



# Spatial Machine Learning Explained: Density-Based Clustering and Outlier Detection

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# Density-based Clustering

→ finds clusters based on feature locations

# Spatial Outlier Detection

→ finds outliers based on feature locations

# Density-based Clustering

→ finds clusters based on feature **locations**

## DBSCAN

- Uses fixed search distance
- Clusters of similar densities
- Fast

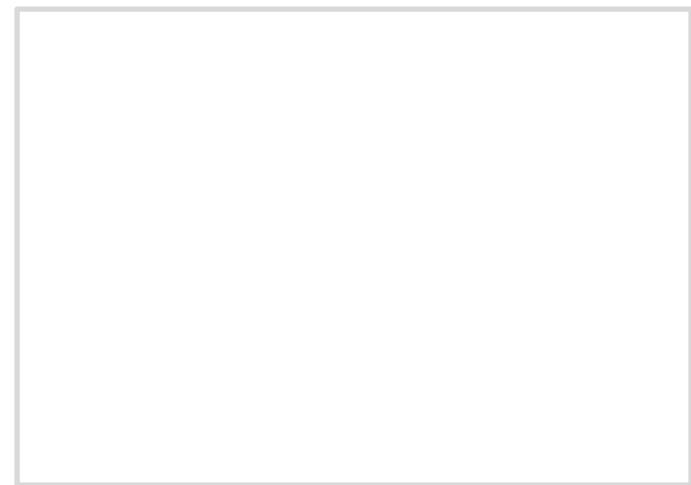
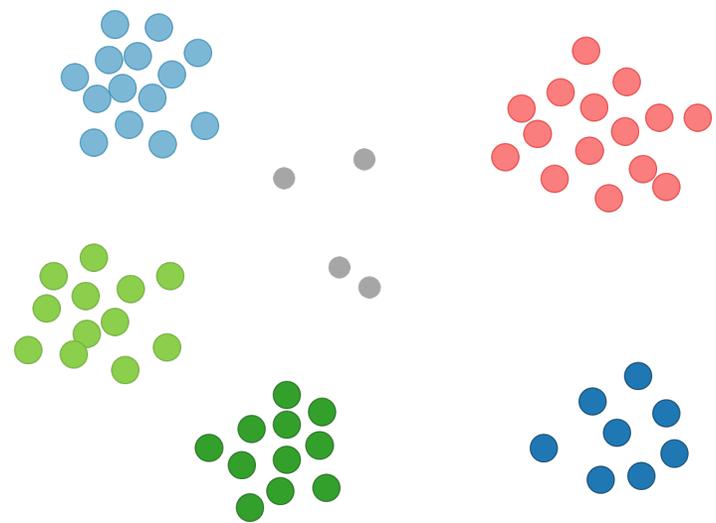
## HDBSCAN

- Uses range of search distances to find clusters of varying densities
- Data driven, requires least user input

## OPTICS

- Uses neighbor distances to create reachability plot
- Most flexibility for fine tuning
- Can be computationally intensive

