Fuzzy Semi-supervised Clustering

A step forward into the future

Outline

Fuzzy C-Means clustering

Full-Iterative & Selective FCM

Experimentation

Performances

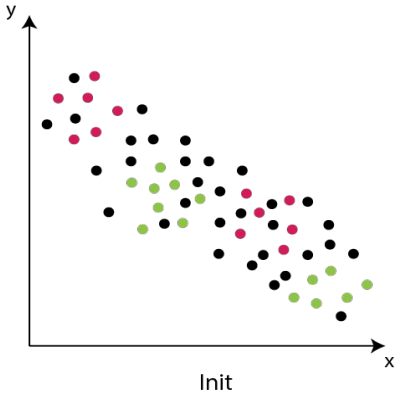
Interpretability

Fuzzy C-Mean Clustering

- ➔ Choose a number of cluster
- ➔ Assign a membership grade to each data point for being in a cluster
- ➔ Repeat until the algorithm has converged
  - ◆ Compute the centroid of each cluster based on the membership grades
  - ◆ Update the membership grades with the centers

Our Solutions

- Selective Fuzzy C-Mean
- Fully-Iterative Fuzzy C-Mean



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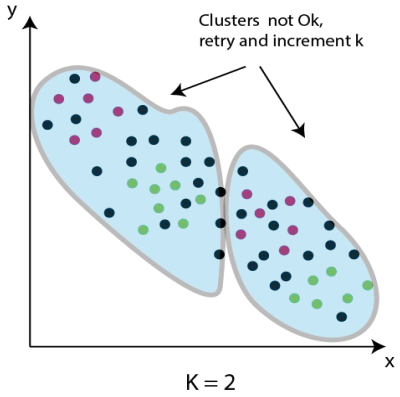

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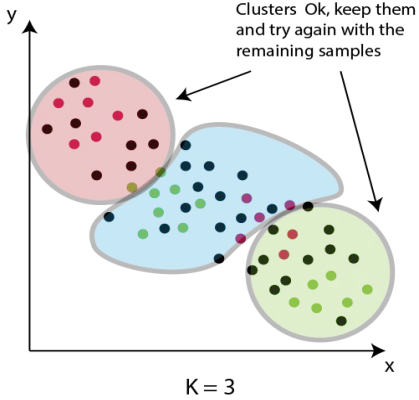

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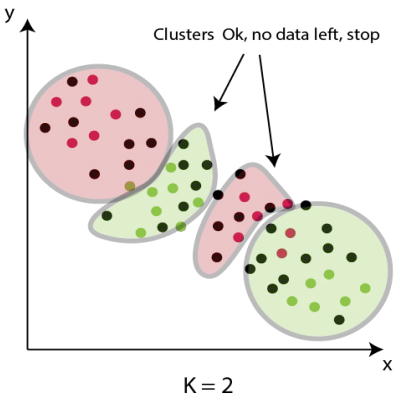

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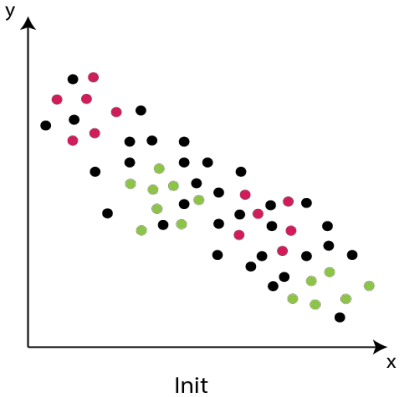

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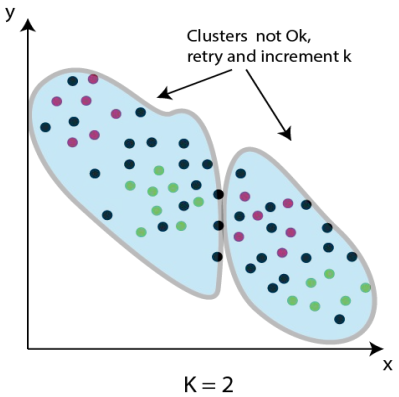

