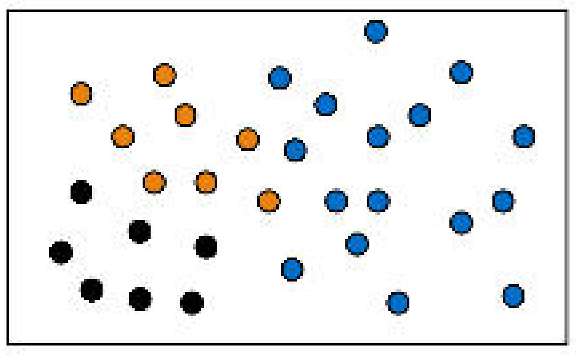
Clustering Tendency

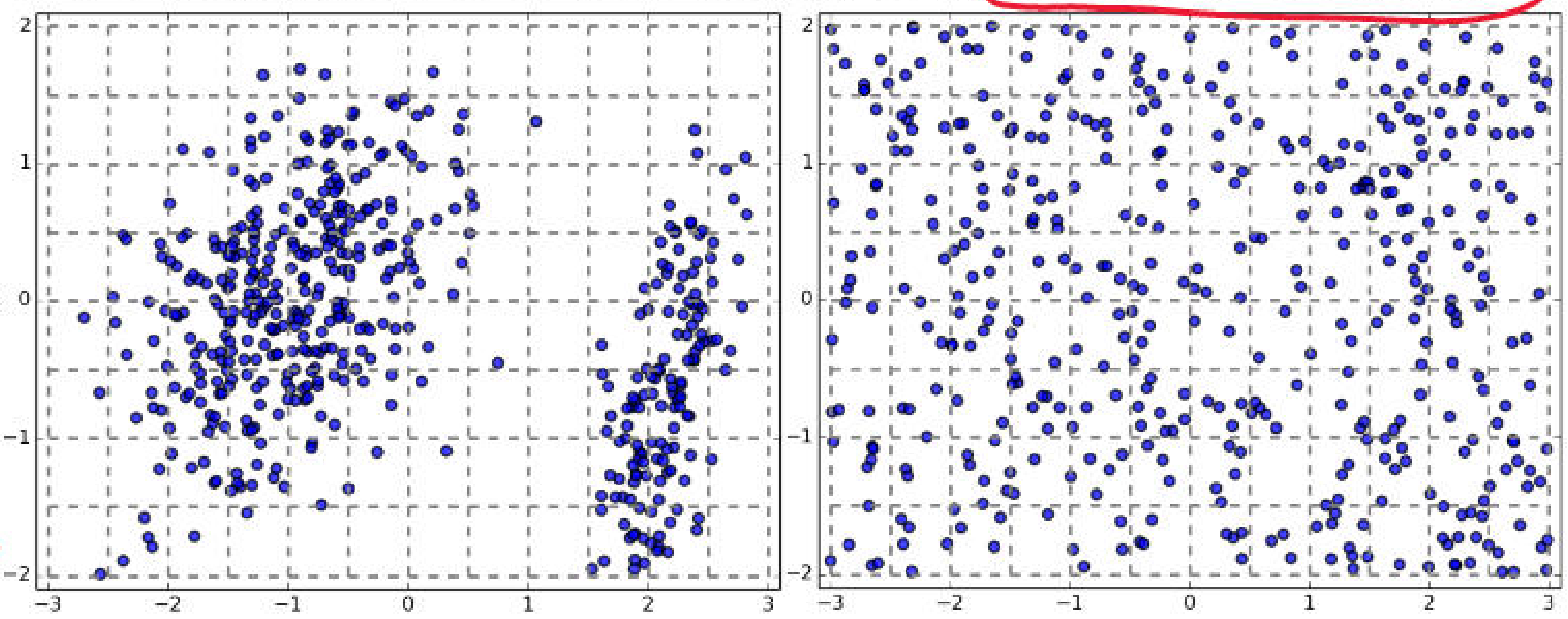
Clustering Tendency: Whether the Data Contains Inherent Grouping Structure



- Assessing the **suitability of clustering** data是否值得去聚类
  - (i.e., whether the data has any inherent grouping structure)
- Determining ***clustering tendency*** or ***clusterability***
  - **A hard task** because there are so many different definitions of clusters
    - E.g., partitioning, hierarchical, density-based, graph-based, etc.
  - Even fixing cluster type, still hard to define an appropriate null model for a data set
- Still, there are some **clusterability assessment methods**, such as
  - **Spatial histogram**: Contrast the histogram of the data with that generated from random samples   To be covered here
  - **Distance distribution**: Compare the pairwise point distance from the data with those from the randomly generated samples
  - **Hopkins Statistic**: A sparse sampling test for spatial randomness

Testing Clustering Tendency: A Spatial Histogram Approach

- **Spatial Histogram Approach:** Contrast the *d*-dimensional histogram of the input dataset ***D*** with the histogram generated from random samples
  - Dataset D is clusterable if the distributions of two histograms are rather different
- Method outline
  - Divide each dimension into equi-width bins, count how many points lie in each cells, and obtain the empirical joint probability mass function (EPMF)



  - Do the same for the randomly sampled data
  - Compute how much they differ using the *Kullback-Leibler* (*KL*) *divergence* value

Recommended Readings

- M. J. Zaki and W. Meira, Jr.. Data Mining and Analysis: Fundamental Concepts and Algorithms. Cambridge University Press, 2014
- L. Hubert and P. Arabie. Comparing Partitions. *Journal of Classification*, 2:193–218, 1985
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- M. Halkidi, Y. Batistakis, and M. Vazirgiannis. On Clustering Validation Techniques. *Journal of Intelligent Info. Systems*, 17(2-3):107–145, 2001
- J. Han, M. Kamber, and J. Pei. Data Mining: Concepts and Techniques. Morgan Kaufmann, 3rd ed. , 2011
- H. Xiong and Z. Li. Clustering Validation Measures. in (Chapter 23) C. Aggarwal and C. K. Reddy (eds.), Data Clustering: Algorithms and Applications. CRC Press, 2014