A Family of Hierarchical Clustering Algorithms based on High-order Dissimilarities

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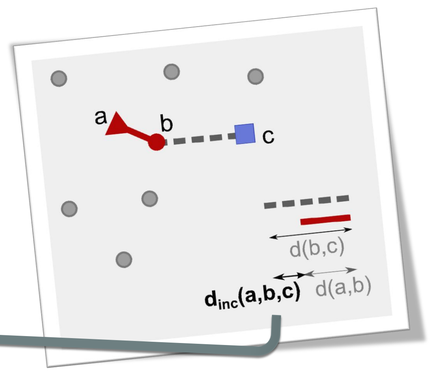
Dissimilarity increments: definition and distribution

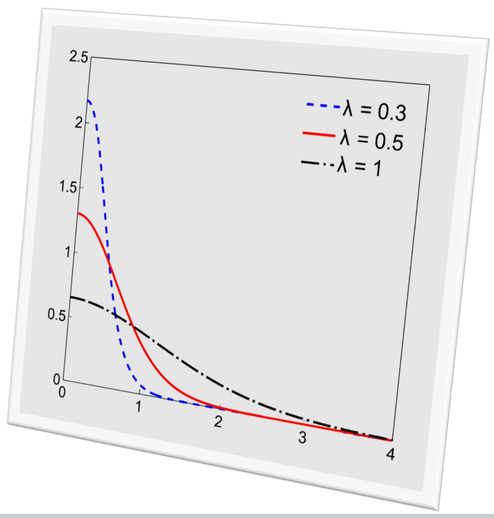
(, ,) – triplet of nearest neighbors
- is the nearest neighbor of
- is the nearest neighbor of (different from)

The **dissimilarity increments** between neighboring patterns is defined as

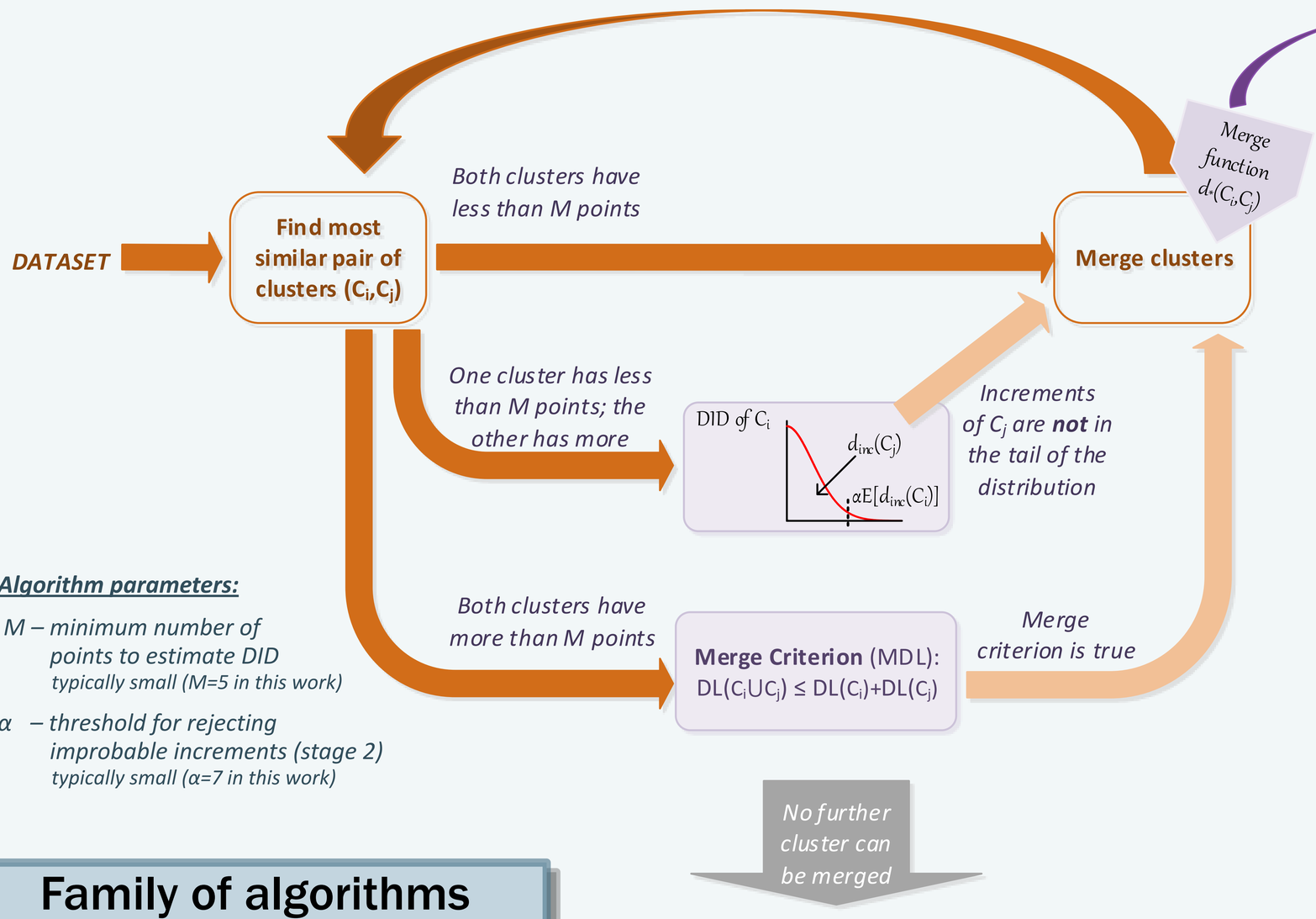
( ) | ( ) ( )|



The **dissimilarity increments distribution (DID)** is a function of the mean value of the dissimilarity increments



