Conference on Spatial Information Theory

COSIT 2009

Spatial Cognition of Geometric Figures in the Context of Proportional Analogies.

A. Schwering, K-U. Kuhnberger, U. Krumnack and H. Gust

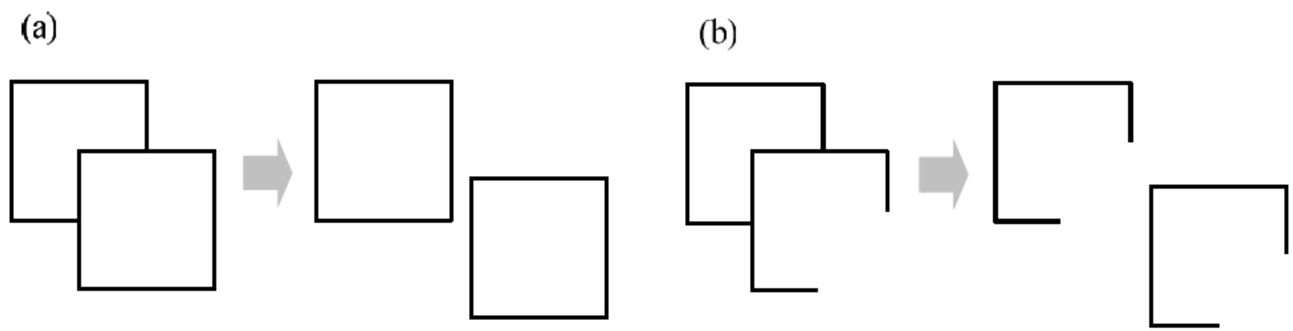


Fig. 2. The perception of a figure is influenced by its context: figure (a) is usually perceived as two complete squares one covering the other, although the covered square is only incompletely visible. In figure (b), the "covered" square is usually perceived as incomplete, because the other square (the context) is incomplete as well.

- Description of human-subject test
- Develop a computational model to solve analogies.

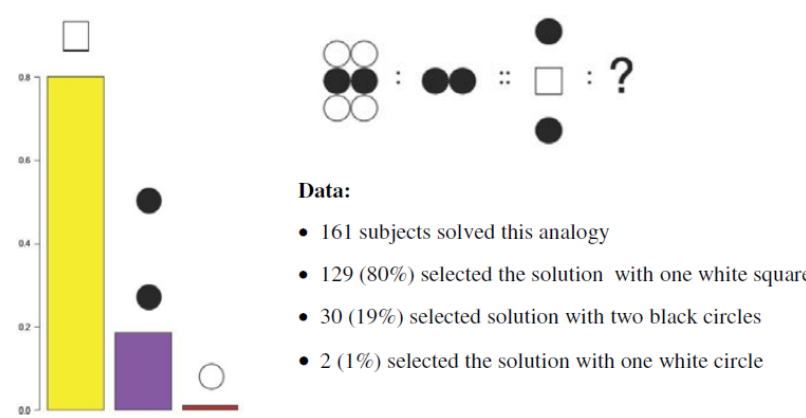


Fig. 4. The first analogy can be solved by focusing on the position of the elements or on the color. The results show that the majority of subjects preferred to keep the middle object, while several subjects chose to keep the black objects. Only two subjects selected the white circle as solution.

Spatial Cognition of Geometric Figures in the Context of Proportional Analogies.

