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Q1. What is hierarchical clustering, and how is it different from other clustering tec
ans-
Hierarchical clustering is a clustering technique that builds a hierarchy of clusters

Hierarchical clustering is different from other clustering techniques, such as K-means

Hierarchy: Hierarchical clustering creates a hierarchy of clusters, while other cluste

Number of clusters: Hierarchical clustering does not require the user to specify the r

Cluster shape: Hierarchical clustering can handle clusters of any shape, while some ot

Distance metrics: Hierarchical clustering can use different distance metrics to measur

Computational complexity: Hierarchical clustering can be more computationally intensiv

Overall, hierarchical clustering is a flexible and powerful clustering technique that
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In [ ]:
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Q2. What are the two main types of hierarchical clustering algorithms? Describe each i
ans-

The two main types of hierarchical clustering algorithms are agglomerative clustering

Agglomerative clustering:
Agglomerative clustering, also known as bottom-up clustering, starts with each data po

Divisive clustering:
Divisive clustering, also known as top-down clustering, starts with a single cluster c

Both agglomerative and divisive clustering can be used for various real-world applicat
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In [ ]:
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Q3. How do you determine the distance between two clusters in hierarchical clustering,
common distance metrics used?
ans-
In hierarchical clustering, the distance between two clusters is determined by a dista

Euclidean distance: This is the most commonly used distance metric, and it measures th

Manhattan distance: This metric measures the distance between two points in a city-blo

Cosine similarity: This metric measures the cosine of the angle between two vectors. I

Pearson correlation: This metric measures the correlation between two variables, and i

Jaccard similarity: This metric measures the similarity between two sets of data point

Once the distance metric is chosen, the distance between two clusters can be determine

Overall, the choice of distance metric and linkage method can affect the quality and i
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In [ ]:
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Q4. How do you determine the optimal number of clusters in hierarchical clustering, ar
common methods used for this purpose?
ans-
Determining the optimal number of clusters in hierarchical clustering is an important
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Dendrogram visualization: The dendrogram shows the hierarchy of the merged clusters, a

Elbow method: The elbow method involves plotting a measure of the dissimilarity betwee

Silhouette method: The silhouette method measures how well each data point fits into i

Gap statistic: The gap statistic compares the total dissimilarity for different number

Overall, the choice of the optimal number of clusters will depend on the specific data
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In [ ]:
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Q5. What are dendrograms in hierarchical clustering, and how are they useful in analyz
ans-
Dendrograms are a graphical representation of the hierarchy of clusters produced by hi

Dendrograms are useful in analyzing the results of hierarchical clustering in several

Cluster identification: Dendrograms help identify the clusters by showing the hierarch

Cluster similarity: Dendrograms help visualize the similarity between the clusters by

Outlier detection: Dendrograms can help identify outliers or data points that do not b

Interpretation: Dendrograms help interpret the results of hierarchical clustering by s

Overall, dendrograms are a useful tool for visualizing and interpreting the results of
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In [ ]:
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Q6. Can hierarchical clustering be used for both numerical and categorical data? If ye
distance metrics different for each type of data?
ans-
Yes, hierarchical clustering can be used for both numerical and categorical data, but

For numerical data, common distance metrics used in hierarchical clustering include Eu

For categorical data, distance metrics such as Jaccard distance, Dice distance, and Ha

It is important to choose the appropriate distance metric based on the type of data ar
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Q7. How can you use hierarchical clustering to identify outliers or anomalies in your
ans-
Hierarchical clustering can be used to identify outliers or anomalies in your data by

To use hierarchical clustering to identify outliers, follow these steps:

Perform hierarchical clustering on your data using an appropriate distance metric and

Visualize the resulting dendrogram.

Look for singleton clusters or clusters with very few data points.

Examine the data points in these clusters to see if they are outliers or anomalies.

Remove the outliers from the dataset or treat them separately, depending on the analys

Alternatively, you can use a distance-based outlier detection method, such as the Loca

Overall, hierarchical clustering can be a useful tool for identifying outliers or anom
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