demo

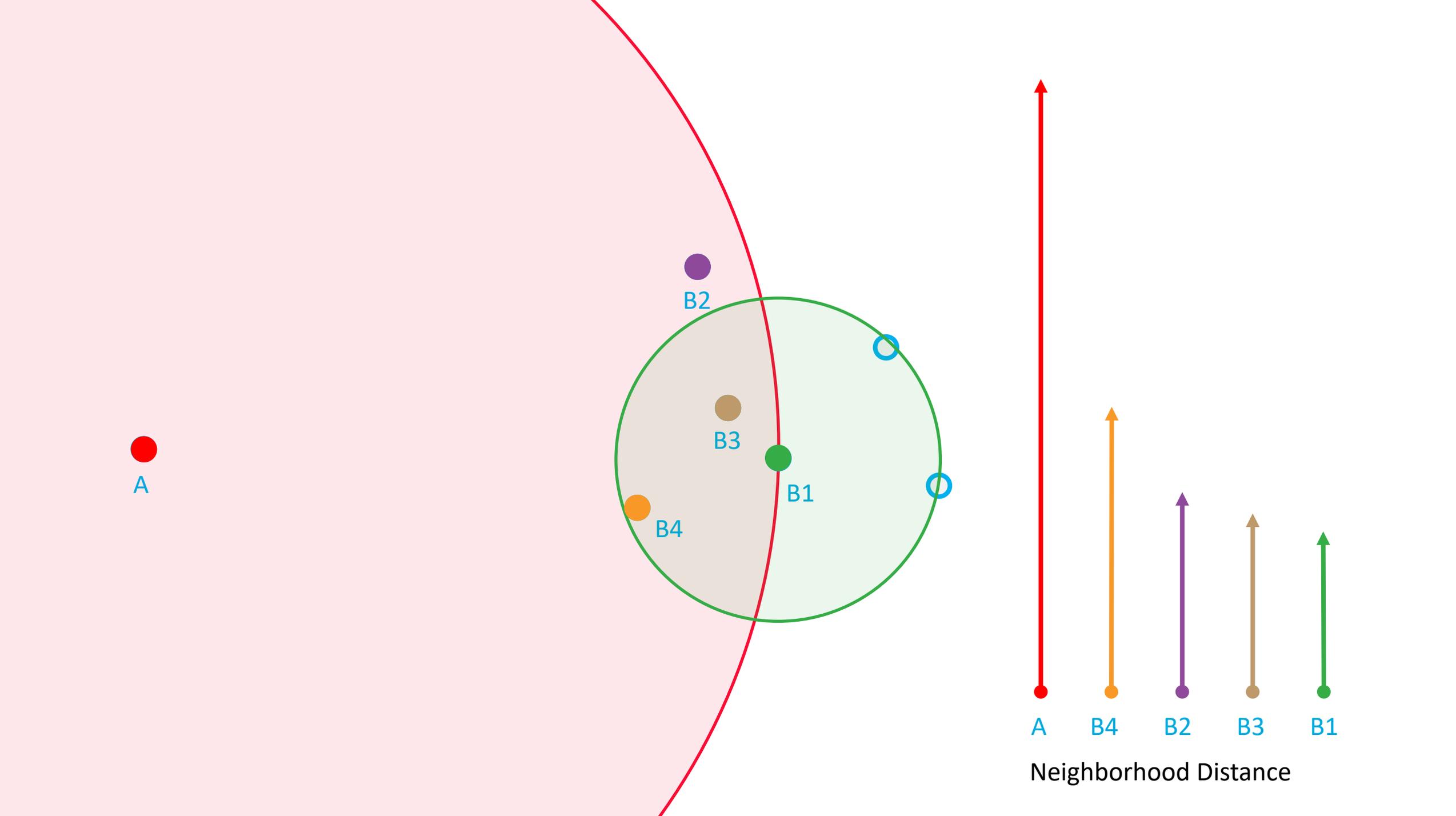


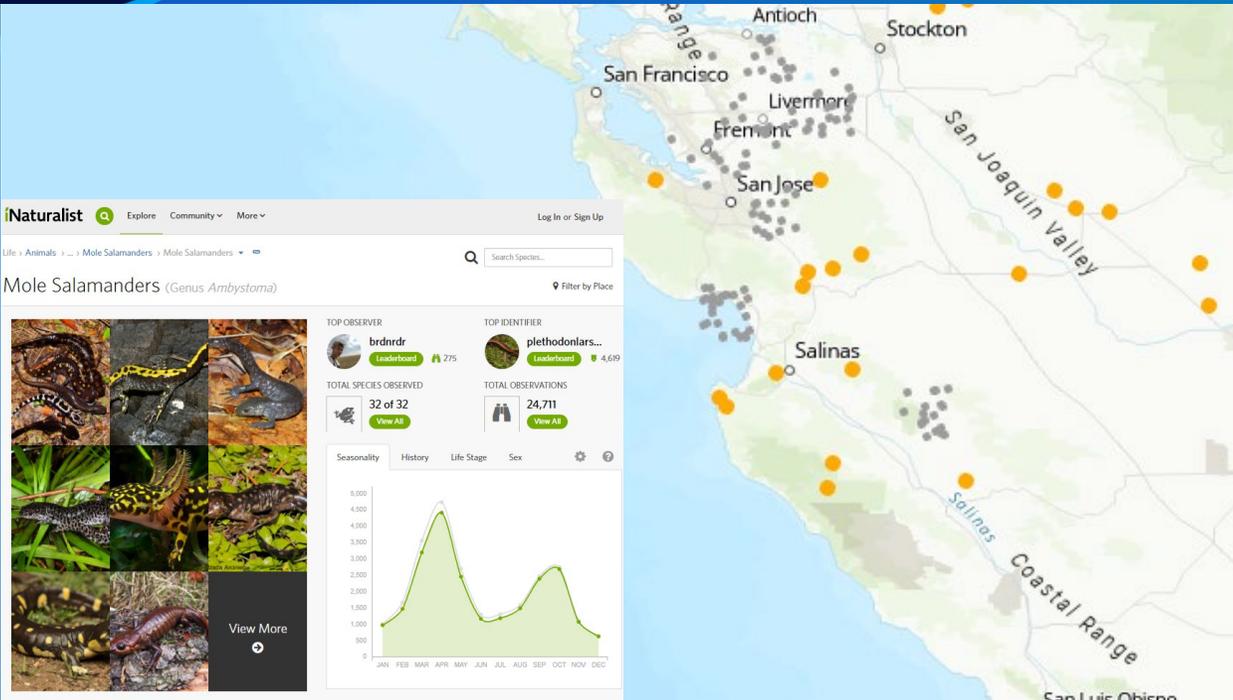
# Spatial Outlier Detection

The background features a complex abstract design. On the left side, there are several overlapping elements: a blue map-like shape with a yellow dot, a red curved line, and a yellow curved line. Below these, there's a blue shape with a grid pattern. At the bottom, there are more abstract shapes in blue, red, and yellow, including a hexagonal pattern and a globe-like shape. The overall aesthetic is modern and data-oriented.

# Spatial Outlier Detection

- Identify spatially anomalous points
- Focus on “which are outliers” rather than “how many clusters”
- Exclude outliers for robust analysis





# California Tiger Salamander Conservation

<https://www.inaturalist.org/taxa/26778-Ambystoma-californiense>