CSC 390
Topics in Artificial Intelligence

"Unsupervised Machine Learning"

Fall 2016

Prof. Sara Mathieson
Smith College

Outline: 10/18

- Finish Paper Discussion
- More about how to read a scientific paper
- Begin: probability and statistics background

- Grace Hopper
  - Thursday: special topic: machine learning in population genetics

- Midterm (take-home)
  - out Tuesday Oct 18
  - due Wednesday Oct 25 at 5pm

- Homework 5: in-class presentations (start Tues Nov 1)

- Feedback

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- After that, move on to the methods if you're interested in the details
- If you're experienced in the field… skim conclusions first, then go to the methods

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- Results: spend time on the key evaluation metrics, some later material can be skimmed if it's long

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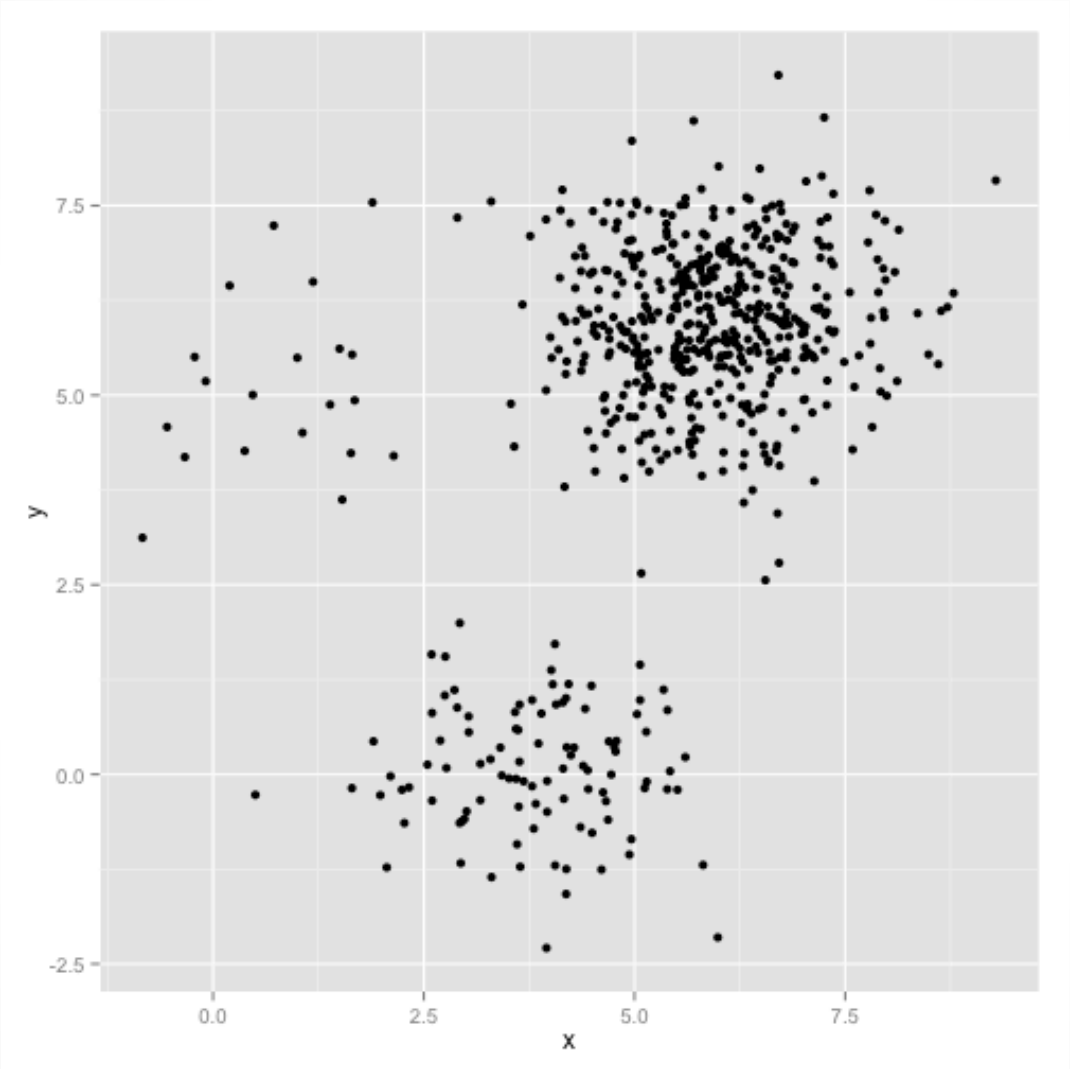
- Can make the results long, but also valuable
- Use methods and conclusions to decide whether you want to run the algorithm on your data
- Results on one dataset may not be that meaningful for another