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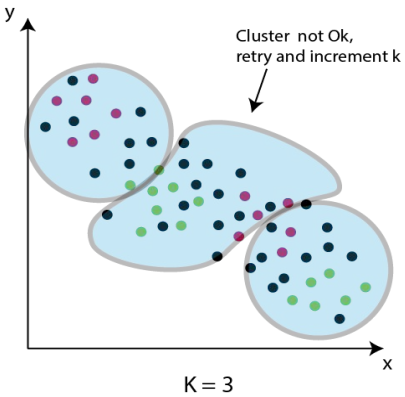

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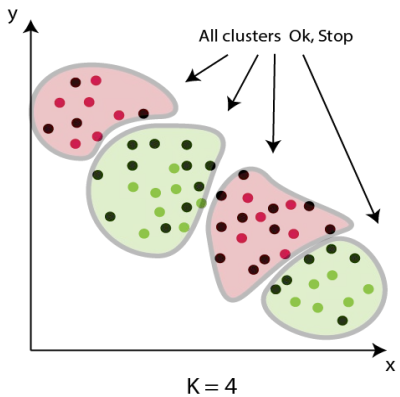

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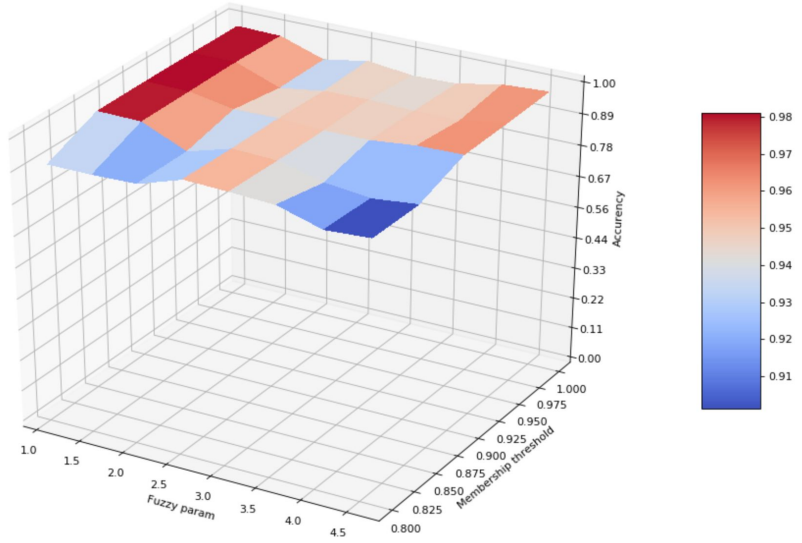
Experimentations
FI-FCM

