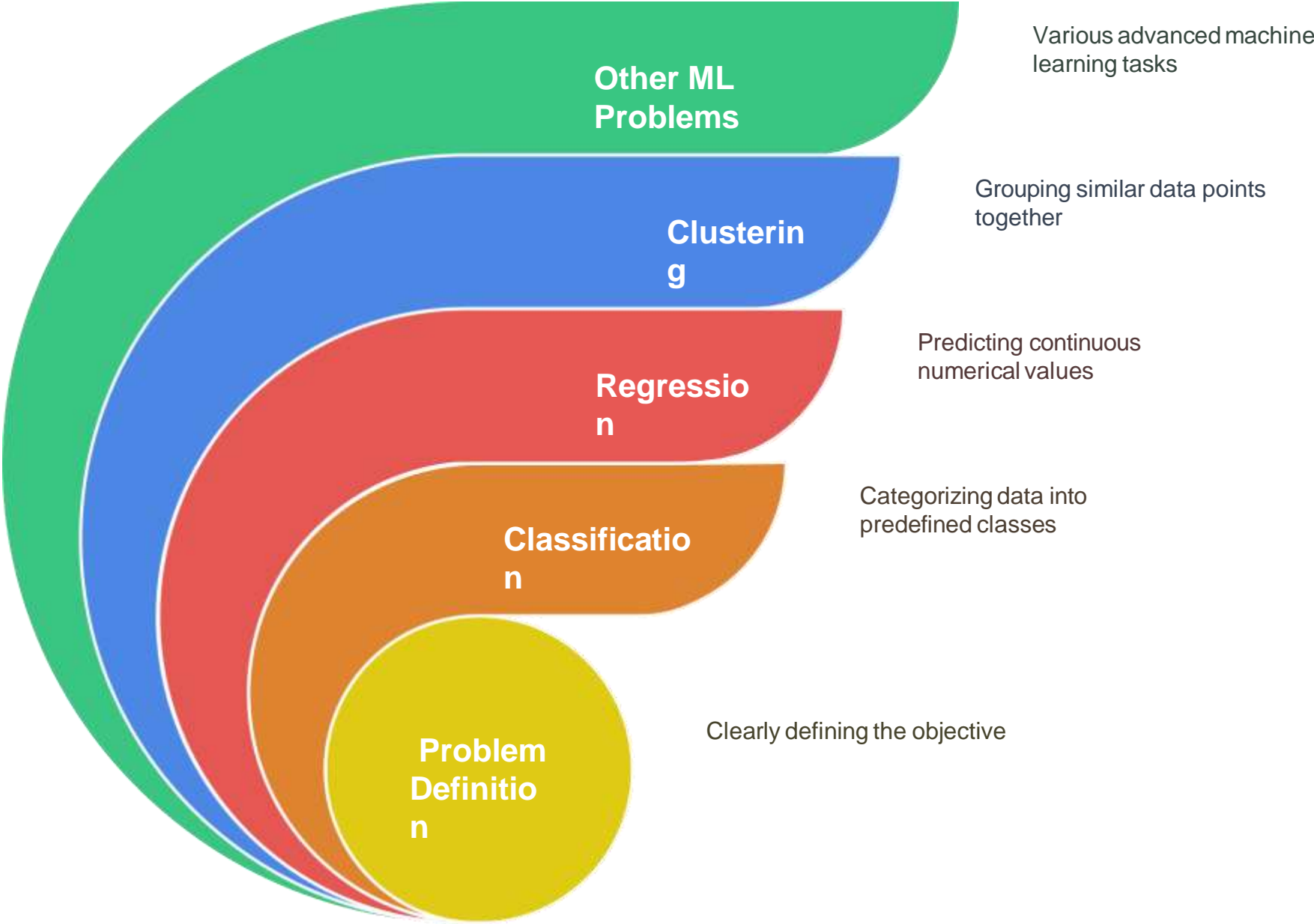




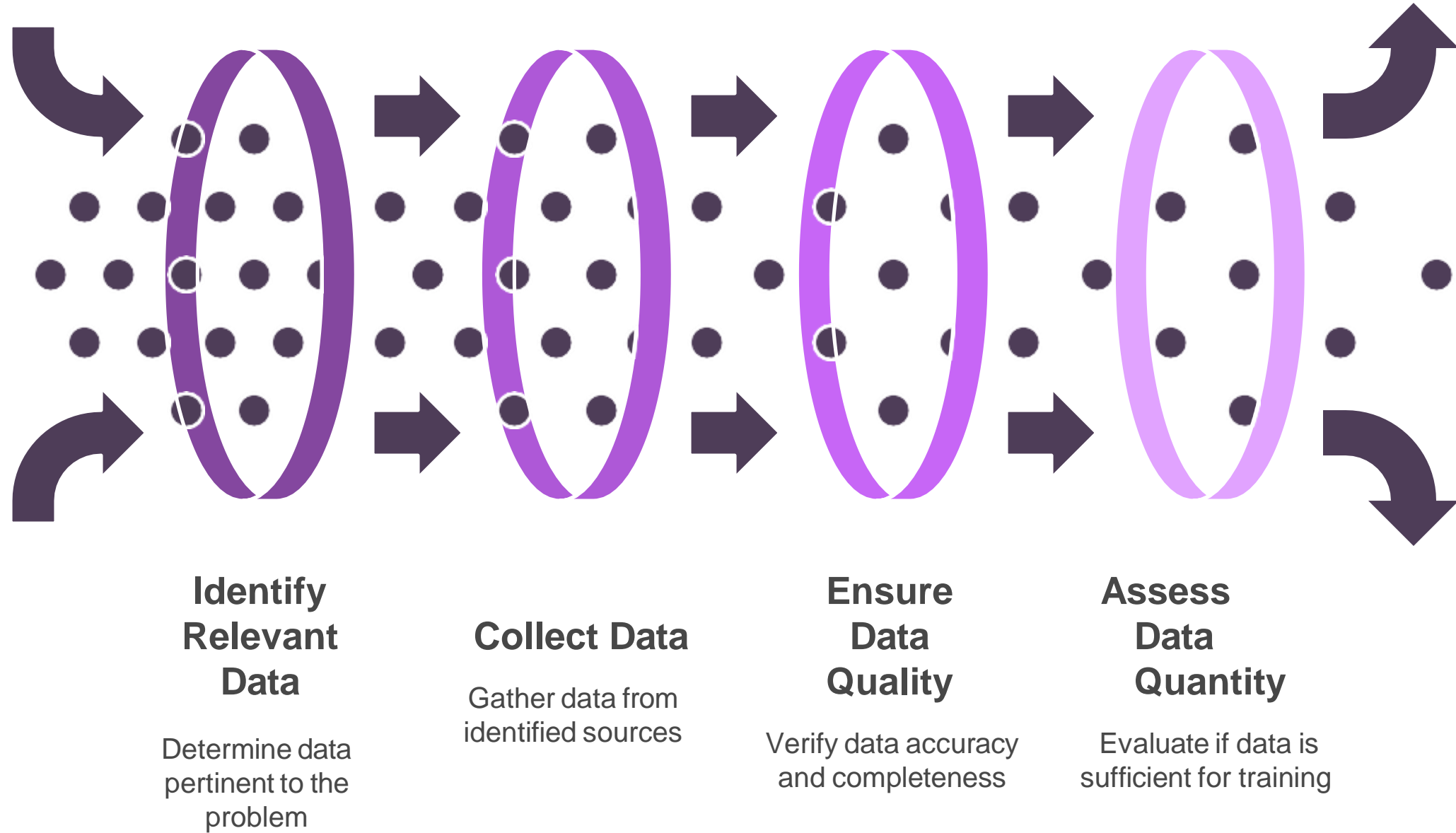
# Steps to Apply Machine Learning to Your Data

In this document, we will outline the essential steps to effectively apply machine learning techniques to your data. Whether you are a beginner or have some experience, this guide will help you navigate the process from data collection to model deployment. By following these steps, you can harness the power of machine learning to derive insights and make predictions from your data.