Example where k-means produces undesirable results



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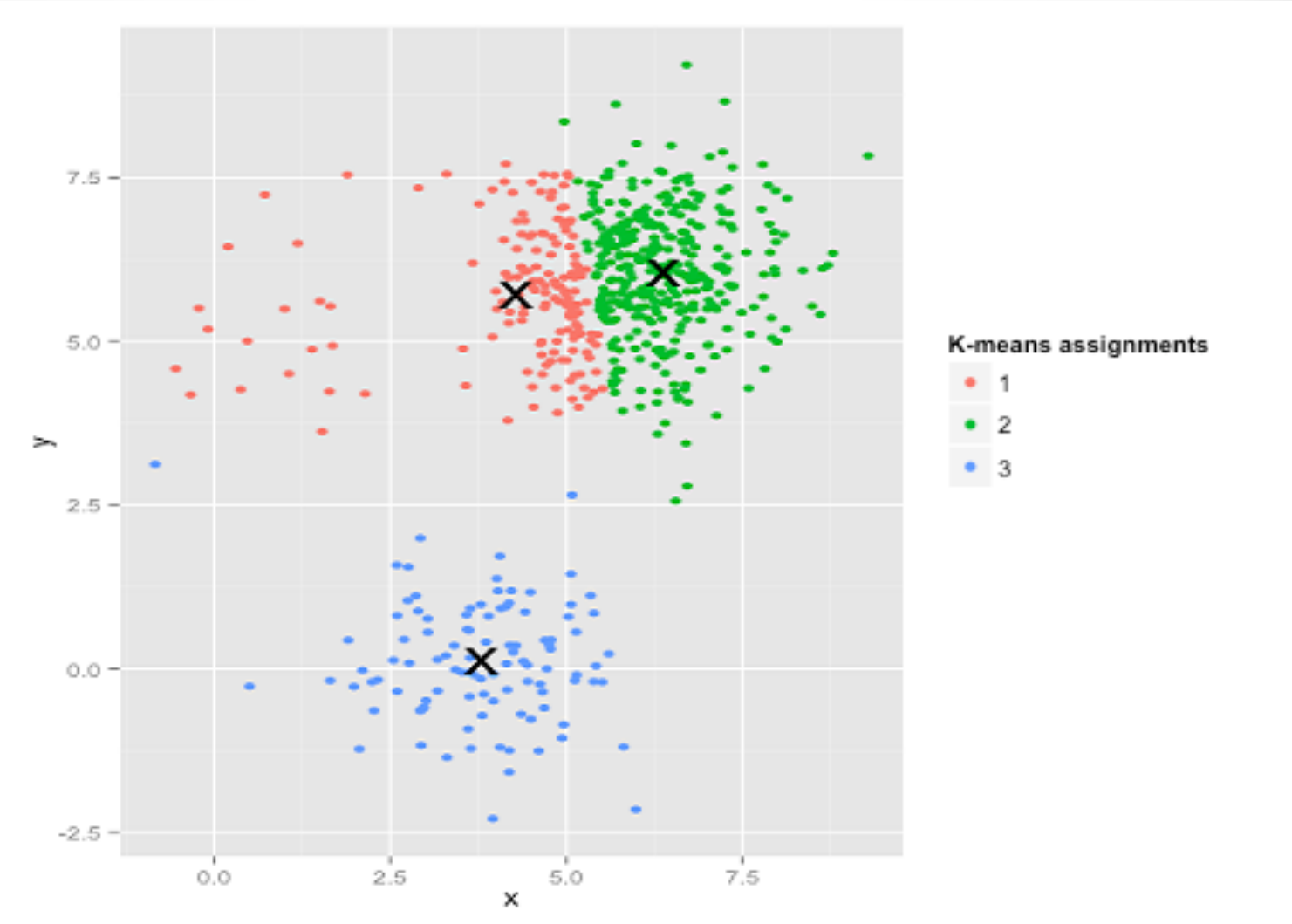

