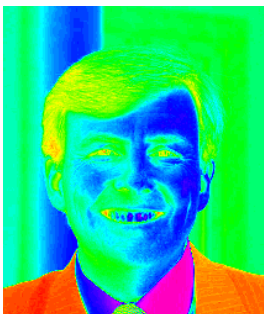
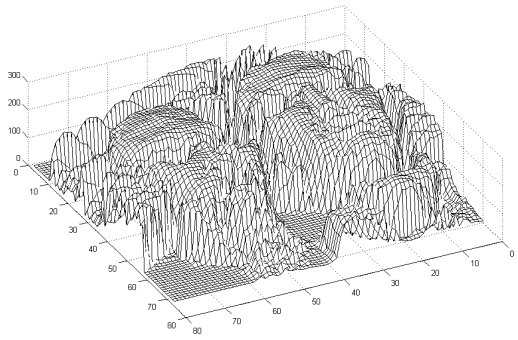
Representation & Dissimilarities

ASCI APR
Marco Loog



TU Delft
Delft University of Technology



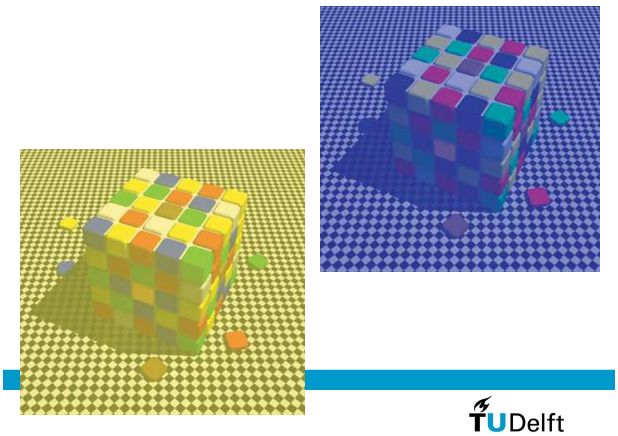
TU Delft

TU Delft

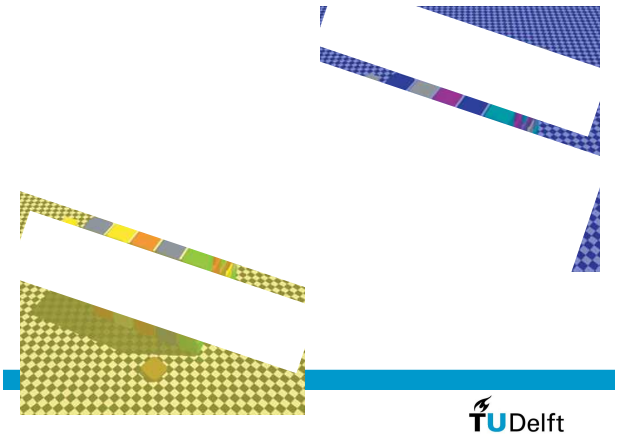
TU Delft

TU Delft

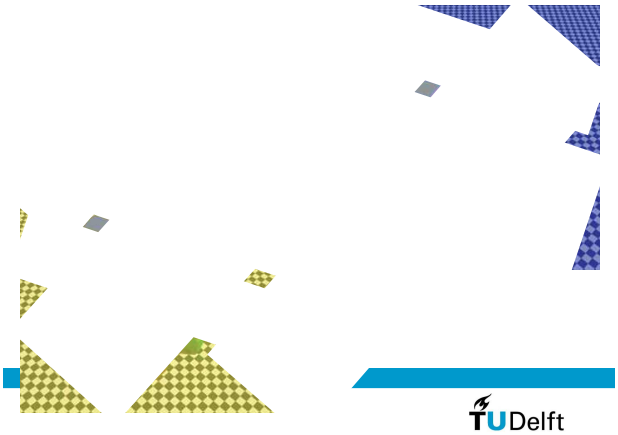
TU Delft



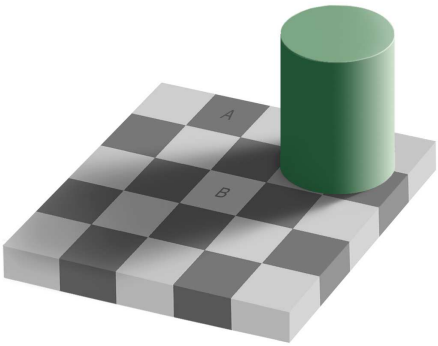
TUDelft



TUDelft



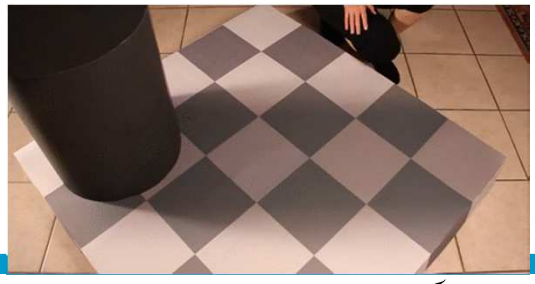
TUDelft



TUDelft

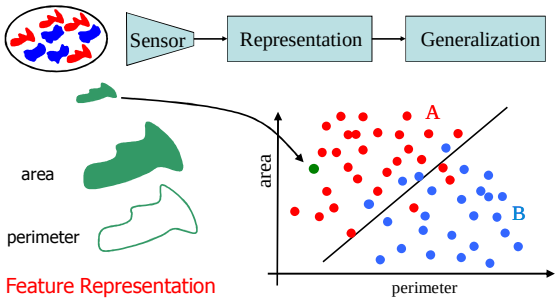
"Live" Demo

- https://www.youtube.com/watch?v=z9Sen1HTu5o



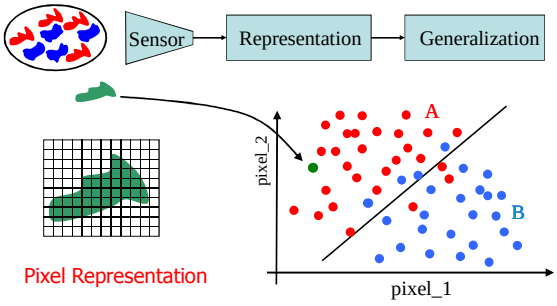
TUDelft

Pattern Recognition System



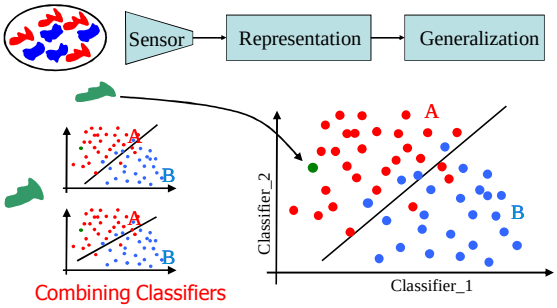
TUDelft

Pattern Recognition System



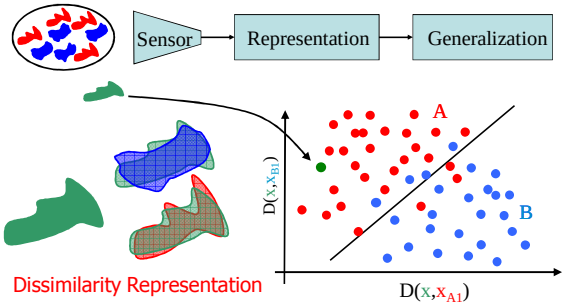
TU Delft

Pattern Recognition System



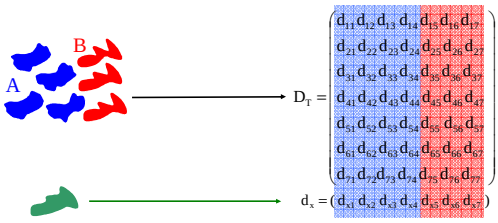
TU Delft

Pattern Recognition System



TU Delft

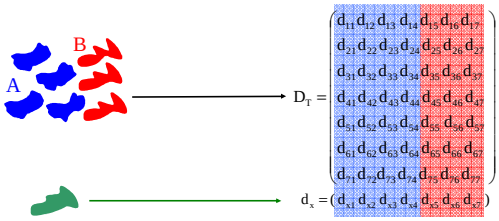
Dissimilarity Representation



- What would kNN do?

TU Delft

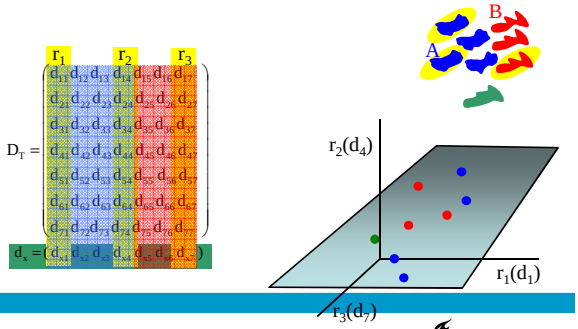
Dissimilarity Representation



- Compare with kNN
- Compare with kernels

TU Delft

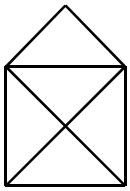
Dissimilarity Space Classification



TU Delft

Euclidean, Metric, non-Metric

- Types of dissimilarities from perspective of metrics
- Does it behave like "proper" distance?



- Definition of a metric?
- Examples of non-Euclidean metrics?
- Non-metric? Anyone?