A. Schwering, K-U. Kuhnberger, U. Krumnack and H. Gust

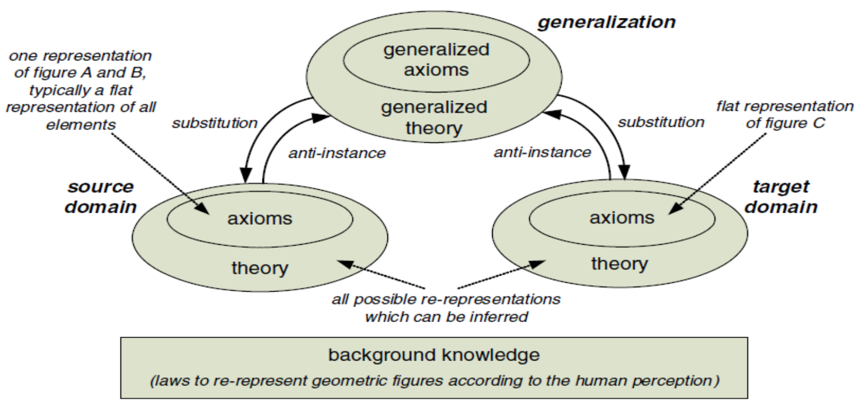


Fig. 9. Overview of the HDTP architecture

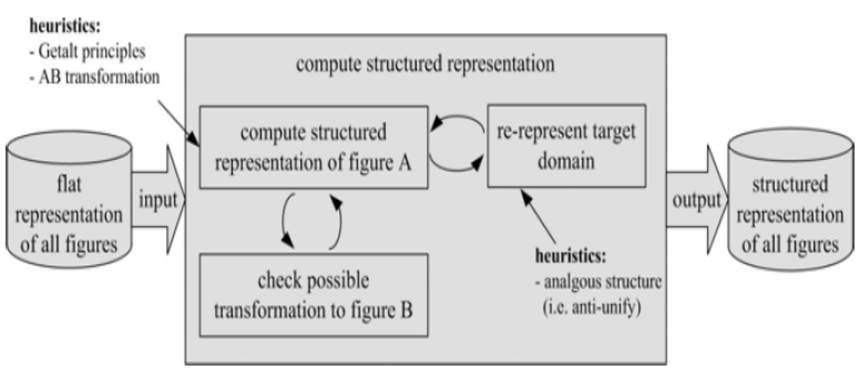


Fig. 12. Iterative process of computing the correct structured representation of the analogy

- Heuristic Driven Theory Projection HDTP
  - Construct a general theory that subsumes many common structures of target and source domains.

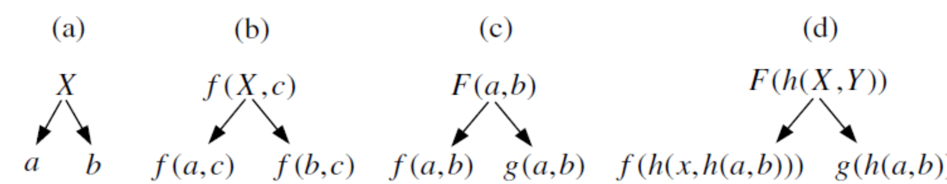


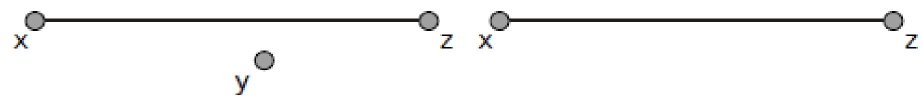
Fig. 8. Anti-unification compares two formulae and creates the least general generalization. While (a) and (b) are first-order anti-unification, (c) and (d) require second-order anti-unification to capture the common structure of the formulae.

- Results (not in the paper)
  - Applying the model to the experiments results showed ~ 80% of accuracy in obtaining the most common selected analogy.