Fuzzy parameter : 1.5

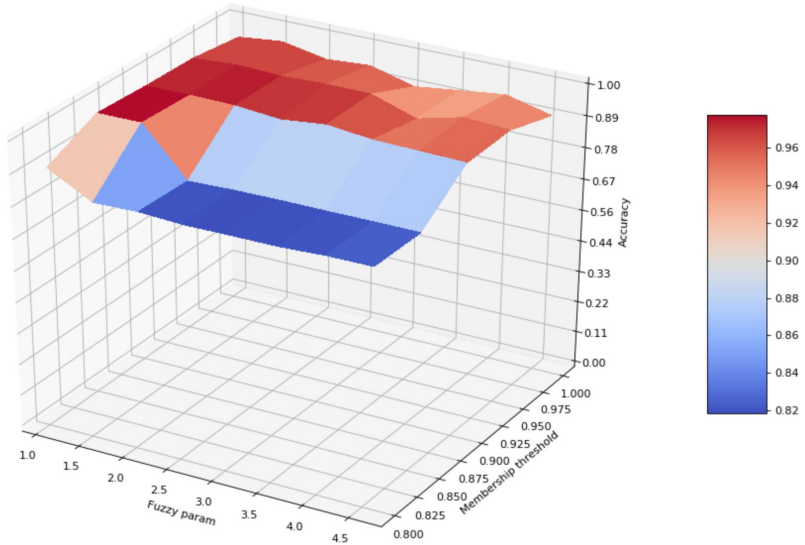
Membership threshold: 0.9



Experimentations
S-FCM

Fuzzy parameter : 1.5

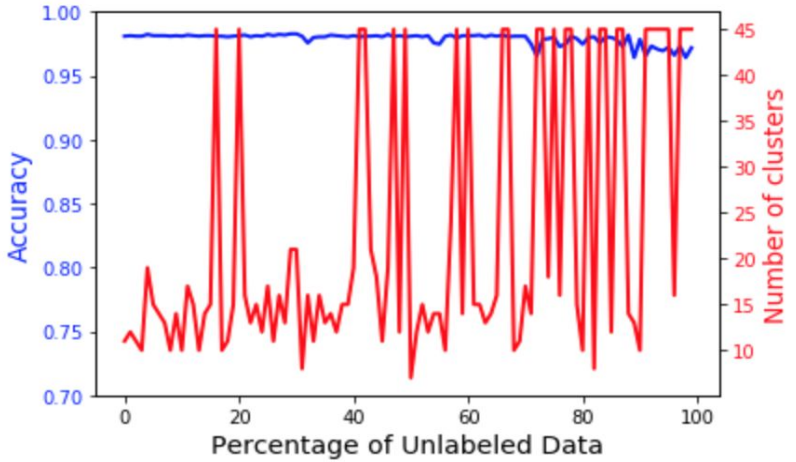
Membership threshold: 0.925



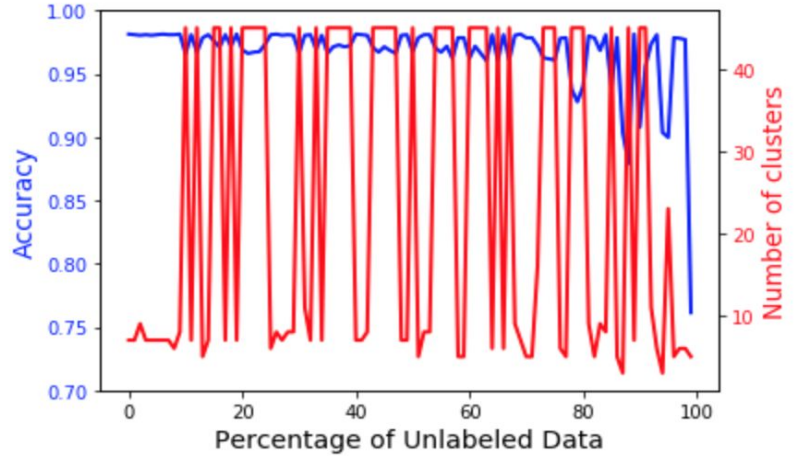
Performances

- Accuracy
- Number of clusters

S-FCM

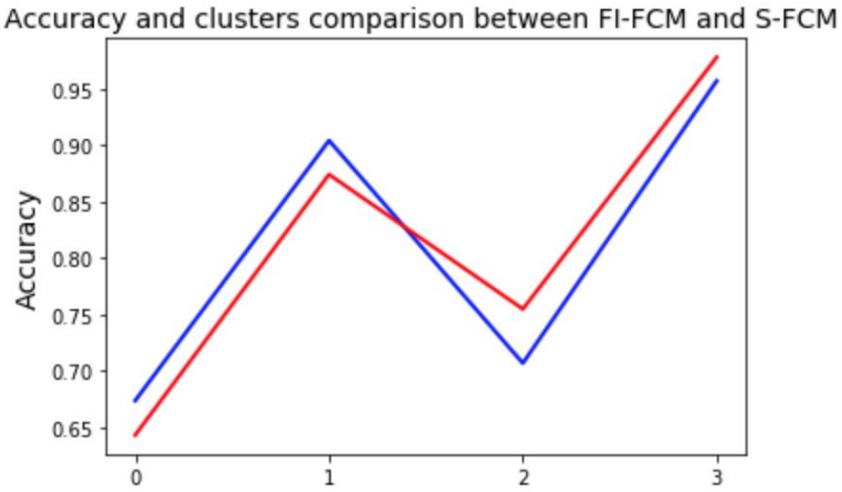


FI-FCM



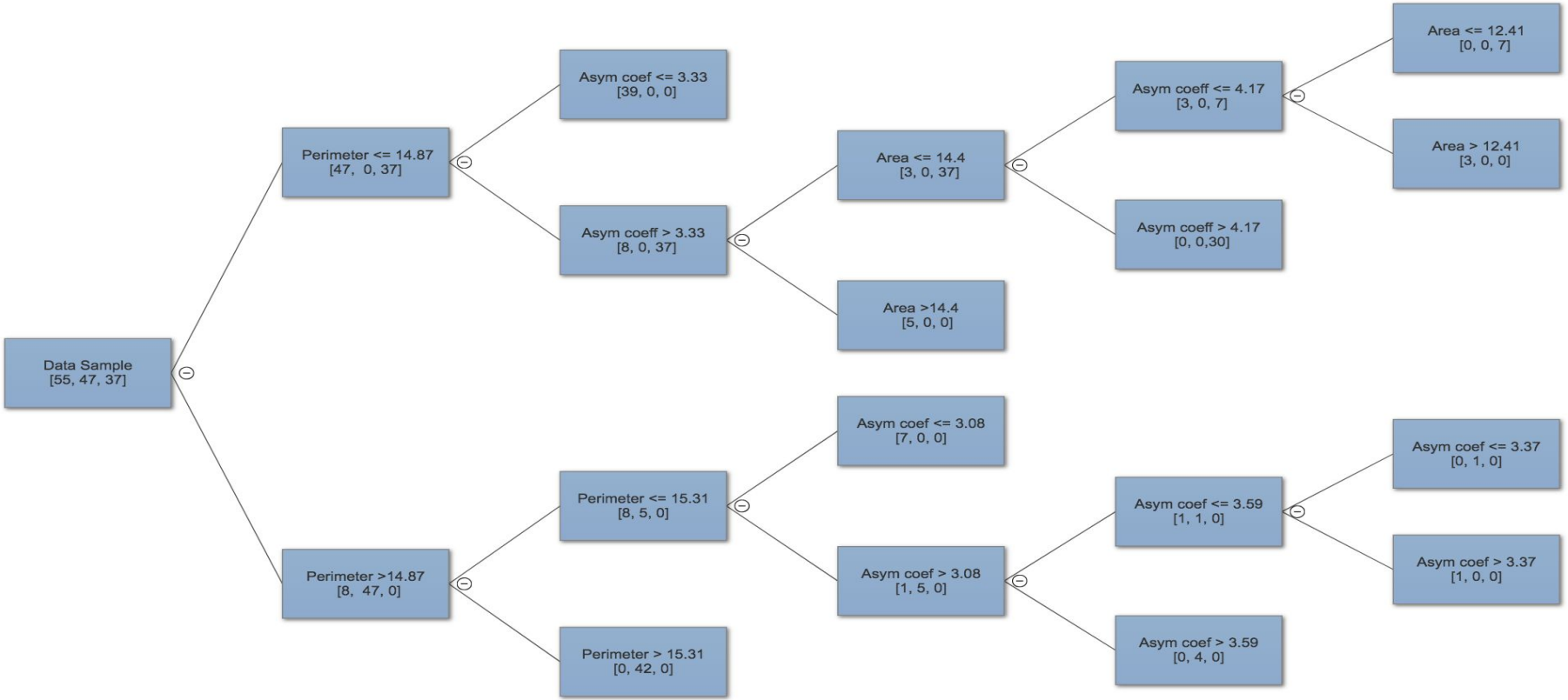
Models Comparison

- FI-FCM : Better with less labels, unsupervised process
- S-FCM : Better in the long run, supervised selection process



Interpretability

- ➔ Decision Tree on the labeled dataset
- ➔ Extract binary rules
  - ◆ Can reduce a lot the dimensionality
- ➔ Transform the binary rules in fuzzy rules



Decision Tree - Seed dataset

Questions?

References

1. P. Milano, “A Tutorial on Clustering Algorithms,”
2. T. H. Thong and L. H. Son, “An Overview of Semi-Supervised Fuzzy Clustering Algorithms,”
3. Y. M. M. S. ENDO Yasunori, HAMASUNA Yukihiro, “On Semi-Supervised Fuzzy c-Means
4. Clustering,”
5. M. Halkidi and al., “Clustering validity checking methods: Part ii,”
6. Q. ZHAO, “Cluster validity in clustering methods,”
7. H. Khosravi and al., “FCM-Fuzzy Rule Base: A new Rule Extraction Mechanism,”