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Example where k-means produces undesirable results

- Larger issue: k-means is biased toward equally sized clusters

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Terms from these two papers

- Strategies:
  - Google term along with the word "clustering"
  - Use context or try to find the first time the term was used
  - Mark and come back if it ends up being an important term
  - Relate back to a non-scientific definition of the term

Terms from these two papers

- Monotone
- Disjoint
- Chaining effect
- Document taxonomy
- Similarity matrix
- Distributions
- Agglomerative, divisive
- Overlapping
- Cardinality
- Cosine similarity
- Centroid
- Partition
- Data representation
- Topics

Paper 1

"Data clustering: 50 years beyond K-means"

by Anil K. Jain

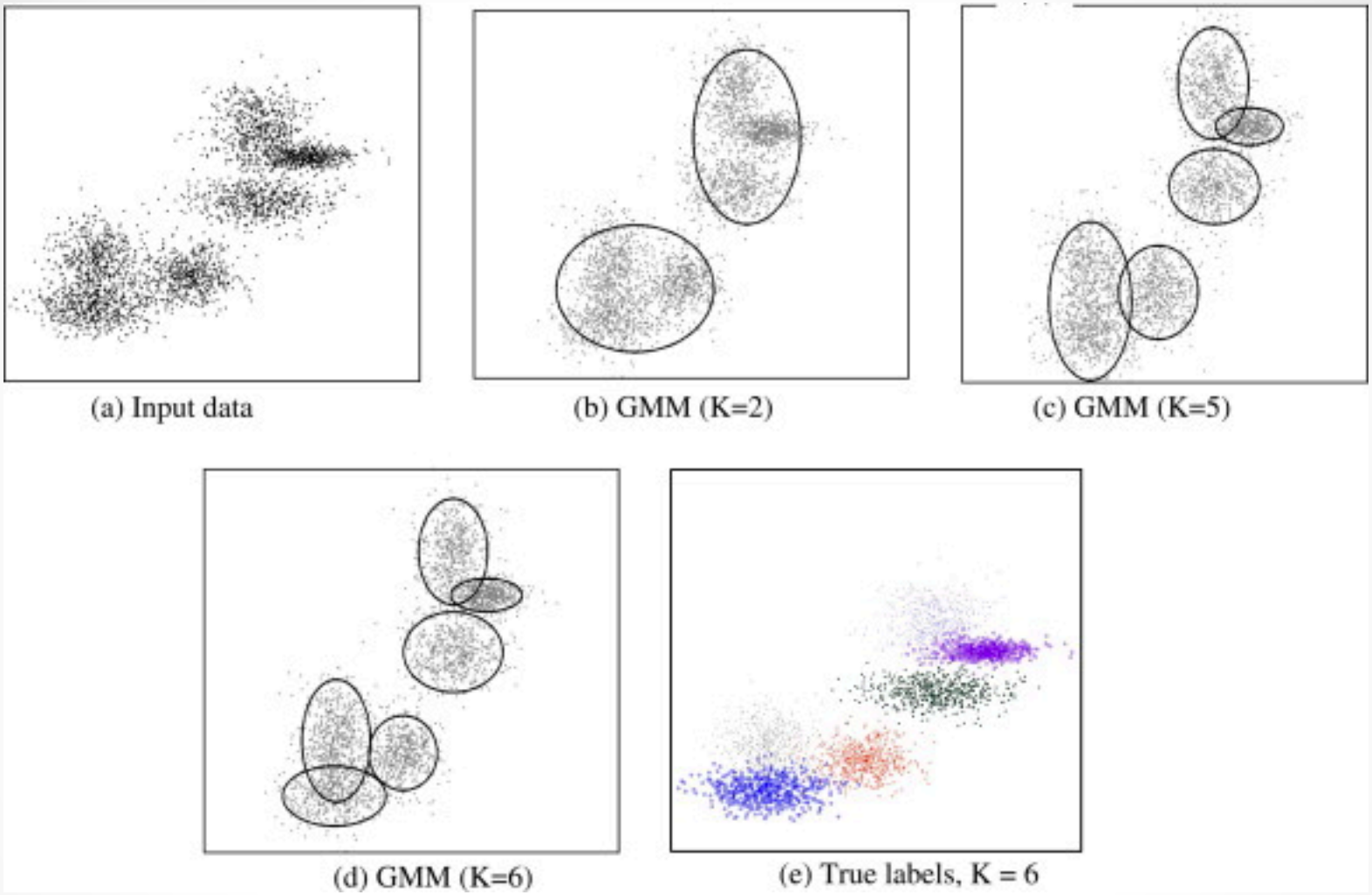

Fig. 7.
Automatic selection of number of clusters, K. (a) Input data generated from a mixture of six Gaussian distributions; (b)–(d) Gaussian mixture model (GMM) fit to the data with 2, 5, and 6 components, respectively; and (e) true labels of the data.0

