

K-mean

* Sensitive to noisy data and outliers
  + Variations: Using K-medians, K-medoids, etc.
* K-means is applicable only to objects in a continuous n-dimensional space
  + Using the K-modes for categorical data
* Not suitable to discover clusters with non-convex shapes 
  + Using density-based clustering, kernel K-means, etc.

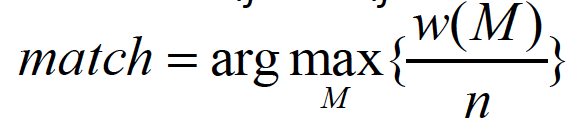
Density-Based Clustering Methods, Major features

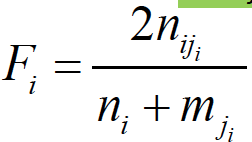
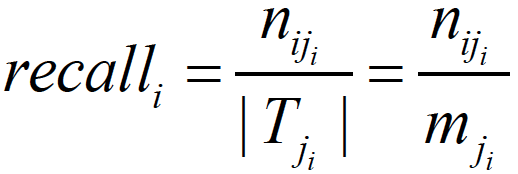
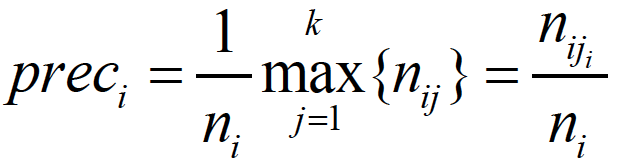
* Discover clusters of arbitrary shape
* Handle noise
* One scan (only examine the local region to justify density)
* Need density parameters as termination condition

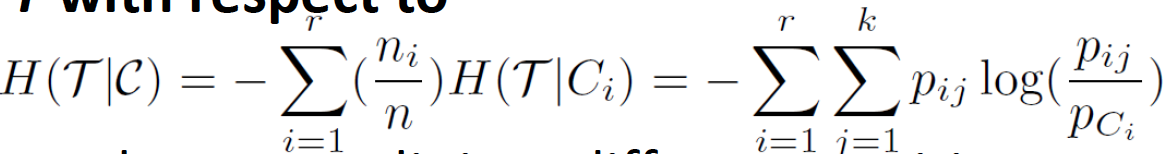
Features and challenges of a typical grid-based algorithm

* Efficiency and scalability: # of cells << # of data points
* Uniformity: Uniform, hard to handle highly irregular data distributions
* Locality: Limited by predefined cell sizes, borders, and the density threshold
* Curse of dimensionality: Hard to cluster high-dimensional data

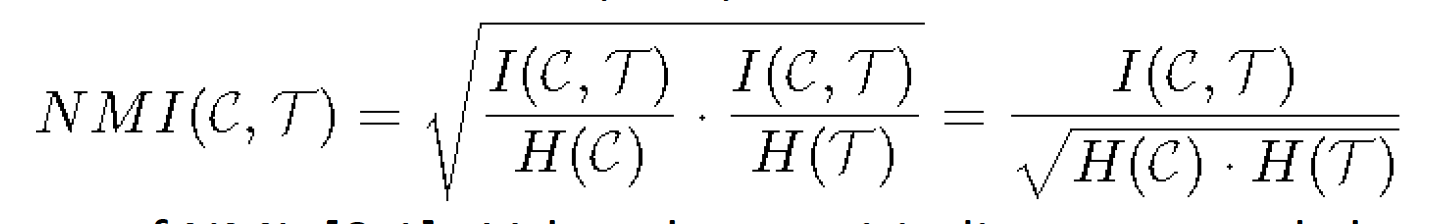
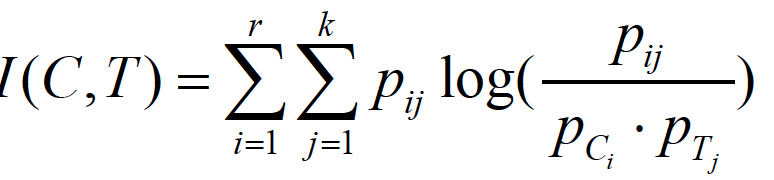
A picture containing object