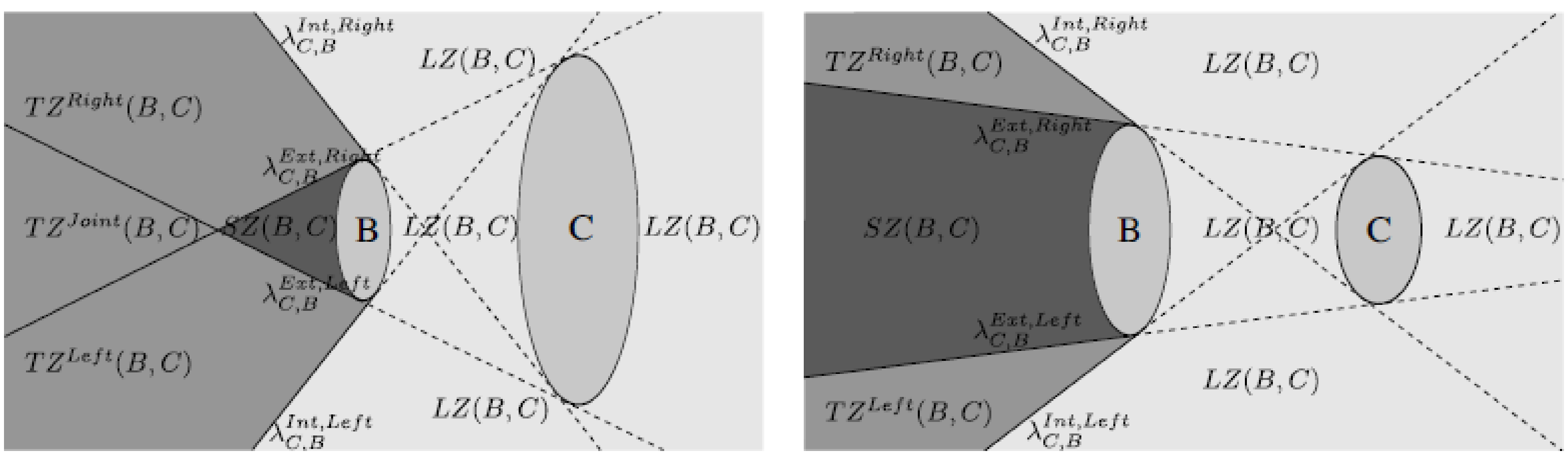
A Qualitative Approach to localization and Navigation based on Visibility Information

P.Fogliaroni, J. Wallgrun, E. Clementi, F. Tarquini and D. Wolter

- Method for creating a topological map based on the sensor's input, in a qualitative manner without exact coordinates.



(a) $Visible(x, y, z)$ (b) $Occluded(x, y, z)$



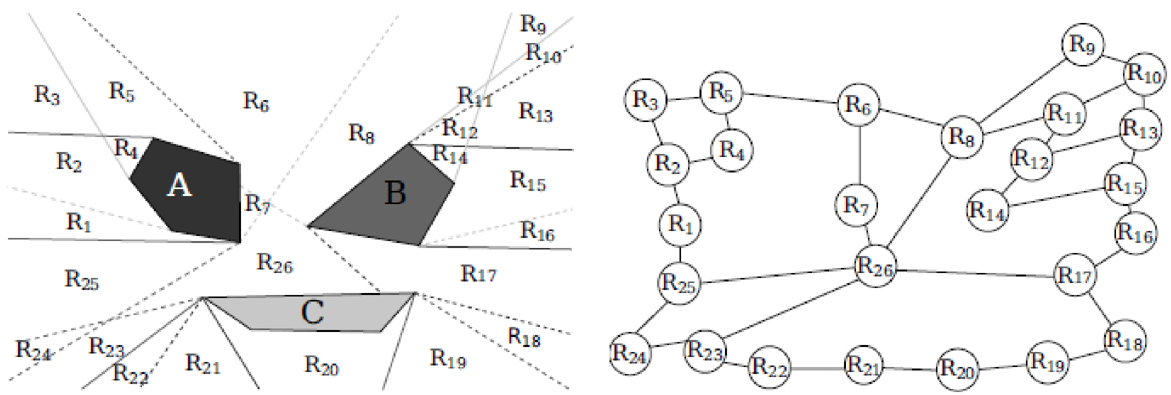
(a) Limited $ShadowZone$ (b) Unlimited $ShadowZone$

$$
\begin{aligned}
Visible(A, B, C) &\iff A \subseteq LZ(B, C) \\
PartiallyVisible^{Left}(A, B, C) &\iff A \subseteq TZ^{Left}(B, C) \\
PartiallyVisible^{Right}(A, B, C) &\iff A \subseteq TZ^{Right}(B, C) \\
PartiallyVisible^{Joint}(A, B, C) &\iff A \subseteq TZ^{Joint}(B, C) \\
Occluded(A, B, C) &\iff A \subseteq SZ(B, C)
\end{aligned}
$$

A Qualitative Approach to localization and Navigation based on Visibility Information

P.Fogliaroni, J. Wallgrun, E. Clementi, F. Tarquini and D. Wolter

- Creation of topological map:
  - Division of space based on visibility model.