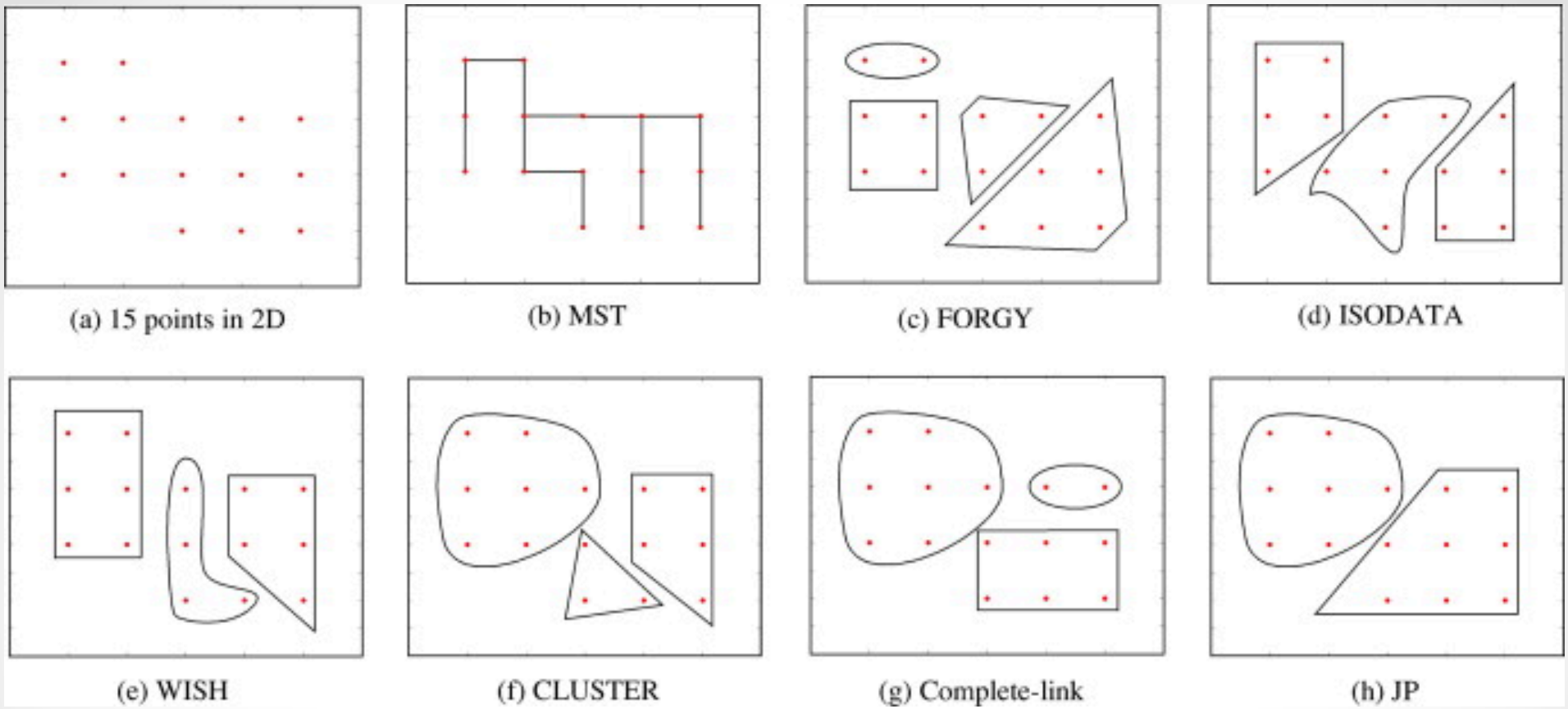

Fig. 9.
Several clusterings of fifteen patterns in two dimensions: (a) fifteen patterns; (b) minimum spanning tree of the fifteen patterns; (c) clusters from FORGY; (d) clusters from ISODATA; (e) clusters from WISH; (f) clusters from CLUSTER; (g) clusters from complete-link hierarchical clustering; and (h) clusters from Jarvis-Patrick clustering algorithm. (Figure reproduced from Dubes and Jain (1976).)