# Machine Learning Problem Definition

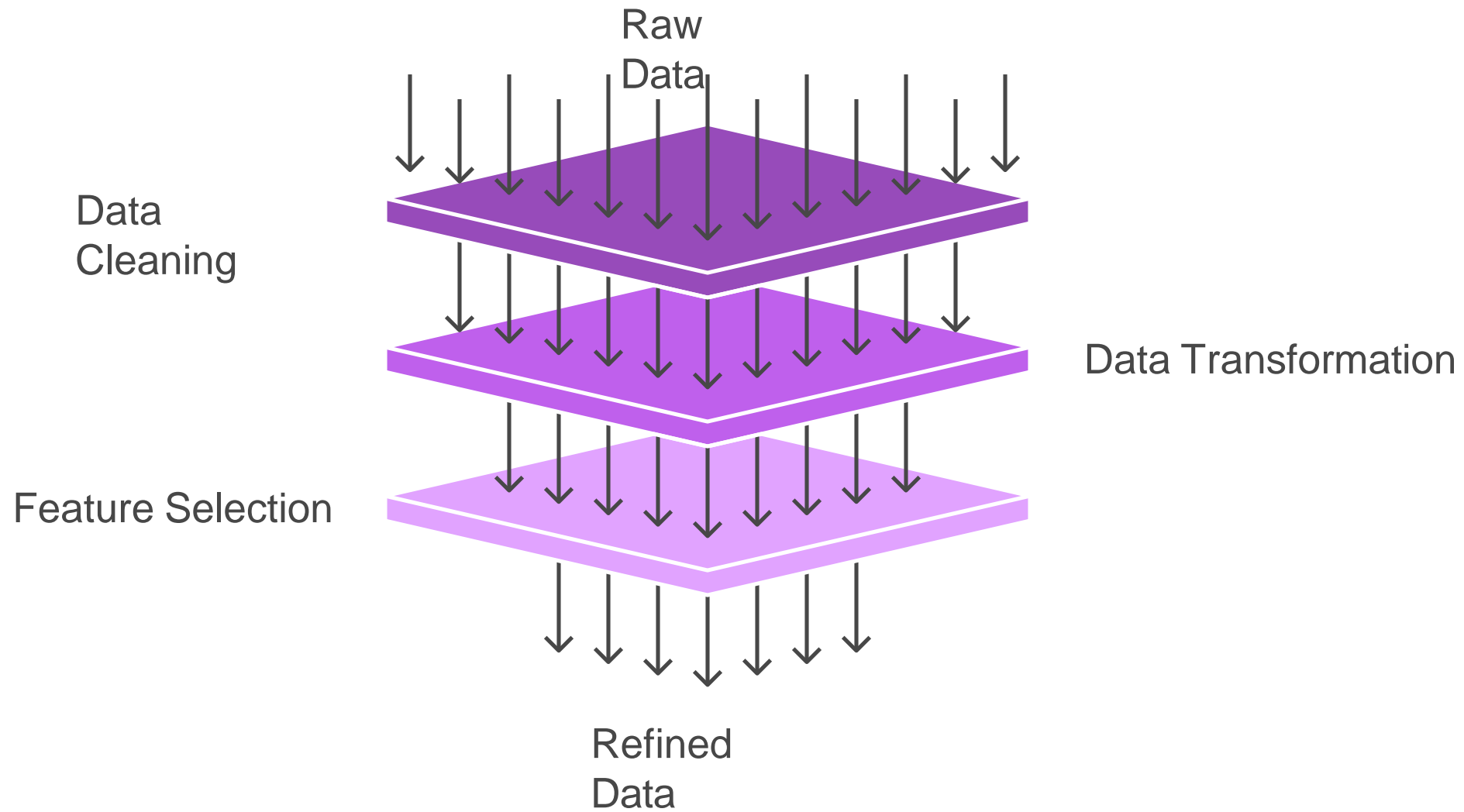


# Data Collection Process for Machine Learning

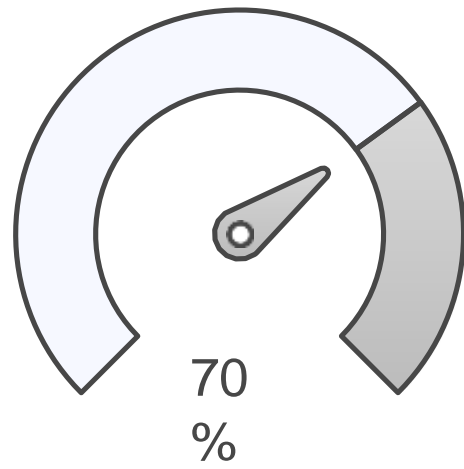




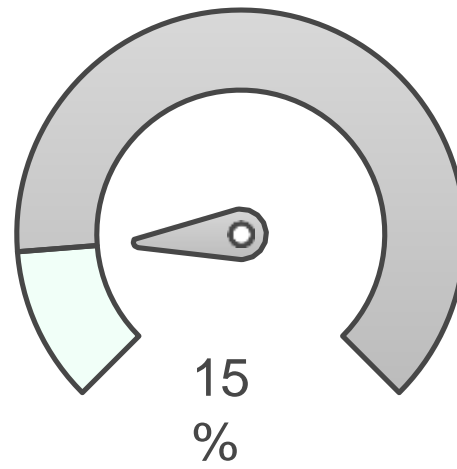
# Data Preprocessing Funnel



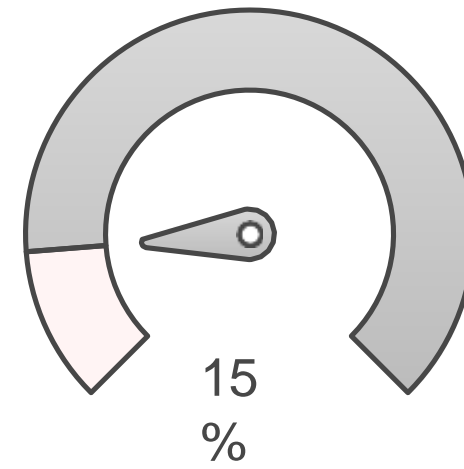
## Data Split for Machine Learning



Training Set

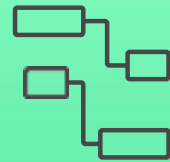


Validation Set



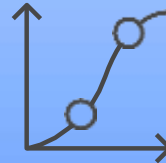
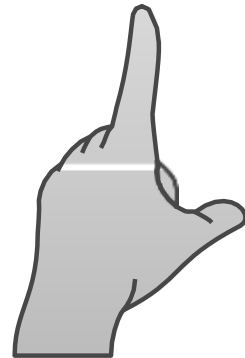
Test Set

# Which machine learning algorithm should be chosen?



## Classification

Suitable for categorizing data into distinct classes.



## Regression

Ideal for predicting continuous numerical values.

