To cut the feet to fit the shoes:

Forcing unsupervised cluster analysis to reproduce results of subjective vegetation classification

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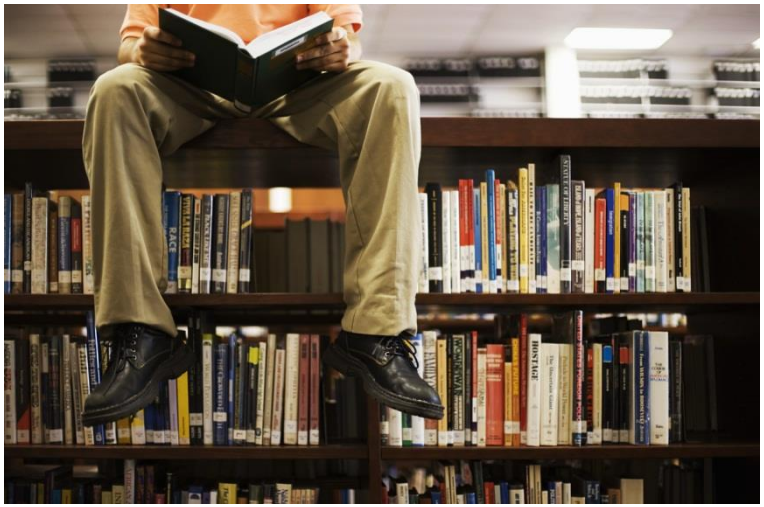


Terminology

Methods for creating vegetation classification scheme

- expert-based classification (“subjective”)
  - hand sorting of vegetation relevés
  - based on expert knowledge and experience
- unsupervised numerical classification (“objective”)
  - cluster analysis (incl. TWINSPAN)
  - based on selected numerical algorithm

Methods for reproduction of existing classification

- supervised classification
  - expert based or numerical (e.g. COCKTAIL)

How does good vegetation classification looks like?

- based on ecologically meaningful concept
- easily being observed in the field
- simple, or at least not overly complicated
- reproducible on new vegetation records

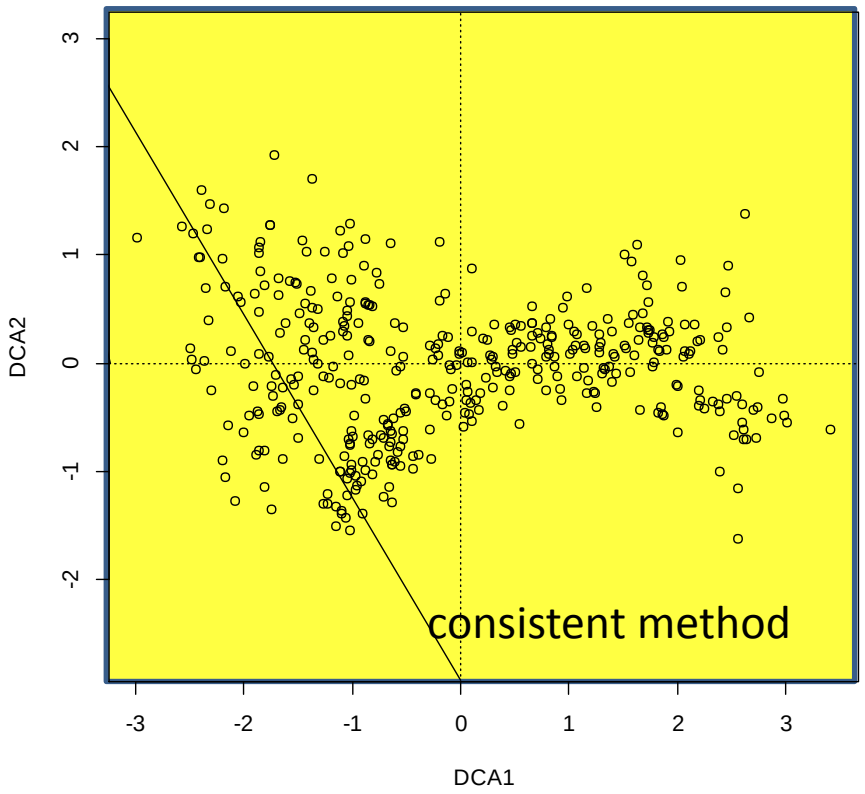
- good classification is like a good story – it's not only about list of diagnostic species, but also about other features, like habitat quality, disturbance regime, origin, historical development, management etc.
- but it should not be just a story – it must be based on real data and real patterns (concept-driven vs data-driven classification)