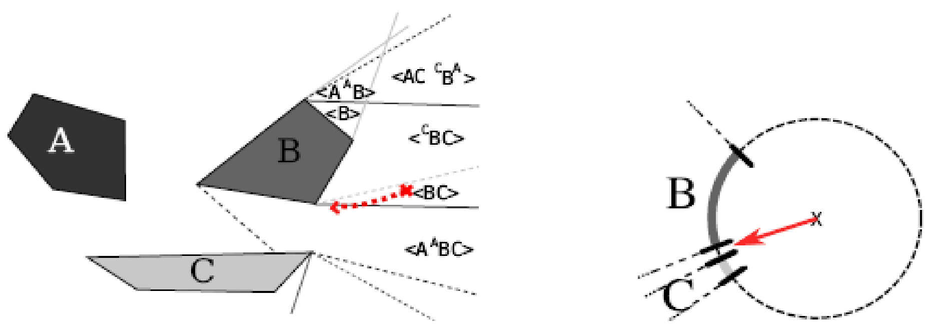
(a) Space subdivision (b) Topological map

Fig. 3. The subdivision and topological map based on the visibility model

A Qualitative Approach to localization and Navigation based on Visibility Information

P.Fogliaroni, J. Wallgrun, E. Clementi, F. Tarquini and D. Wolter

- Topological map can be created automatically, while the agent explores the territory:



(a) (b)

$$PartiallyVisible^{Right}(a,B,C) \Rightarrow C \cap LZ(B,a) \neq \emptyset \wedge C \cap SZ(B,a) \neq \emptyset$$

$$Visible(a,B,A) \Rightarrow Visible(A,B,a)$$
$$Visible(a,C,A) \Rightarrow Visible(A,C,a)$$
$$Visible(a,A,B) \Rightarrow Visible(B,A,a)$$
$$Visible(a,C,B) \Rightarrow Visible(B,C,a)$$
$$Visible(a,A,C) \Rightarrow Visible(C,A,a)$$
$$Occluded(a,B,C) \Rightarrow Occluded(C,B,a)$$

Case Based Reasoning for Eliciting the evolution of Geospatial Objects.

J.S. Motta, G. Camara, M.I. Sobral, O. Bittencourt, L.M. Garcia and L.Vinas

- Automated approach for describing how geospatial objects evolve.

