DBSCAN Clustering

MACHINE LEARNING CLUSTERING

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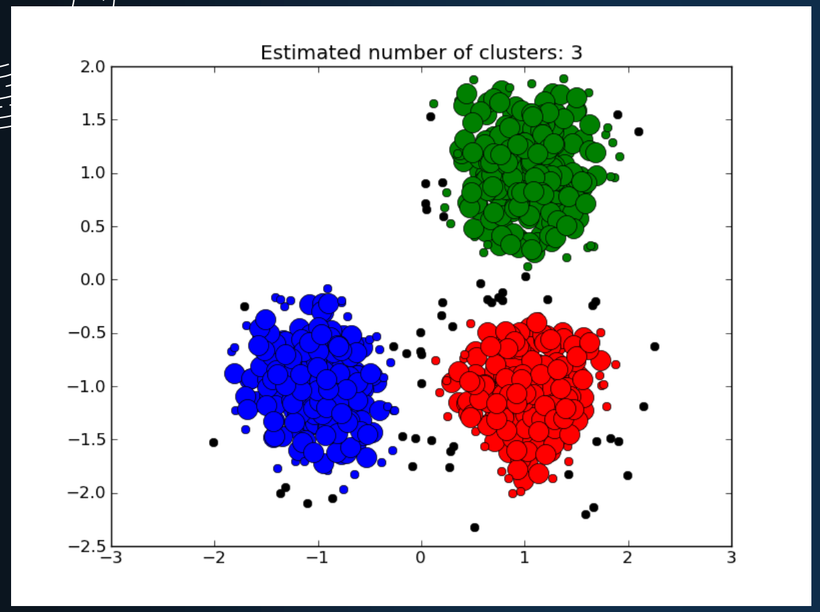
Introduction to DBSCAN Clustering

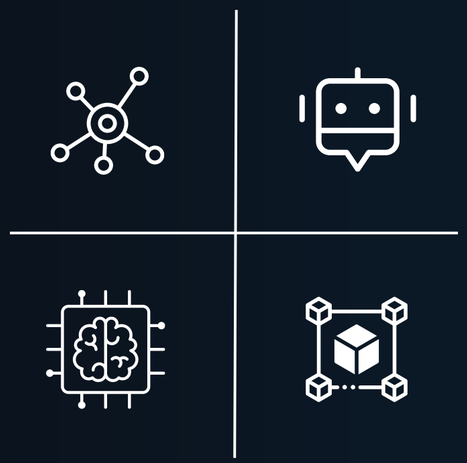
Density-Based Spatial Clustering of Applications with Noise (DBSCAN) is a clustering algorithm that identifies clusters based on the density of data points in the feature space. Clusters are formed by grouping together points that are closely packed, with outliers being identified as noise.

Key Concepts:

- **Epsilon (ε):** Maximum radius of the neighborhood around a point.
- **MinPts:** Minimum number of points required to form a dense region.
- **Core Point:** A point with at least MinPts within ε-neighborhood.
- **Border Point:** A point within the ε-neighborhood of a core point but with fewer than MinPts in its own neighborhood.
- **Noise Point:** A point that is not a core or border point.



Mechanics of DBSCAN Clustering



1. **Identify Core Points:**
   - For each point, count the number of points within its ε-neighborhood.
   - If the count is greater than or equal to MinPts, mark the point as a core point.
2. **Form Clusters:**
   - For each core point, form a cluster by including all points (core and border) within its ε-neighborhood.
   - Expand the cluster by recursively including points within the ε-neighborhoods of core points.
3. **Mark Noise Points:**
   - Points that are neither core points nor within the ε-neighborhood of any core points are marked as noise.

Application and Evaluation

Application:

- Suitable for spatial data, image analysis, and anomaly detection.
- Steps:
  - ✓ Determine appropriate values for ε and MinPts.
  - ✓ Run DBSCAN to identify core points and form clusters.
  - ✓ Analyze clusters and noise points for insights.

Advantages:

- Does not require the number of clusters to be specified.
- Can find arbitrarily shaped clusters.
- Robust to noise and outliers.

Disadvantages:

- Sensitive to the choice of ε and MinPts.
- Can struggle with varying densities.
- Computationally intensive for large datasets due to neighborhood searches.

Thank You