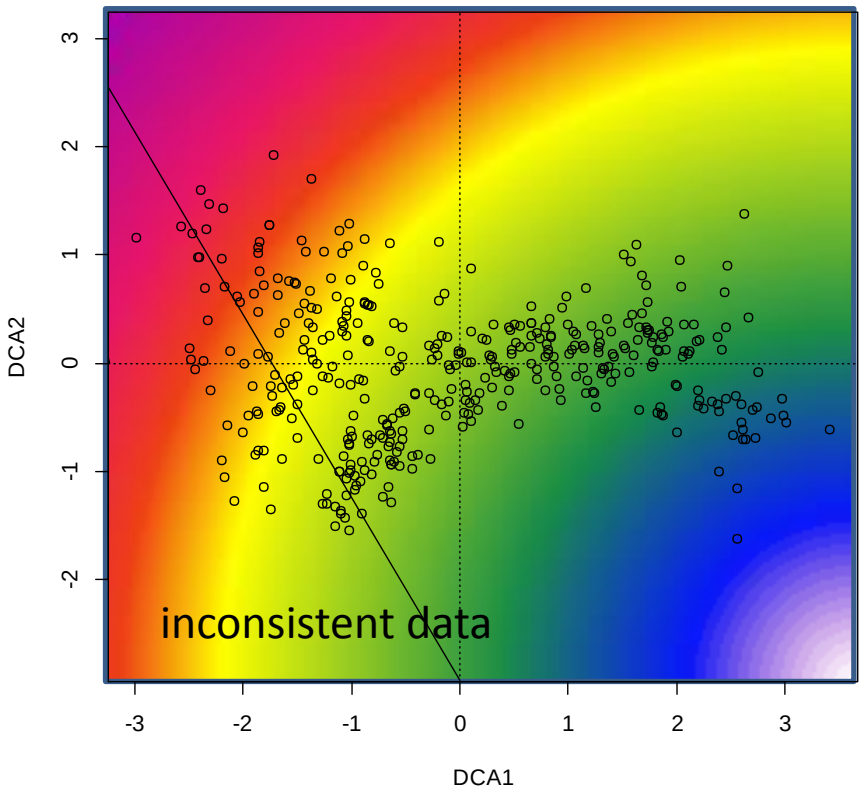
Why is cluster supposed to be better than expert-based?

... numerical cluster analysis is considered to be

- objective
- quantitative
- reproducible
- convenient and fast
- consistent

Cluster analysis: application of consistent method on inconsistent data





Numerical reproduction of existing vegetation associations

Data:

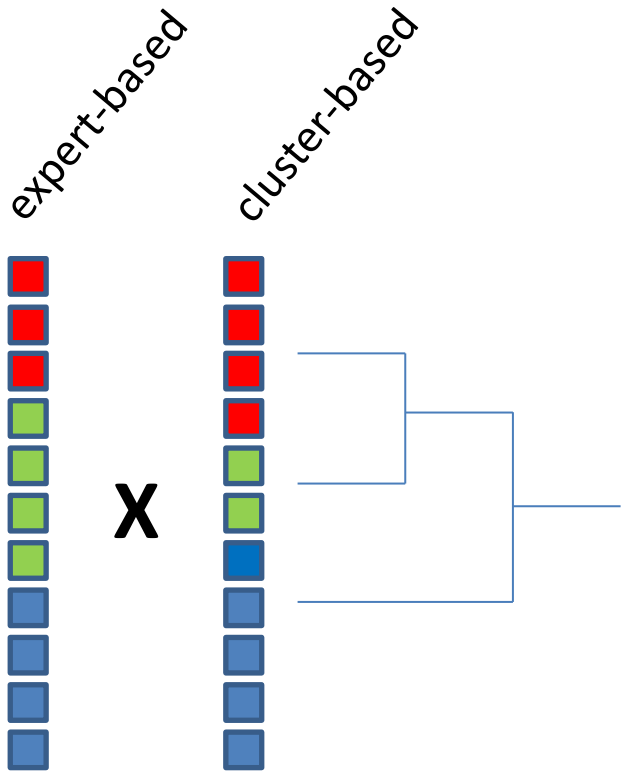
- Czech National Phytosociological Database
- 10 associations, 4 alliances
- classification based on the *Vegetation of the Czech Republic 4. Forest and scrub vegetation* (editor M. Chytrý)
- 40 randomly selected relevés per association
- 400 relevés in total

