GEOG 432/832: Programming, Scripting, and Automation for GIS

Unit 13.01: Clustering

Dr. Bitterman

Today's schedule

- Open discussion
- Slides, discussion, and exercises
- For next class

Open discussion

Today's prep

Download *unit13_inclass.ipynb* and *unit13data.zip* from GitHub repository

Today's prep:

```
%matplotlib inline

import seaborn as sns
import pandas as pd
import geopandas as gpd
import numpy as np
import matplotlib.pyplot as plt
# new ones below
from sklearn import cluster # note the difference
import contextily as cx
```

Verify all packages are in your environment

...and that you're in the correct environment

...can you find them all???

Alternative sources

Not all packages are in the default channel (like *contextily*, depending on your version of Anaconda)

Let's add one

1. While selecting the correct environment, click on "Channels", then "Add..."
2. in the new box, type the URL of conda-forge: `https://conda.anaconda.org/conda-forge/`
3. Press "Enter" to add
4. Update index (or now, indices)
5. Add *contexily* to your environment

Today we'll be tackling clustering

What's a cluster???

Background

Real world is complex

- non-linear
- uncertain
- multivariate (as opposed to univariate...)

Tackling mutivariate data

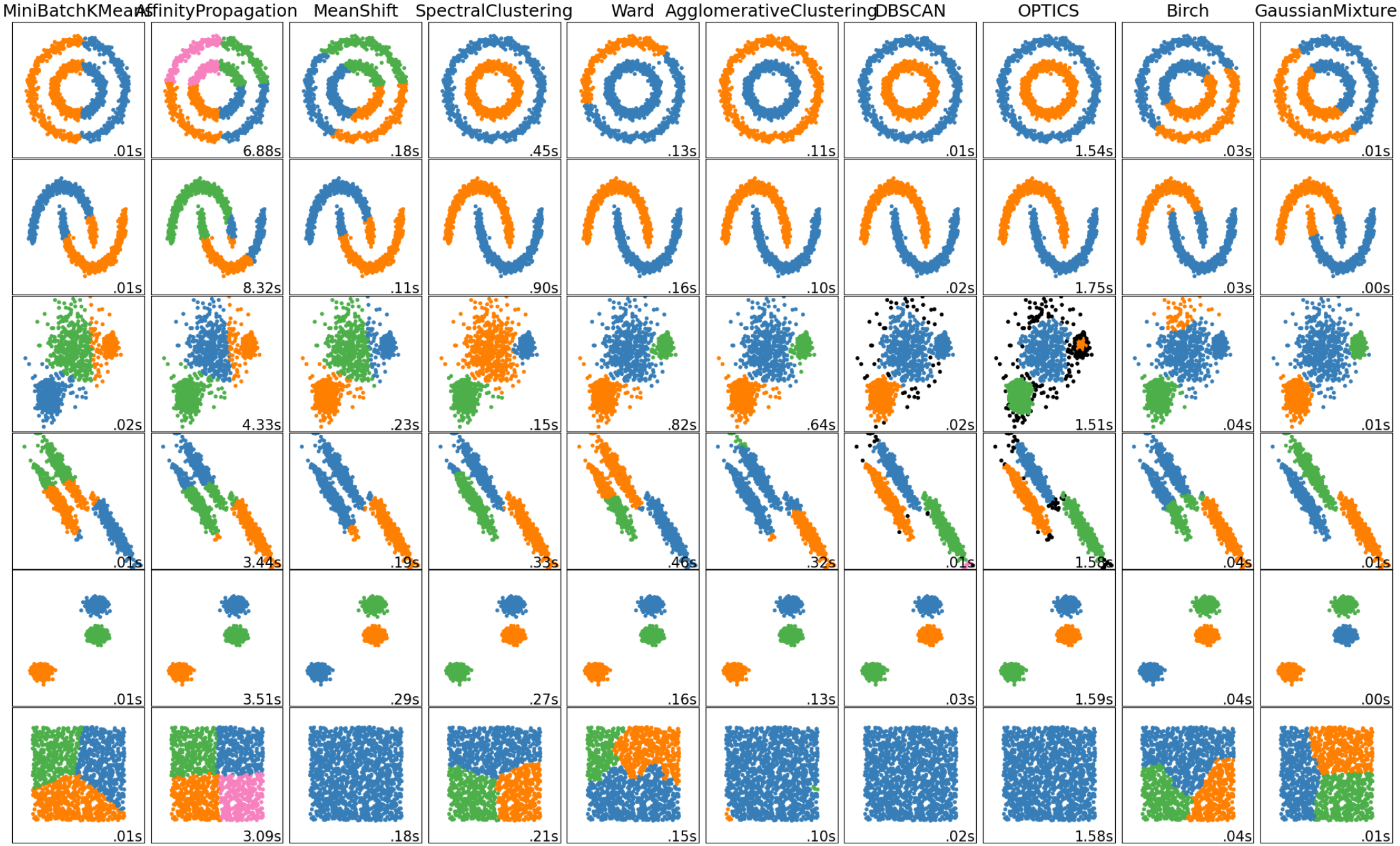
- Can be difficult to "look at" more than a few variables simultaneously
- Often necessary to *reduce dimensionality*
- Many techniques don't require preliminary assumptions about data structure
- Also useful as an exploratory tool

Statistical clustering

- **Basic idea:** summarize the multivariate data by creating a (relatively) small number of classes
- Each observation is assigned to one (and only one) class, depending on its position in multidimensional space
- MANY, MANY, MANY techniques to statistically group observations
- Common thread: define classes or categories of observations that are similar within each of them, but differ between groups

But implmentation details differ

- How "similarity" and "dissimilarity" are defined differs among algorithms
- Applications and utility depend on problem set


MiniBatchKMeans
AffinityPropagation
MeanShift
SpectralClustering
Ward
AgglomerativeClustering
DBSCAN
OPTICS
Birch
GaussianMixture
.01s
6.88s
.18s
.45s
.13s
.11s
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K-means

- A (very) common statistical clustering technique
- anyone familiar???

Whiteboard demo

(also: https://stanford.edu/class/engr108/visualizations/kmeans/kmeans.html)

What are the big assumptions?

(and/or required parameters)

Interactive session (Jupyter notebook)

For next class

- Lab 7 due Thursday
- Lab 8 starts Friday
- Readings are linked/posted on Canvas...