100 DAYS OF LEARN AI

CLUSTERING ALGORITHMS: UNVEILING PATTERNS AND STRUCTURES IN DATA

15 DAY

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Clustering Algorithms

🔍Disclaimer

Everyone learns differently.

What matters is developing problem-solving skills for new challenges.

This post is here to help you along the way.

In AI, there's always something new to learn. It's a continuous journey, with new topics emerging every day. We must embrace this and learn something new each day to keep up with AI's ever-changing landscape.

📝 **I'm still learning, and your feedback is invaluable. If you notice any mistakes or have suggestions for improvement, please share. Let's grow together in the world of AI !**

🌐 **Share your thoughts to improve my journey in AI.**

VASIM SHAIKH

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Welcome Back!

- Welcome to Day 15 of our 100 Days of Machine Learning series!
- Today, we embark on an exciting journey into the world of clustering algorithms, powerful tools that help us uncover hidden patterns and structures within complex datasets.
- Join us as we explore the fundamentals of clustering, its benefits, and practical applications.

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What You'll Learn Today

By the end of today's lesson, you will:

- Gain a comprehensive understanding of clustering algorithms and their types.
- Learn how to apply clustering techniques to real-world datasets.
- Master the key concepts of similarity measures and distance metrics.
- Explore various clustering algorithms, including hierarchical, k-means, and DBSCAN.

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Step 1 - Clustering Overview

Definition:

Clustering algorithms group similar data points into clusters, revealing underlying patterns and structures.

Types of Clustering:

- **Hierarchical Clustering:**
  Creates a tree-like structure of clusters.

- **Partitional Clustering:**
  Divides data into a fixed number of clusters.

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Step 1 - Example

- Let's consider a **dataset of customer purchases.**
- **Hierarchical clustering** can group customers based on their purchase patterns, **identifying segments** like frequent shoppers or **high-value customers.**

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Step 2 - Similarity Measures

Euclidean Distance:
Measures the distance between two data points in **multidimensional space**.

Cosine Similarity:
Calculates the **angle between** two vectors, indicating **their similarity.**

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Step 2 - Example

In text analysis, **cosine similarity** can be used to **cluster documents** based on their content, **identifying similar themes and topics.**

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Step 3 - Distance Metrics

Minkowski Distance:
Generalizes Euclidean distance to arbitrary dimensions.

Mahalanobis Distance:
Considers the covariance of data points, adjusting for correlations.

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Step 3 - Example

In image processing, Mahalanobis distance can be used to cluster pixels based on their color and texture, identifying objects and regions of interest.

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Step 4 - Clustering Algorithms

Hierarchical Clustering:
Builds a hierarchical tree of clusters.

K-Means Clustering:
Partitions data into k clusters based on centroids.

DBSCAN Clustering:
Identifies clusters of arbitrary shape based on density.

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Step 4 - Example

In market segmentation, **k-means clustering** can be used to group **customers** into distinct segments based on their **demographics** and behavior.

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Real-World Example: Customer Segmentation

Applying **k-means** clustering to customer data based on **features** like purchase **history** and demographics.

Example:
Identifying target **segments** for **personalized marketing** campaigns.

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Conclusion

Congratulations on mastering clustering algorithms!

By **understanding** their key concepts and **implementation steps**, you're equipped to uncover patterns in data, **identify hidden structures**, and make data-driven decisions.

Stay tuned for more exciting topics in our series.