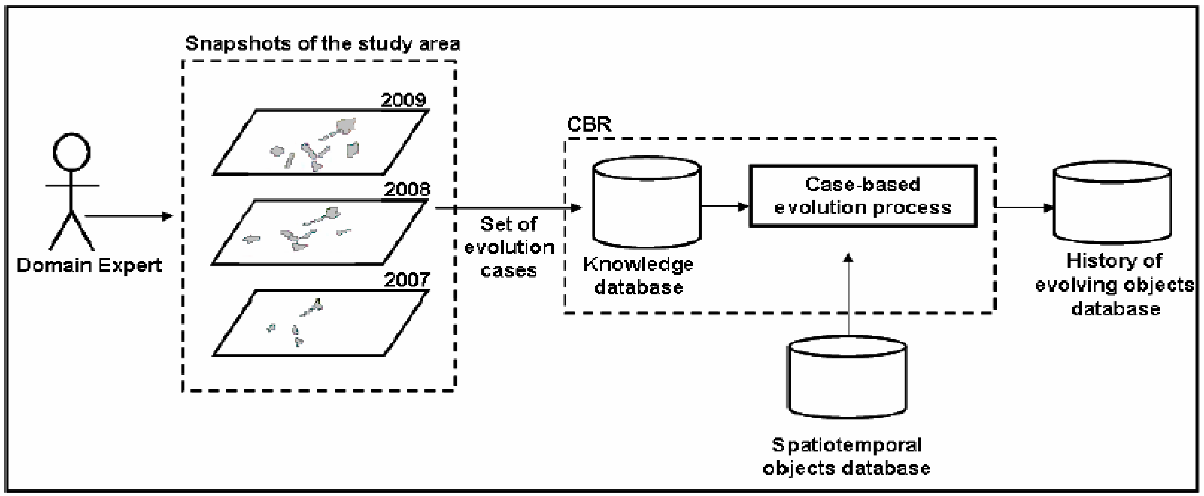


Fig. 3. General view of CBR method for eliciting geospatial objects evolution

Challenges:

- Objects history can be describe using creation, merging and splitting **BUT** these operations should take into account the type of geospatial object.
  - Ex:
    - Merging two parcels -> parcel
    - Merging a street and a parcel -> Expanding the street

Case Based Reasoning for Eliciting the Evolution of Geospatial Objects.

J.S. Motta, G. Camara, M.I. Sobral, O. Bittencourt, L.M. Garcia and L.Vinas

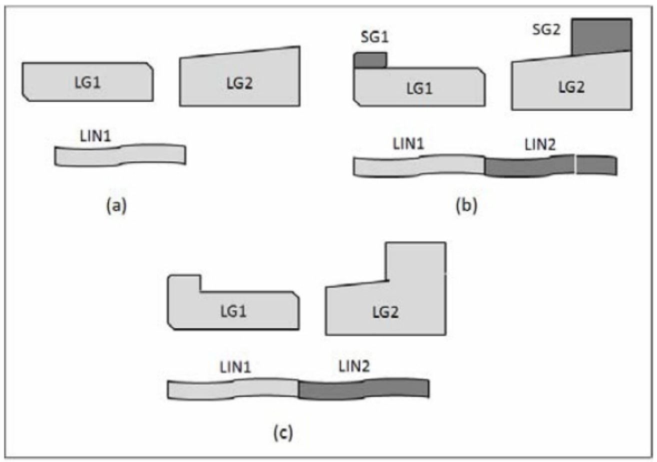
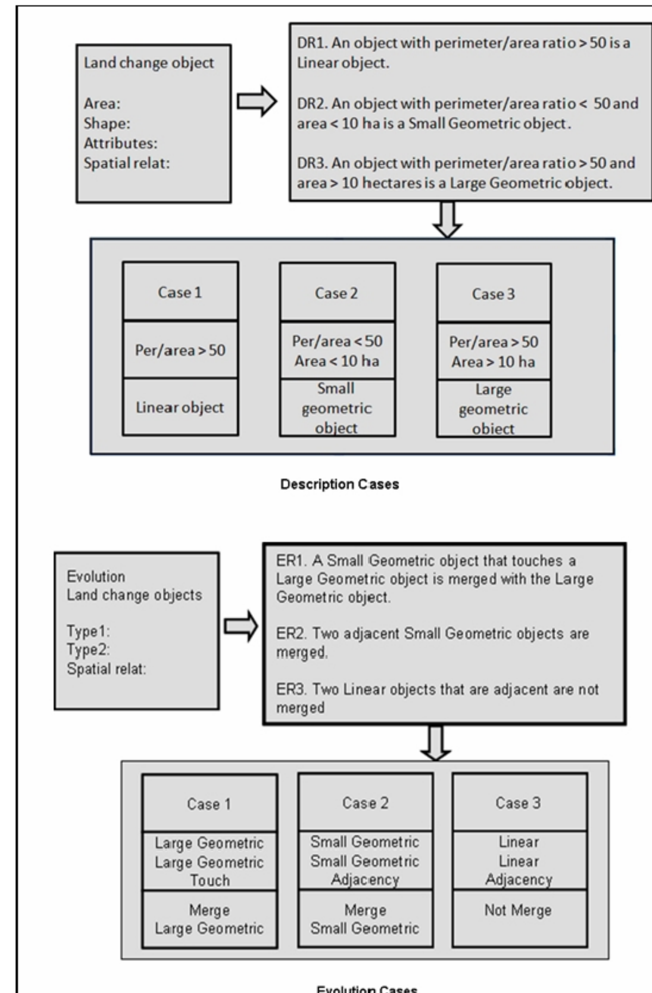