PROPOSAL: A family of agglomerative hierarchical methods, integrating dissimilarity increments in traditional linkage algorithms



Algorithm parameters:

M – minimum number of points to estimate DID
typically small (M=5 in this work)

α – threshold for rejecting improbable increments (stage 2)
typically small (α=7 in this work)

MERGE FUNCTION

Consider the new formed cluster = , obtained by merging and , and is one of the remaining clusters formed in previous steps. Lets consider | | the number of points in cluster

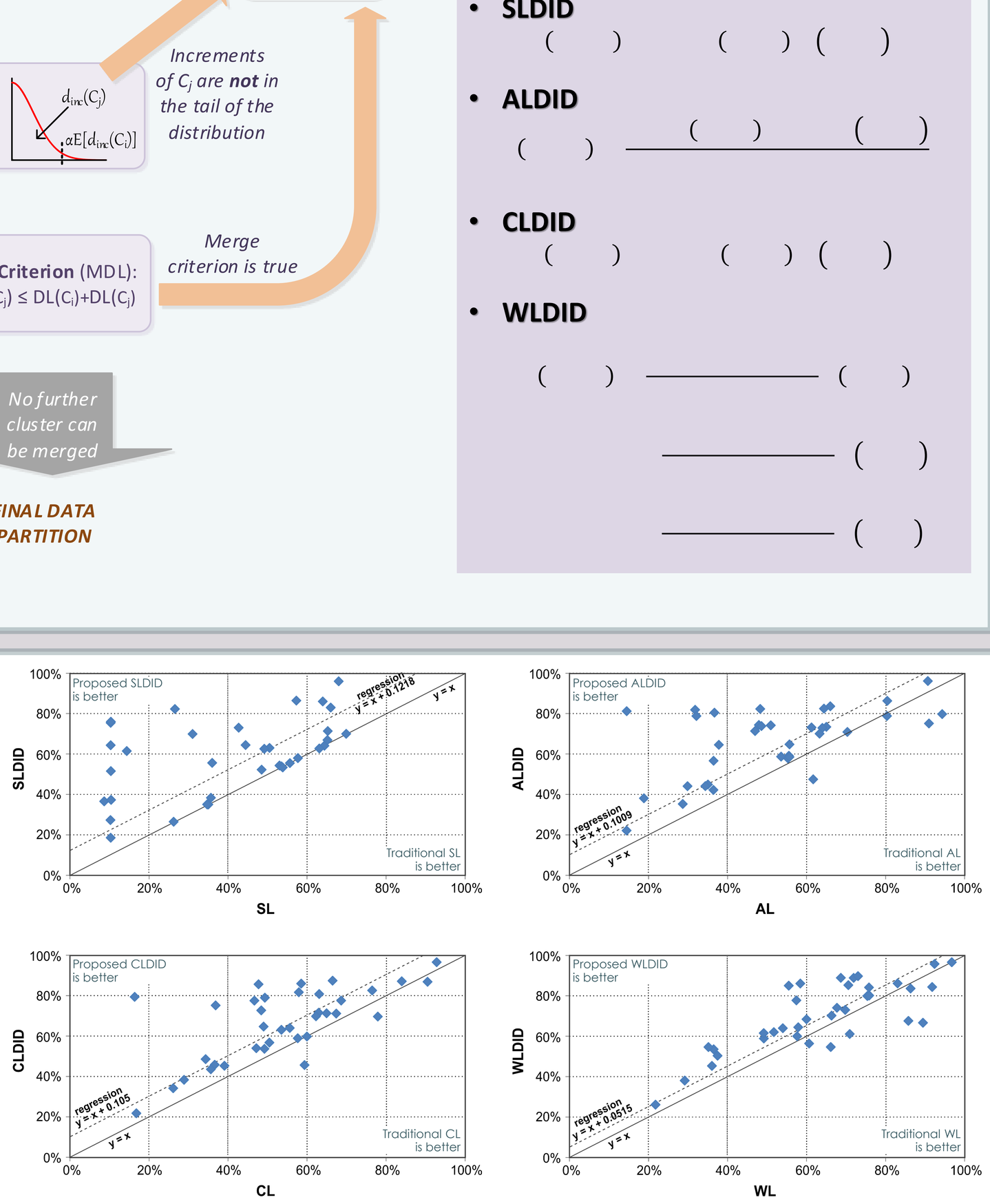
- **SLDID**
  ( ) ( ) ( )
- **ALDID**
  ( ) ( ) ( )
- **CLDID**
  ( ) ( ) ( )
- **WLDID**
  ( ) ( )
  ( )
  ( )

Family of algorithms

➢ This family of hierarchical agglomerative algorithms is able to **automatically find the number of clusters** using a minimum description length criterion based on the dissimilarity increments distribution (DID)

➢ Each algorithm of the proposed family is able to find classes as unions of clusters, leading to the **identification of internal structures of classes**

Experimental results



DATASETS:
36 real-world datasets from the UCI Machine Learning Repository.

EVALUATION:
Percentage of correctly clustered points assuming that one class can be represented as the union of several clusters.

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