Paper 2

"Dynamic hierarchical algorithms for document clustering"

by Reynaldo Gil-García, Aurora Pons-Porrata

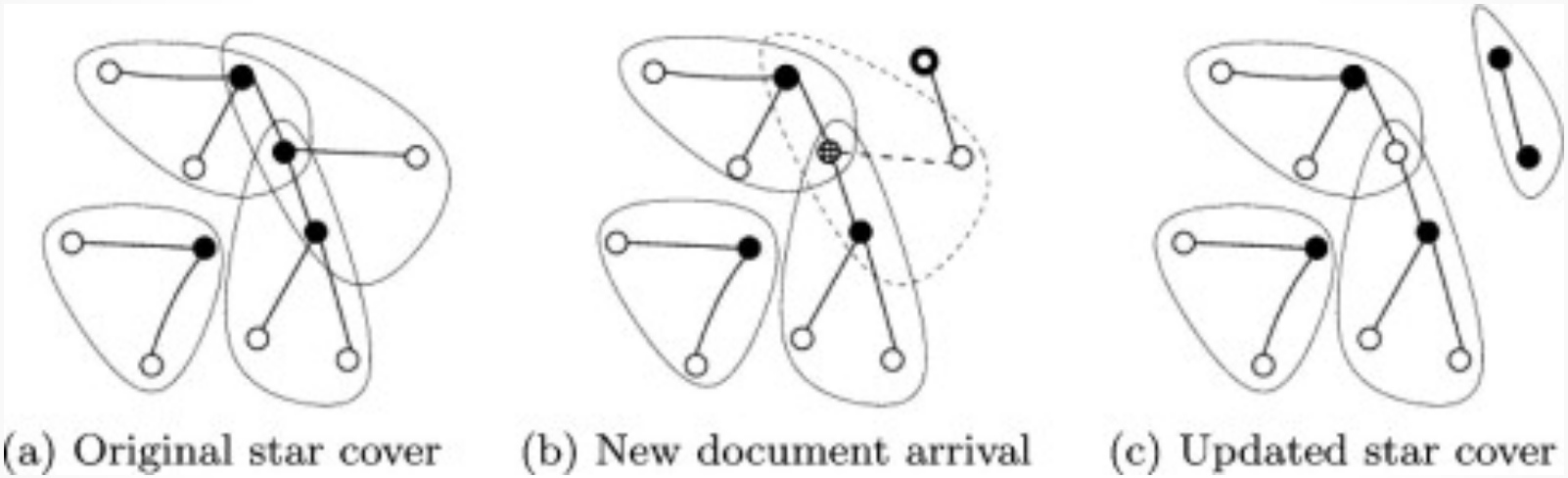

Fig. 4.
Star cover updating (black circles represent the stars).

