Unsupervised Learning Metrics
Introduction to Unsupervised Learning

Learning Objective

By the end of this lesson, students will be able to:

- Define unsupervised learning and its key characteristics.
- Differentiate between supervised and unsupervised learning.
- Identify common techniques: clustering and dimensionality reduction.

Introduction to Unsupervised Learning

Learning Objective

By the end of this lesson, students will be able to:

- Define unsupervised learning and its key characteristics.

- Recognize practical applications of unsupervised learning.

What is Unsupervised Learning?

Unsupervised learning finds **hidden patterns or structures** in unlabeled data. Unlike supervised learning, it doesn't rely on labeled datasets but instead explores the inherent structure of the data.

Supervised vs. Unsupervised Learning

Feature	Supervised Learning	Unsupervised Learning
Data	Labeled	Unlabeled
Objective	Prediction & classification	Discovery & exploration
Common Uses	Spam detection, price prediction	Customer segmentation, anomaly detection
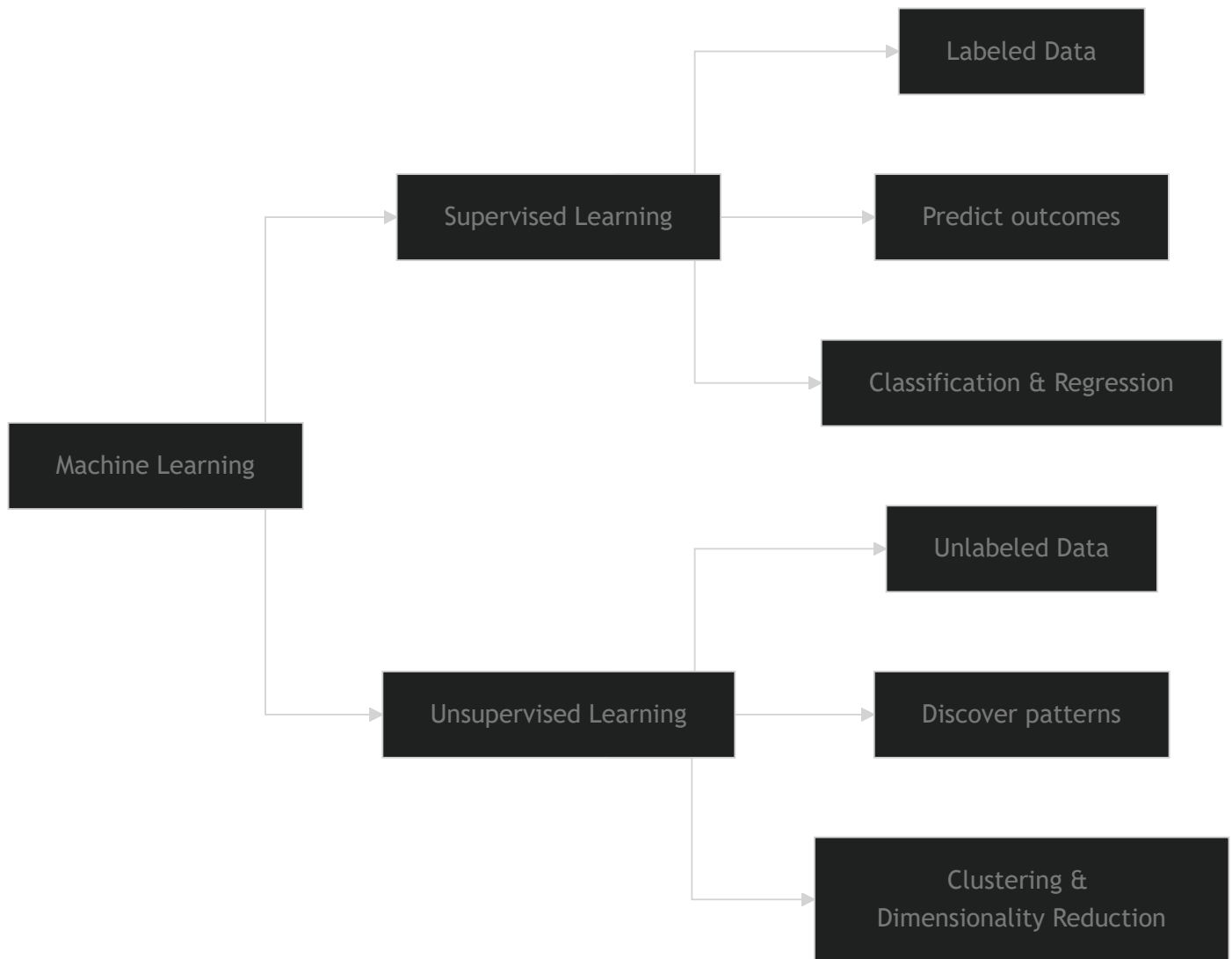
Common Techniques

Clustering

Clustering groups similar data points together to **reveal inherent structures**.

- **Example:** Grouping customers based on shopping habits.
- **Common Algorithms:** K-Means, DBSCAN, Hierarchical Clustering

Dimensionality Reduction

Reduces dataset complexity while **preserving meaningful relationships**.

- **Example:** Visualizing high-dimensional data in 2D or 3D space.
- **Common Algorithms:** PCA, t-SNE, Autoencoders.

Let's try it out! Basic Clustering with K-Means

Let's practically understand clustering by segmenting customers based on purchasing habits.

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```python
import numpy as np
import matplotlib.pyplot as plt
from sklearn.cluster import KMeans

# Generate synthetic customer data
np.random.seed(42)
customer_data = np.random.rand(100, 2) * [100, 500]  # Simulate spending & freque

# Apply K-Means Clustering
kmeans = KMeans(n_clusters=3)
kmeans.fit(customer_data)
labels = kmeans.labels_

# Visualize the clusters
plt.figure(figsize=(8,6))
plt.scatter(customer_data[:,0], customer_data[:,1], c=labels, cmap='viridis')
plt.title('Customer Segmentation using K-Means')
plt.xlabel('Purchase Frequency')
plt.ylabel('Average Spend')
plt.show()
```

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Discuss! Imagine you are working with a marketing agency. How might a marketer use this segmentation data in practice?

Think About Your Role...

Think about clients you have worked with in the past, or are currently working with.

Can you think of any examples where unsupervised learning would provide valuable insights?

Key Takeaways:

- Unsupervised learning discovers hidden patterns in unlabeled data.

- Clustering and dimensionality reduction are primary unsupervised learning methods.

- K-Means is a powerful technique for customer segmentation.

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