Fig. 4. Evolution of prototypical land change objects: (a) Time T1; (b) Time T2 before application of description rules; (c) Time T2 after application of evolution rules

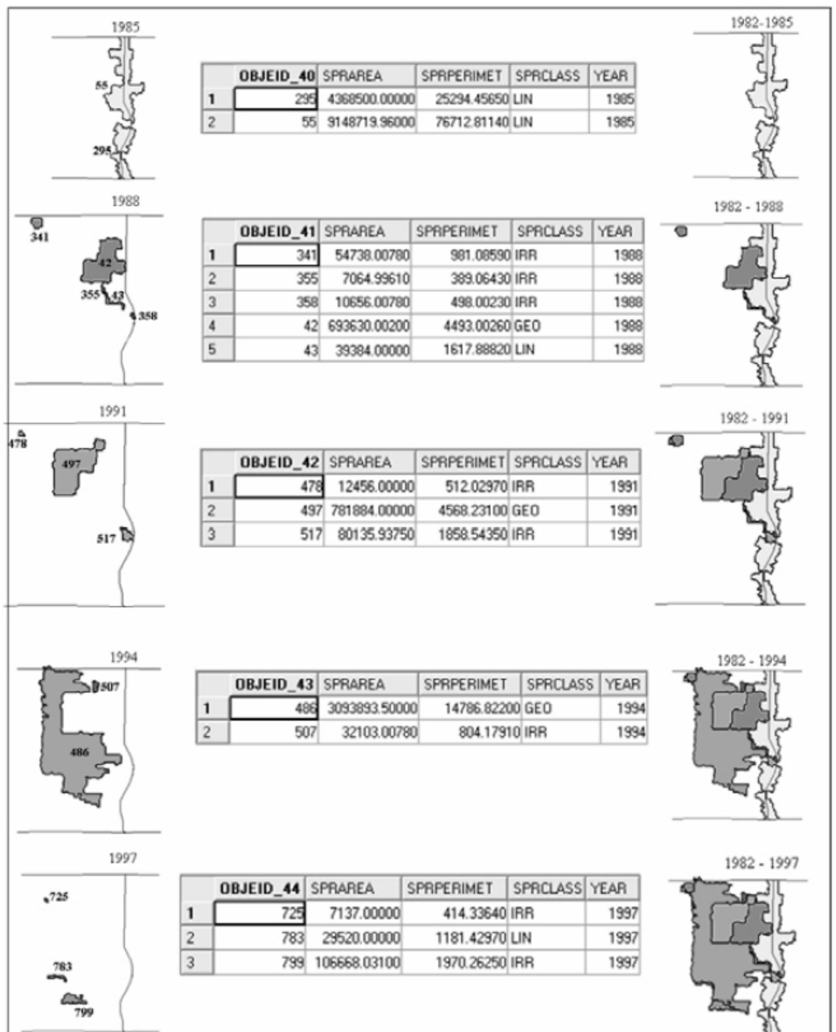


1. Let T = 1.
2. Take the objects from time T from the Geospatial Objects Database. Describe these objects according to the Description Cases Database. Store the results in the Typed Geospatial Objects Database.
3. Take the objects from time T+1 from the Geospatial Objects Database. Describe these objects according to the Description Cases Database. Store the results in the Typed Geospatial Objects Database.
4. Compare the objects of times T and T+1 using the Evolution Cases Database. Evolve the objects if possible. Store the results in a History Objects Database.
5. If there are further snapshots in the Geospatial Objects Database, make T = T+1 and go to step 2 above. Otherwise, exit the program.