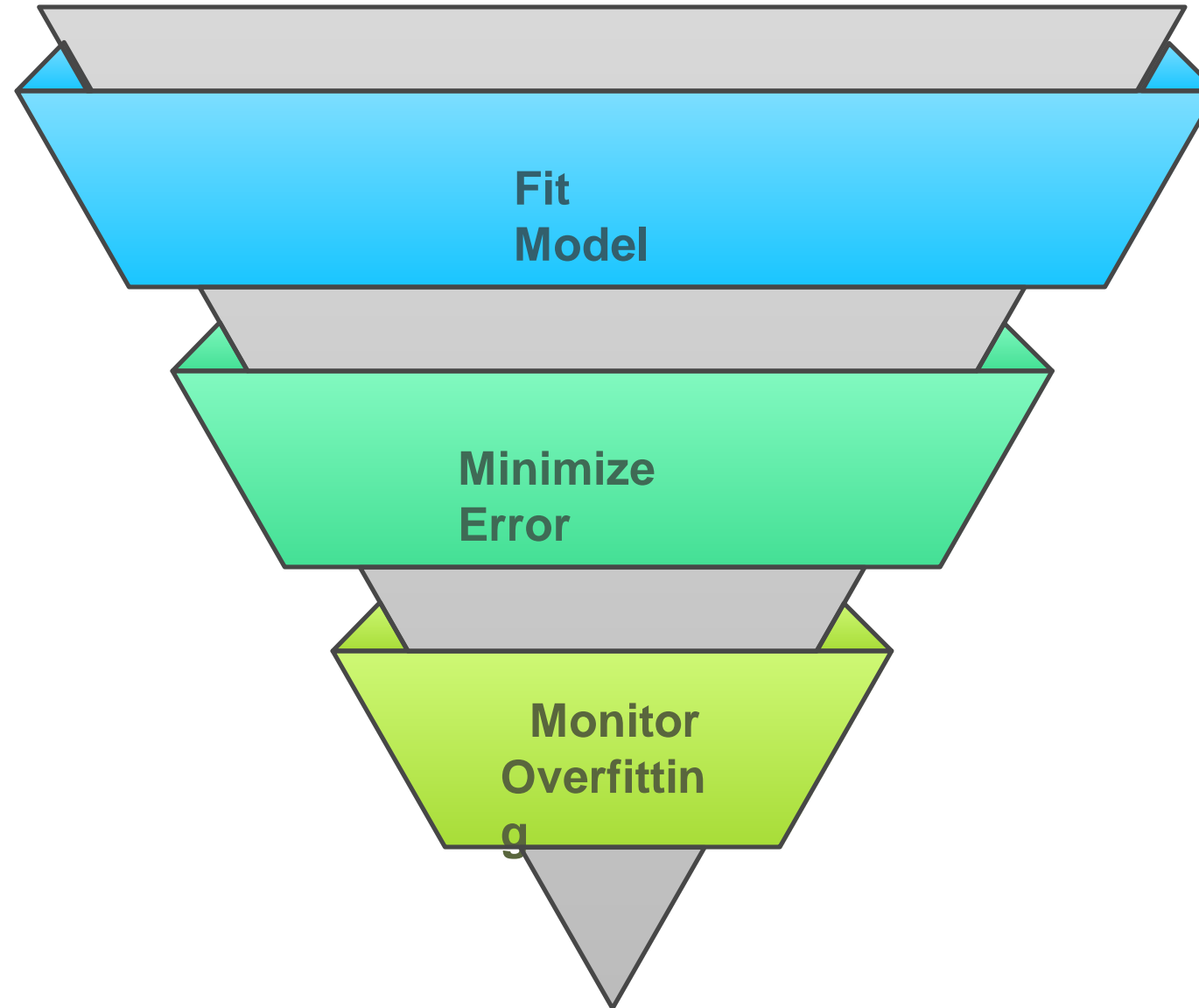


## Clustering

Best for grouping similar data points together.