Alliance	Associaton
Quercion pubescenti-petrae	(1) *Sorbo torminalis-Quercetum*
	(2) *Melico pictae-Quercetum roboris*
Carpinion betuli	(3) *Galio sylvatici-Carpinetum betuli*
	(4) *Carici pilosae-Carpinetum betuli*
Tilio platyphylli-Acerion	(5) *Aceri-Tilietum*
	(6) *Mercuriali perennis-Fraxinetum excelsioris*
	(7) *Arunco sylvestris-Aceretum pseudoplatani*
Alnion incanae	(8) *Alnetum incanae*
	(9) *Carici remotae-Fraxinetum excelsioris*
	(10) *Stellario nemorum-Alnetum glutinosae*

Numerical reproduction of existing vegetation associations

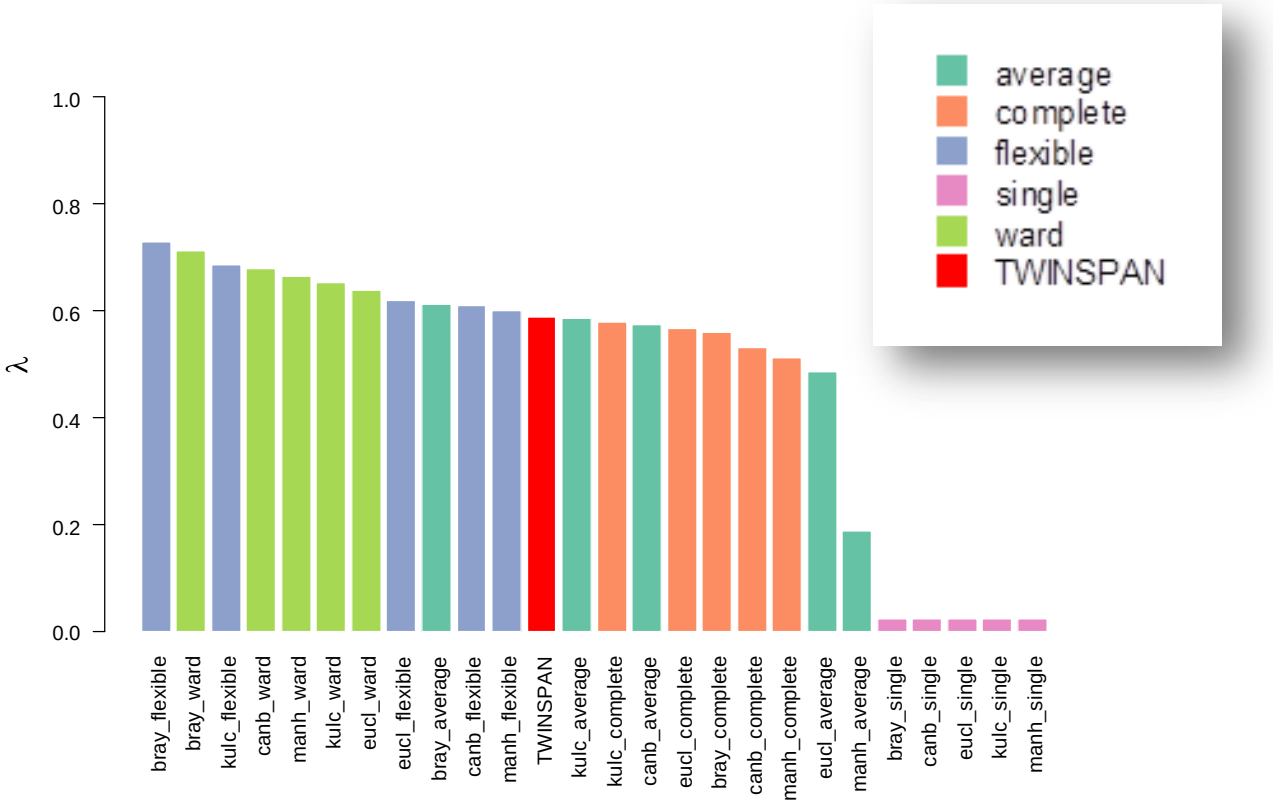
Analysis

- cluster analysis and (modified) TWINSPAN
- cluster analysis: 5 distances x 5 clustering algorithms
  - distances: Bray-Curtis, Canbera, Euclidean, Kulczynsky, Manhattan
  - clustering algorithms: average linkage, beta flexible, complete linkage, single linkage and Ward
- comparison with subjective classification using Goodman-Kruskal's lambda



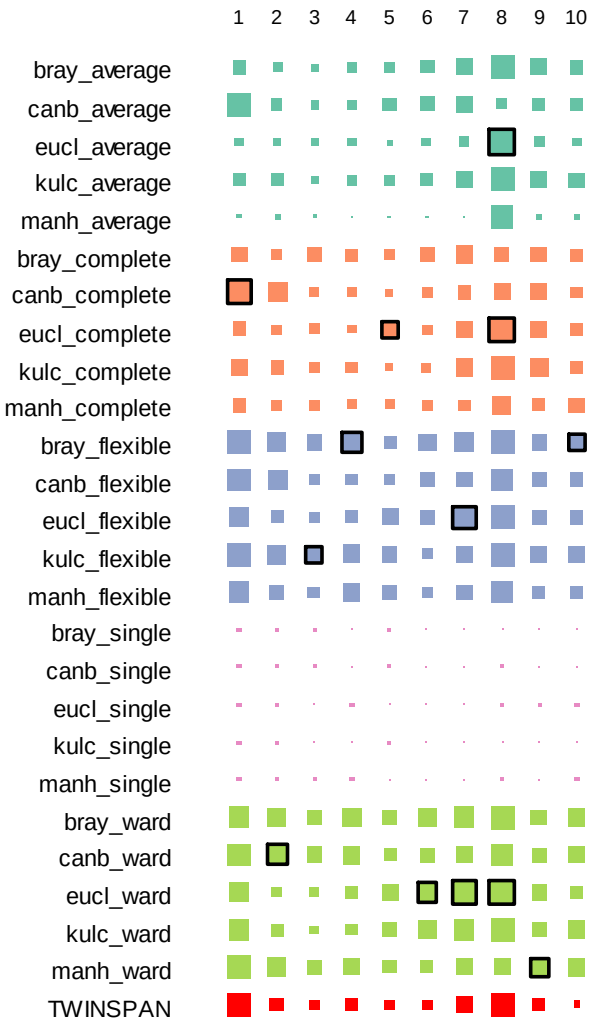
Numerical reproduction of existing vegetation associations

Results: How good are the methods in reproducing all clusters?



(sorting of methods reflects how well they reproduce overall classification)

Numerical reproduction of existing vegetation associations



Results:

How good are the methods in reproducing individual associations?

Conclusions

- it's time to say explicitly that unsupervised numerical classification is **not better** than expert-based, "subjective" one
- human brain has extraordinary ability to sense the signal in noisy data and to combine complex information
- "numerical effort" is better invested into detailed and formalized description of distinguished vegetation units to make them reproducible, instead of "cutting the feet to fit the shoes"
- unconstrained cluster analysis is a good servant, but a bad master – it's useful as an exploratory tool, but not for creating classification schema

Thank you for your attention!