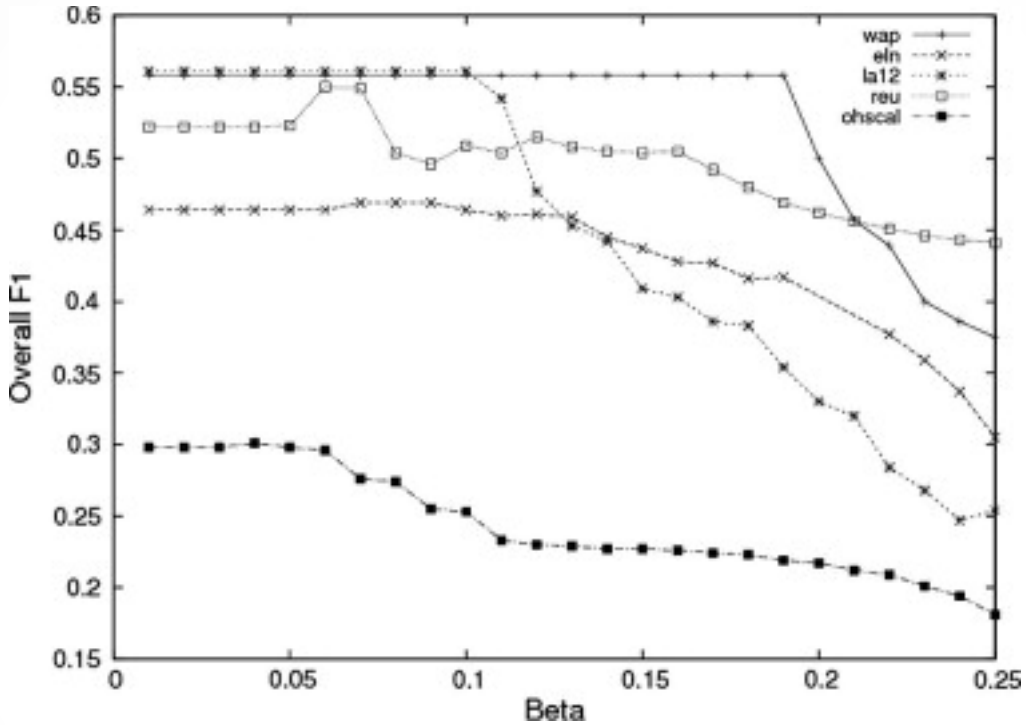

Fig. 5.
DHC sensitivity to β.

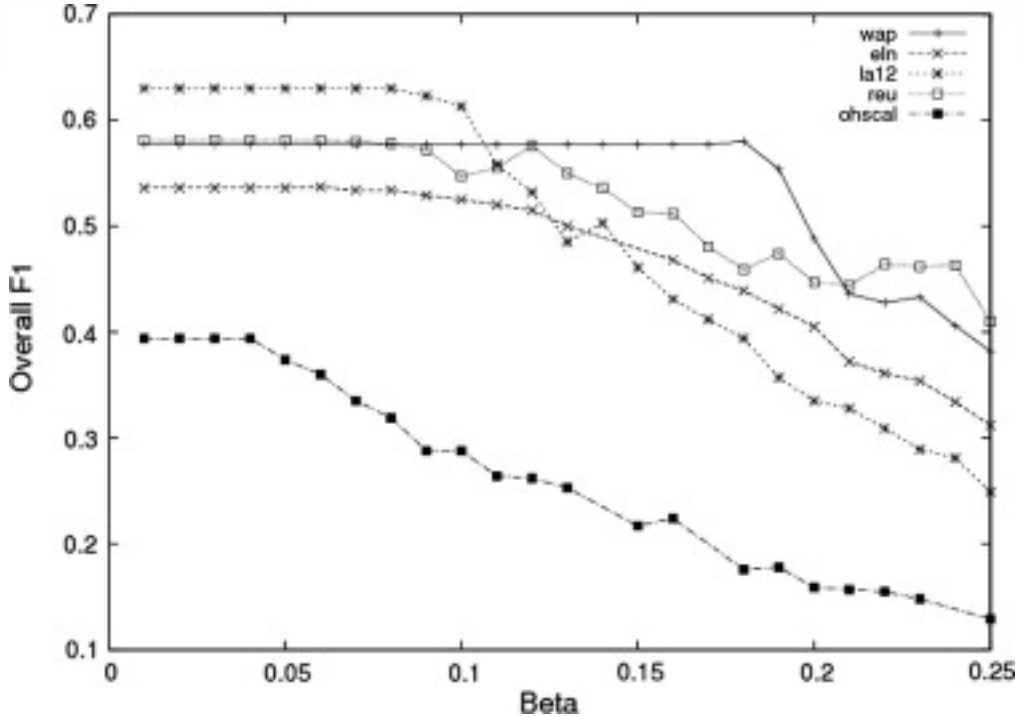

Fig. 6.
DHS sensitivity to β.