Case Based Reasoning for Eliciting the Evolution of Geospatial Objects.

J.S. Motta, G. Camara, M.I. Sobral, O. Bittencourt, L.M. Garcia and L.Vinas

- Case study: Deforestation in Brazilian Amazonia



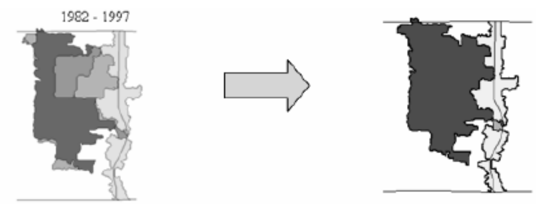
	OBJEID_40	SPRAREA	SPRPERIMET	SPRCLASS	YEAR
1	295	4368500.00000	25294.45650	LIN	1985
2	55	9148719.96000	76712.81140	LIN	1985

	OBJEID_41	SPRAREA	SPRPERIMET	SPRCLASS	YEAR
1	341	54738.00780	981.08590	IRR	1988
2	355	7064.99610	389.06430	IRR	1988
3	358	10656.00780	498.00230	IRR	1988
4	42	693630.00200	4493.00260	GEO	1988
5	43	39384.00000	1617.88820	LIN	1988

	OBJEID_42	SPRAREA	SPRPERIMET	SPRCLASS	YEAR
1	478	12456.00000	512.02970	IRR	1991
2	497	781884.00000	4568.23100	GEO	1991
3	517	80135.93750	1858.54350	IRR	1991

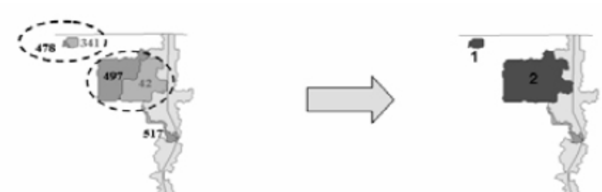
	OBJEID_43	SPRAREA	SPRPERIMET	SPRCLASS	YEAR
1	486	3093893.50000	14786.82200	GEO	1994
2	507	32103.00780	804.17910	IRR	1994

	OBJEID_44	SPRAREA	SPRPERIMET	SPRCLASS	YEAR
1	725	7137.00000	414.33640	IRR	1997
2	783	29520.00000	1181.42970	LIN	1997
3	799	106668.03100	1970.26250	IRR	1997



Report Object's History

New Object	Father's Object 1	Type	Year	Father's Object 2	Type	Year	Result	New Area	Year
10	9	Concentration	1997	799	Small Lot	1997	Concentration	4858478,5447	1997
9	8	Concentration	1997	783	Small Lot	1997	Concentration	4751810,5137	1997
8	7	Concentration	1994	725	Small Lot	1997	Concentration	4722290,5137	1997
7	6	Concentration	1994	1	Small Lot	1991	Concentration	4715153,5137	1994
6	5	Concentration	1994	4	Concentration	1994	Concentration	4647959,5059	1994
5	2	Concentration	1991	507	Small Lot	1994	Concentration	1507617,0098	1994
4	3	Concentration	1994	43	Small Lot	1988	Concentration	3140342,4961	1994
3	486	Concentration	1994	355	Small Lot	1988	Concentration	3100958,4961	1994
2	42	Concentration	1988	497	Concentration	1991	Concentration	1475514,002	1991
1	478	Small Lot	1991	341	Small Lot	1988	Small Lot	67194,0078	1991

