Statistics and Data Analysis

Unit 05 – Lecture 07: Case Study: PCA + Clustering

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https://github.com/tali7c/Statistics-and-Data-Analysis

Quick Links

Overview Pipeline Interpretation Exercises Demo Summary

Agenda

Learning Outcomes

- Run PCA before clustering for visualization/stability

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- Explain why scaling matters for clustering

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- Run PCA before clustering for visualization/stability
- Explain why scaling matters for clustering
- Use KMeans and interpret clusters cautiously
- Visualize clusters in PCA space

Pipeline: Key Points

- Scale features

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- Run PCA (2D for visualization)

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- Scale features
- Run PCA (2D for visualization)
- Cluster (KMeans) and visualize

Interpretation: Key Points

- Clusters are patterns, not truth

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- Check stability across seeds/k

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- Clusters are patterns, not truth
- Check stability across seeds/k
- Explain clusters using original variables

Exercise 1: Scaling

Why scale before KMeans?

Solution 1

- Distance-based; scale dominates otherwise.

Exercise 2: Choose k

Name one heuristic to choose k.

Solution 2

- Elbow, silhouette, domain knowledge.

Exercise 3: Explain cluster

How to explain cluster to non-technical audience?

Solution 3

- Describe in original variables (high spend, frequent visits, etc.).

Mini Demo (Python)

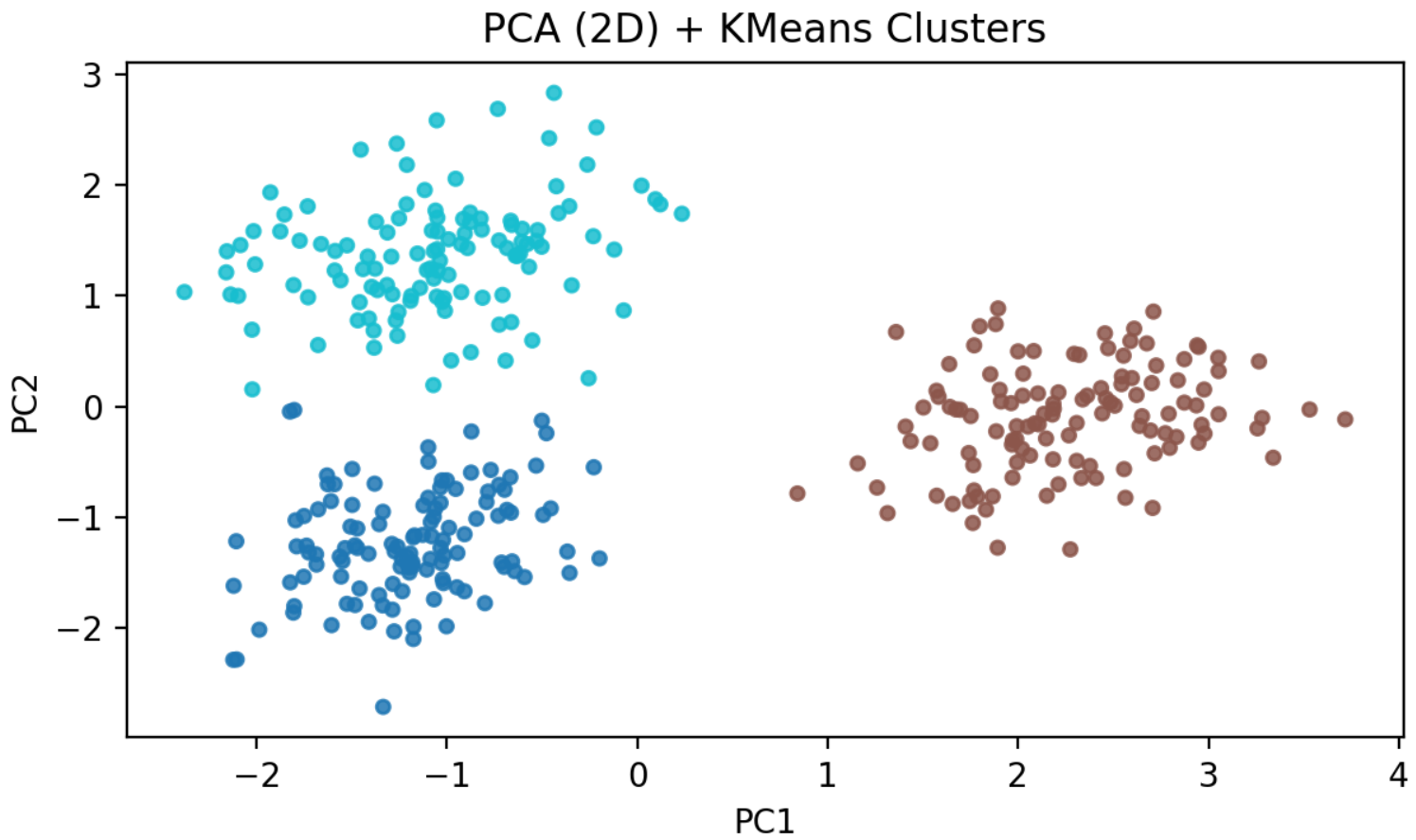
Run from the lecture folder:

```
python demo/demo.py
```

Outputs:

- `images/demo.png`
- `data/results.txt`

Demo Output (Example)



Summary

- Key definitions and the main formula.

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- How to interpret results in context.

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- Key definitions and the main formula.
- How to interpret results in context.
- How the demo connects to the theory.

Exit Question

Why should you validate cluster stability before using clusters for decisions?