Description automatically generated



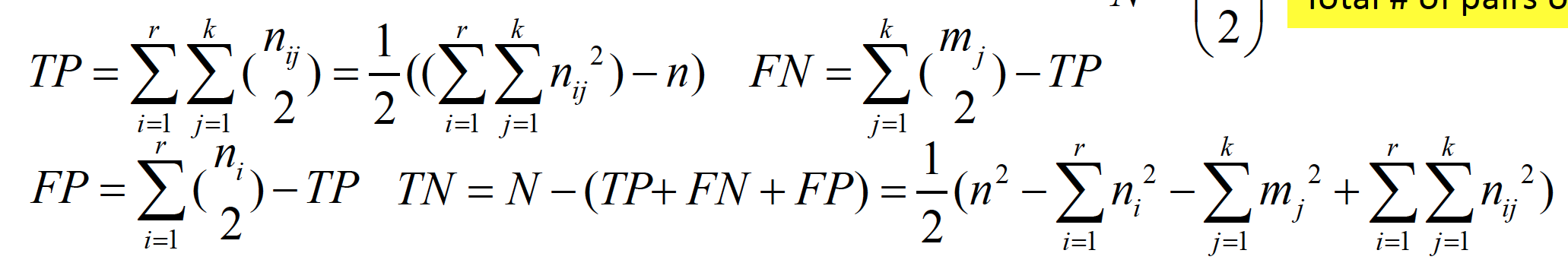
**Conditional entropy of T with respect to clustering C:**

For a perfect clustering, the conditional entropy value is 0, where the worst possible conditional entropy value is log k.

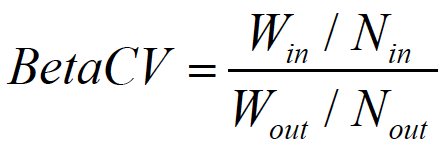
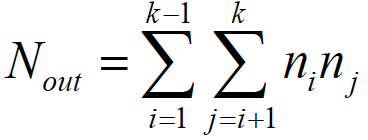
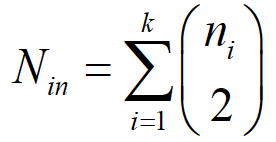
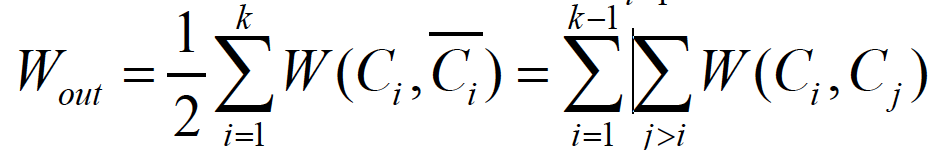
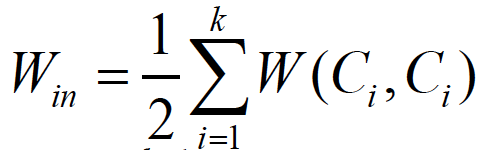


Value close to 1 indicates a good clustering

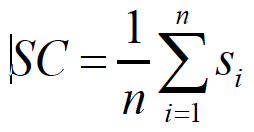
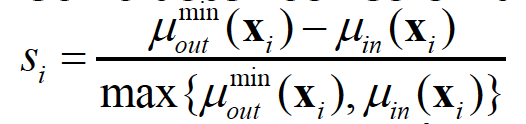
Calculate the four measures:



* Jaccard = TP/(TP + FN + FP) [i.e., denominator ignores TN]
* Perfect clustering: Jaccard = 1



* The smaller, the better the clustering
* Normalized cut: The higher normalized cut value, the better the clustering



* Silhouette coefficient：SC close to +1 implies good clustering
* Silhouette coefficient as a relative measure
* Beta-CV measure : The smaller, the better the clustering
* Normalized cut : The higher normalized cut value, the better the clustering
* Modularity : The smaller the value, the better the clustering—the intra-cluster distances are lower than expected