# Model Training Process



# Model Performance Evaluation and Refinement

Model Evaluation

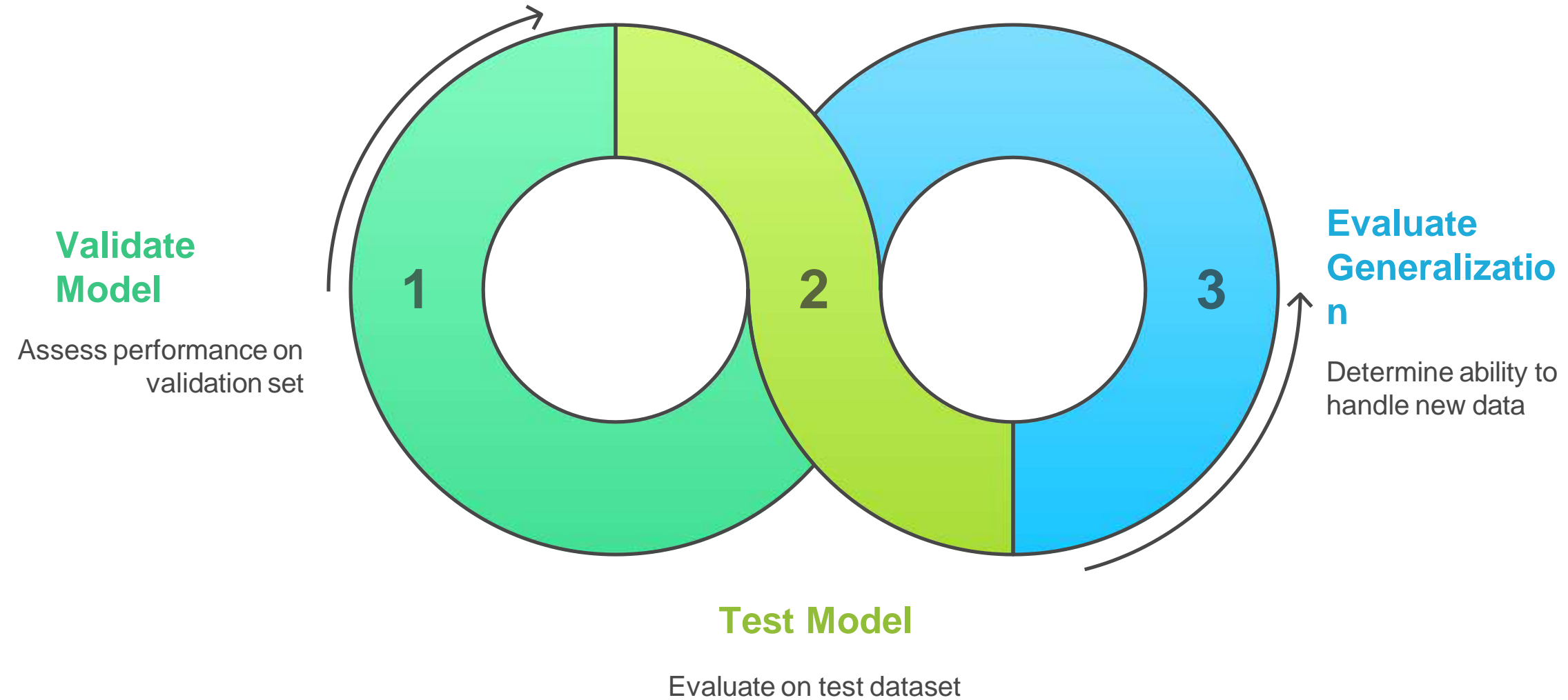
Metric Selection

Performance Measurement

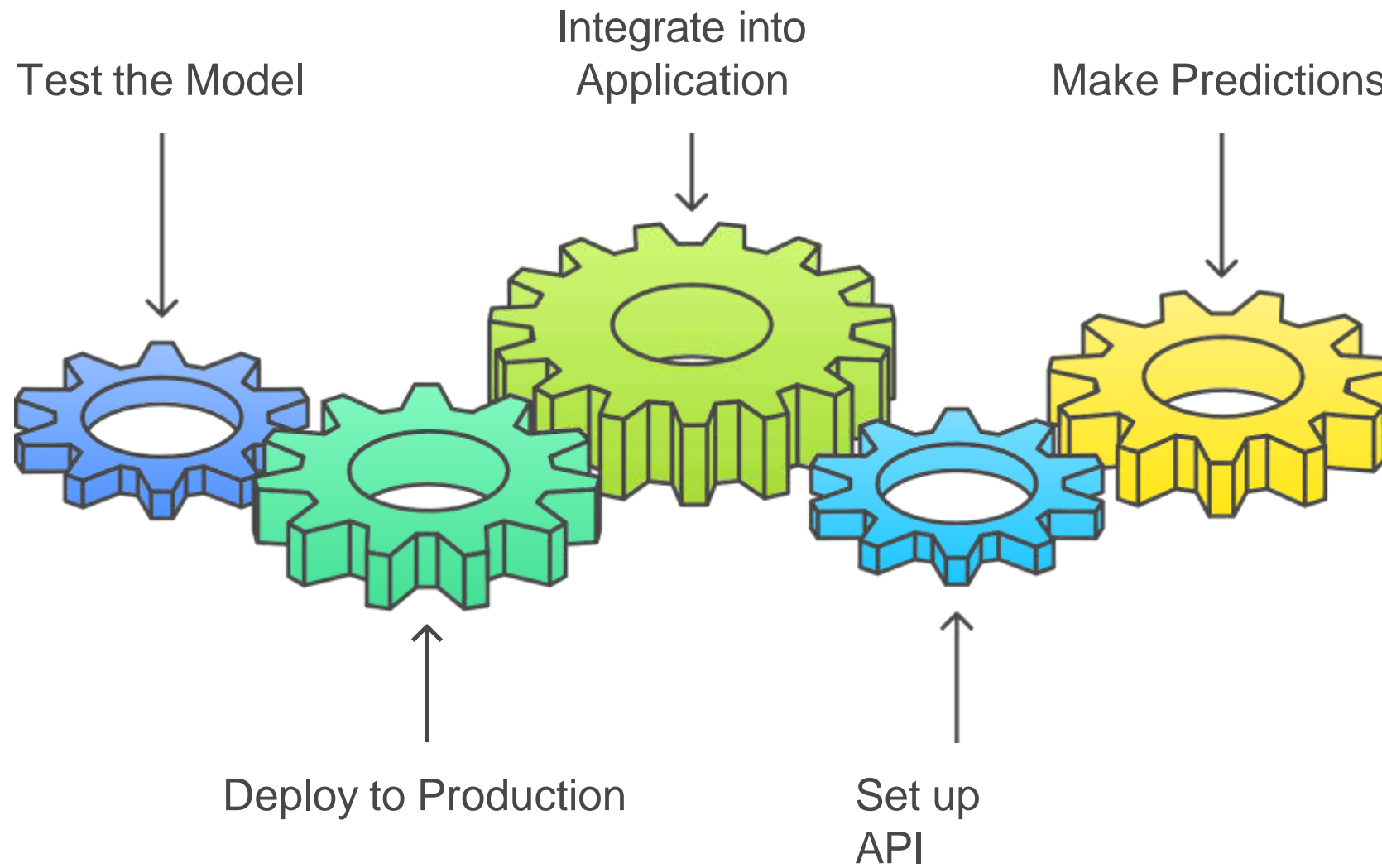
Hyperparameter Adjustment

Improved Model  
Performance

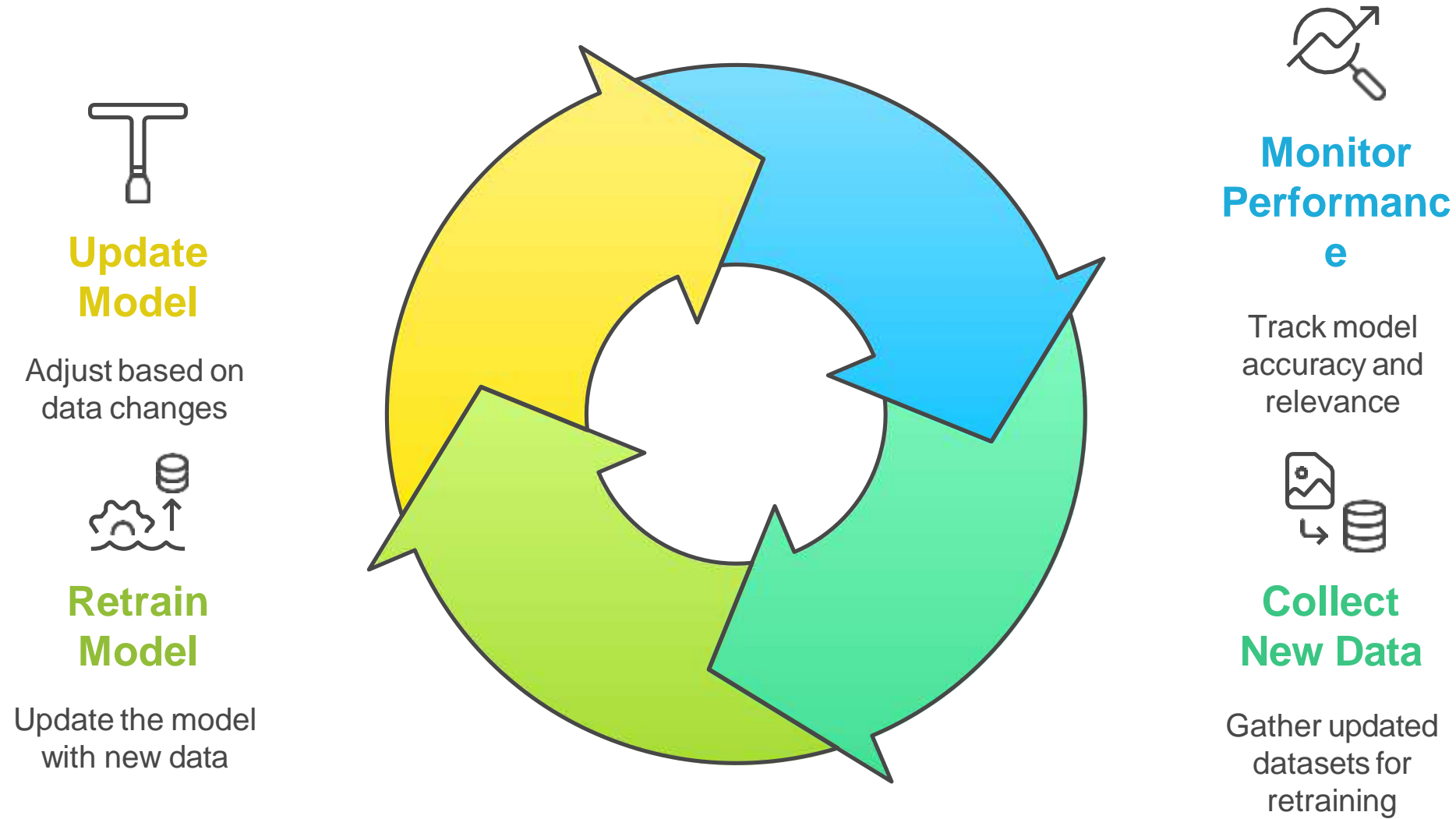
# Model Testing Cycle



# Model Deployment Process



# Model Monitoring and Maintenance Cycle








# Choosing a Machine Learning Algorithm

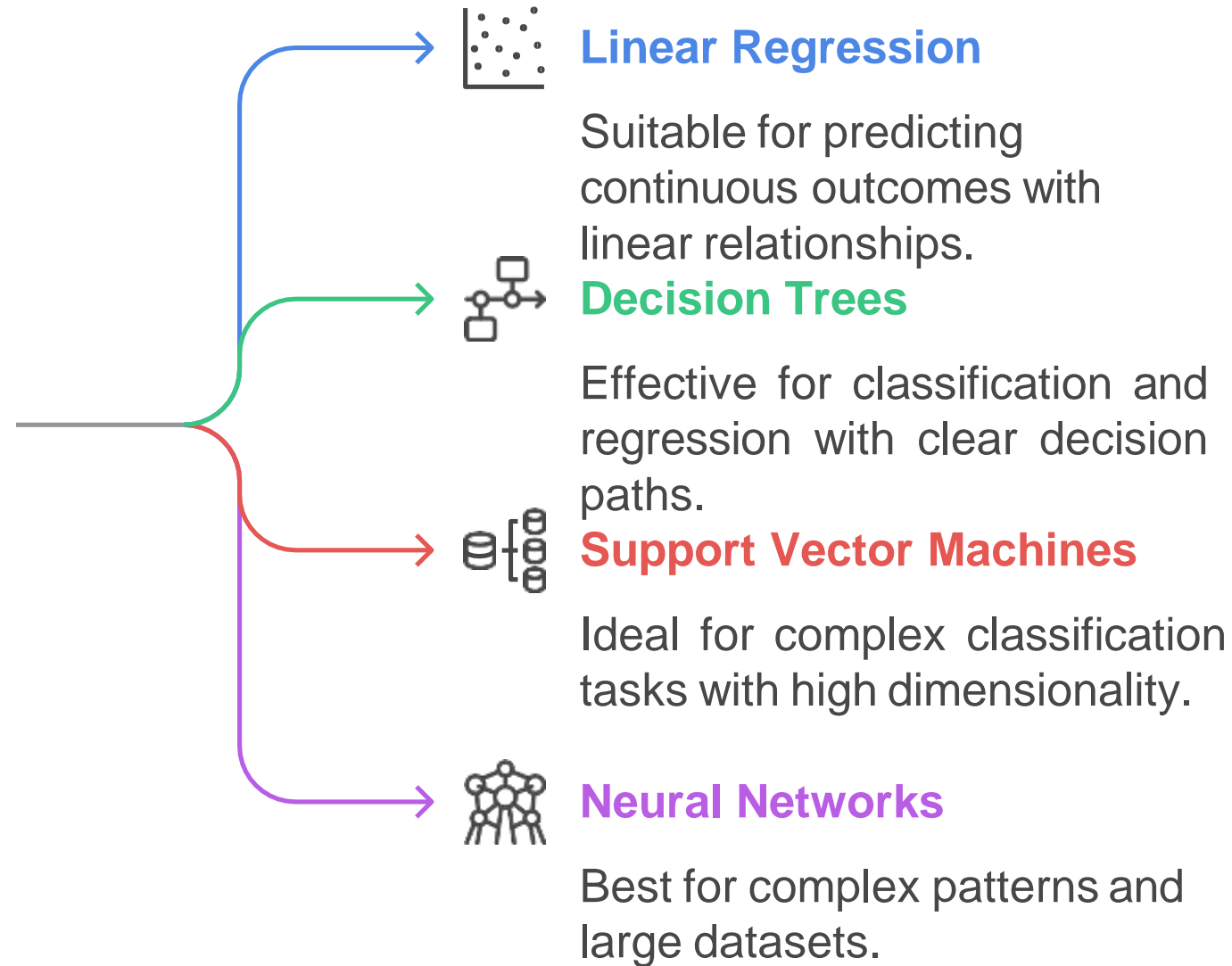
## Understanding the Problem Type

In the rapidly evolving field of machine learning, selecting the right algorithm is crucial for the success of any data-driven project. This document aims to provide guidance on how to choose an appropriate machine learning algorithm based on the nature of the data, the problem at hand, and the desired outcomes. By understanding the strengths and weaknesses of various algorithms, practitioners can make informed decisions that enhance model performance and efficiency.

The first step in choosing a machine learning algorithm is to clearly define the problem you are trying to solve. Machine learning problems can generally be categorized into three main types:

- Neural Networks

  
**Which  
supervised  
learning  
algorithm to  
choose?**



# Unsupervised Learning Techniques

- 1** Grouping data into distinct clusters based on similarity.

**K-Means Clustering**

- 2** Building a tree-like structure of data clusters.

**Hierarchical Clustering**

- 3** Reducing data dimensionality while preserving essential information.

**Principal Component Analysis**

**Pattern Discovery**



## Which reinforcement learning algorithm to use?



### **Q-Learning**

Suitable for simple environments with discrete action spaces.



### **Deep Q-Networks (DQN)**

Effective for complex environments with high-dimensional state spaces.