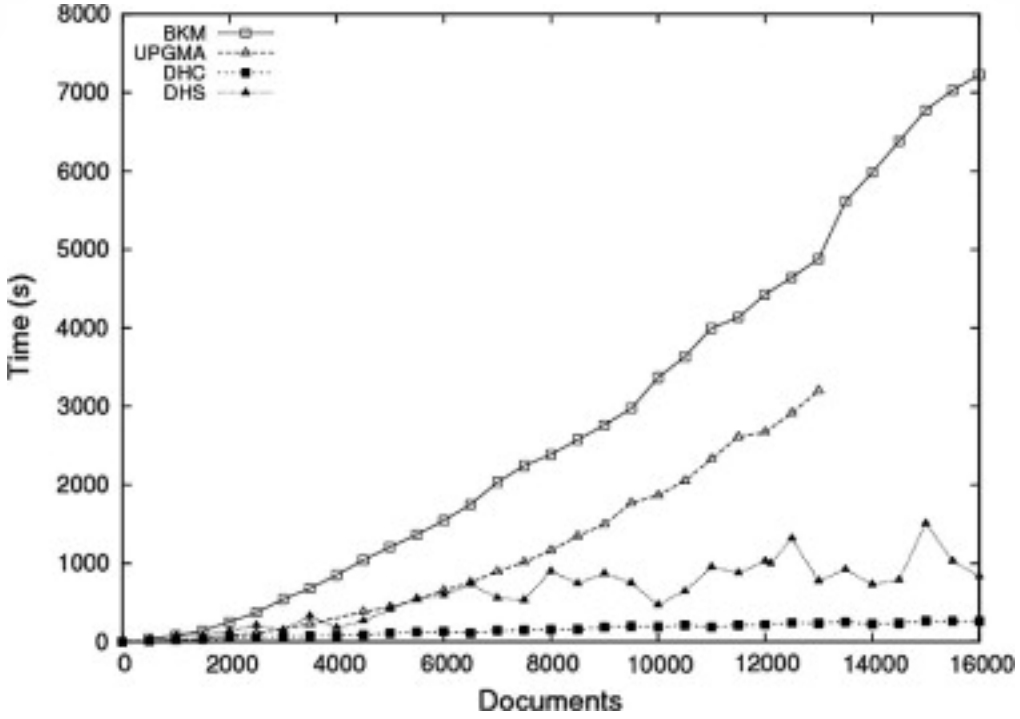

Fig. 7.
Time performance.

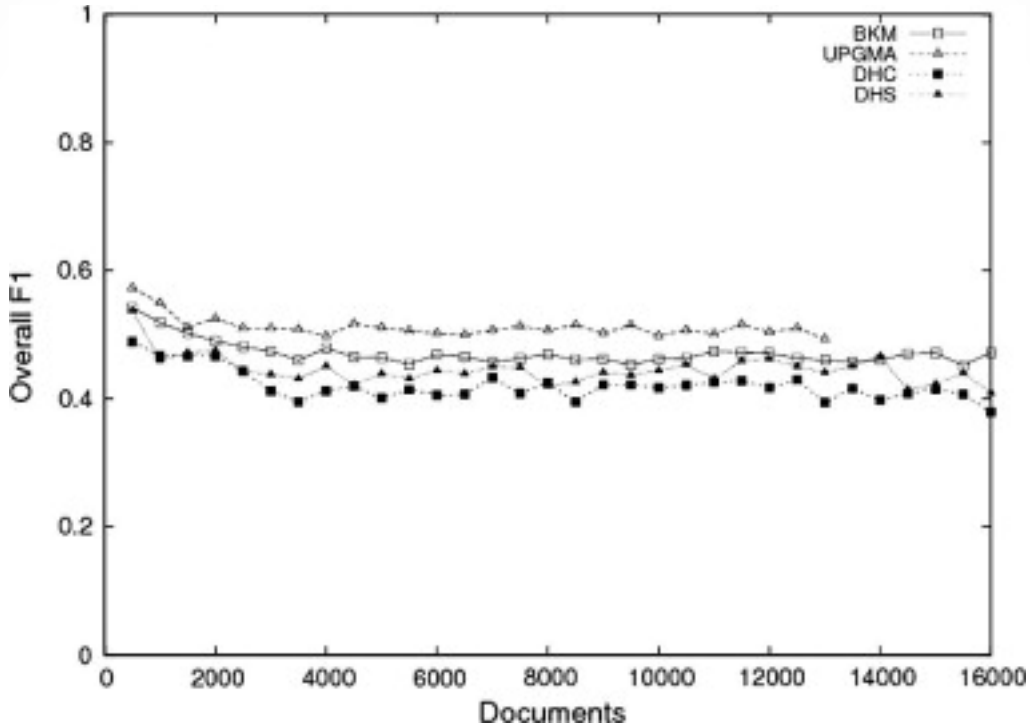

Fig. 8.
Clustering quality in a dynamic environment.