- Mahalanobis?

TUDelft

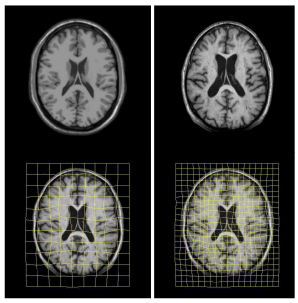
Examples of Dissimilarities

- Distances between sets : single linkage etc.
- String comparisons : edit distances
- Information-theoretic measures : e.g. Kullback-Leibler
- Time series: dynamic time warping distance
- Human judgments of similarities
- Shape distances
- Spectra, histograms : probabilistic measures, χ^2
- Features [binary, categorical, continuous], various types of distances

TUDelft

E.g. Registration-Based Classification

- Given
  - Images
  - Registration technique
  - Image labels



TUDelft

"Conclusions"

- Dissimilarity based representation is an alternative for features
  - Fits many problems rather nicely / in a natural way
  - Not clear what features to use / clear how objects relate pairwise, e.g. known distance
  - Known expert-defined measures
  - Extends kernel methods; applicable to non-Euclidean, even non-metric data
  - Important topic : representation set selection…

TUDelft

Some References

- Pekalska, E., & Duin, R. P. Foundations and Applications, World Scientific.
- Pękalska, E., Duin, R. P., & Paclík, P. (2006). Prototype selection for dissimilarity-based classifiers. *Pattern Recognition*, *39*(2), 189-208.
- Klein, S., Loog, M., et al. (2010, April). Early diagnosis of dementia based on intersubject whole-brain dissimilarities. In *Biomedical Imaging: 2010 IEEE International Symposium on* (pp. 249-252). IEEE.

TUDelft