

## Advances in Fuzzy Clustering

Research Center for Artificial Intelligence  
(CENTRIA)  
Soft Computing and Constraints (SCC)



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## Objectives

- Fuzzy Clustering methods applied to problems in Machine Learning and in Data Mining applications.
- Methods for the interpretation of clustering results.
- Dynamic versions of fuzzy clustering methods to model spatio-temporal phenomena.
- Fuzzy Clustering and Archetypal analysis

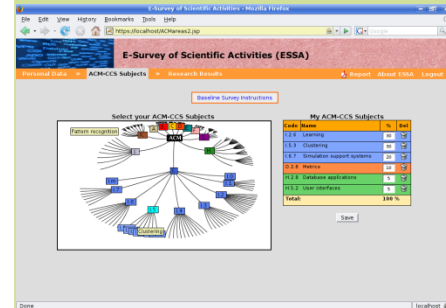


Fig. 1

## Methodology

- Bilinear fuzzy clustering models.
- Least-Squares clustering criteria with fuzzy constraints.
- Non-linear alternating optimisation algorithms:
  - projection methods
- Fuzzy Additive clustering using a Spectral approach:
  - Eigenvector space
- Recursive algorithm for mapping and lifting a cluster of topics on a taxonomy of its field by minimizing a penalty function wrt taxonomy topology.
- Unsupervised fuzzy clustering for image segmentation and indices of classification uncertainty to recognize patterns with fuzzy boundaries.

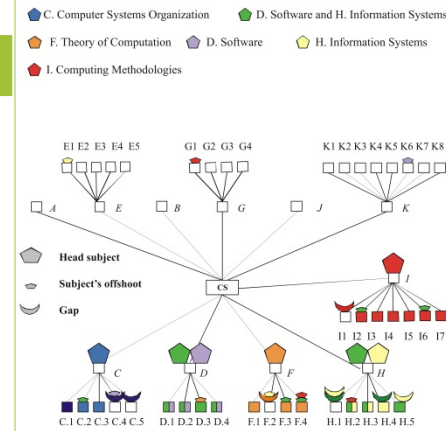


Fig. 2

## Expected Results

- *Spectral Cluster Lifting* method to find clusters of Research Activities and representing them over a Taxonomy of a Knowledge Domain:
  - Survey tool to collect data on research topics and their proportions on researcher's activity. Research profiles as crisp or fuzzy sets (Fig. 1).
  - Representation of six research subject clusters onto the ACM computing classification taxonomy. Case study in DI-FCT-UNL in 2006 (Fig. 2).
- *FuzzyUpwell System* for spatio-temporal analysis of oceanographic phenomena on Sea Surface Temperature images using unsupervised fuzzy clustering. Automatic detection of coastal upwelling areas (Fig. 3) and their fronts as fuzzy boundaries (Fig. 4) in the Western coast of Portugal.

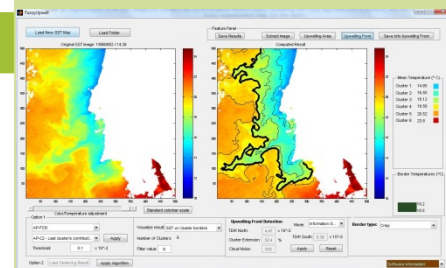


Fig. 3

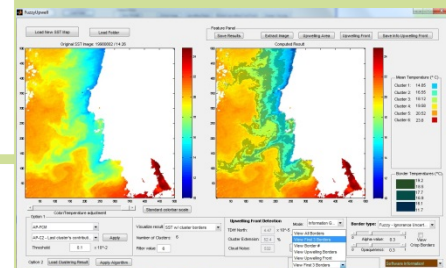


Fig. 4

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