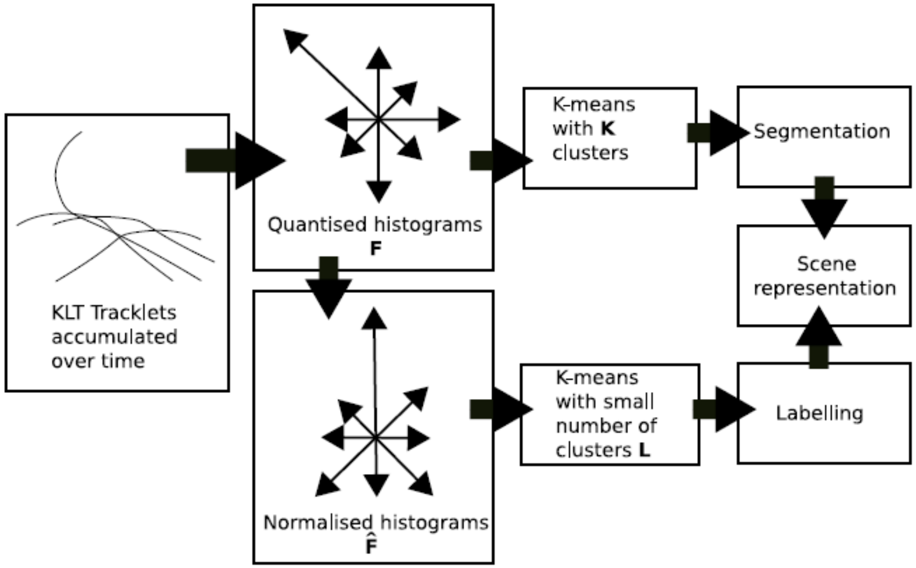


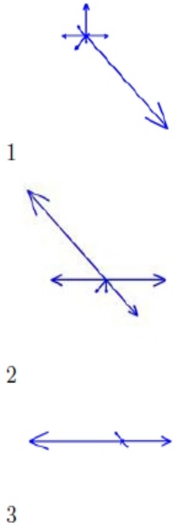
object 478 (1991) merge with object 341(1988) – Rule ER3
object 497 (1991) merge with object 42 (1988) – Rule ER1
object 517 don't merge – Rule ER2

Scene Modelling and Classification Using Learned Spatial Relations.

H.M. Dee, D.C. Hogg and A. Cohn

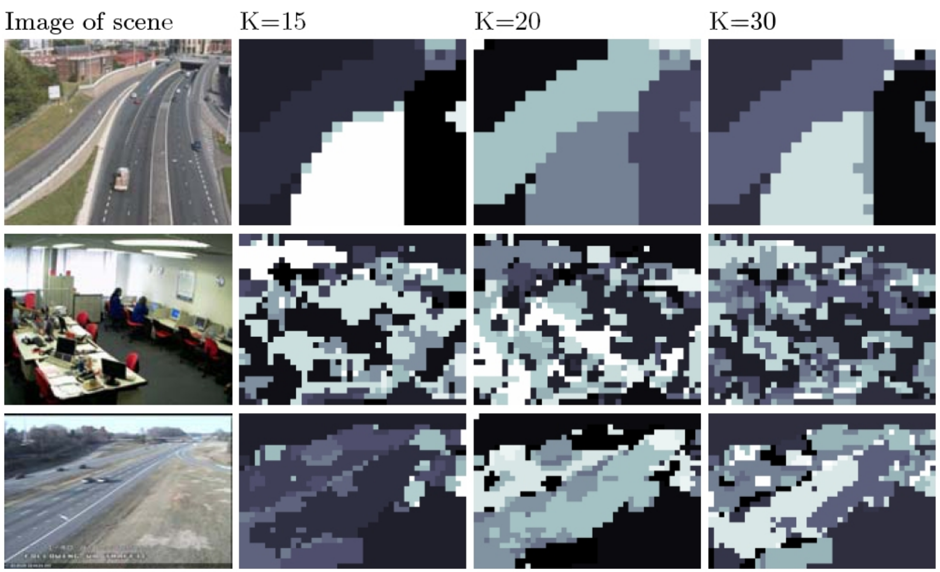
- Model the variation motion pattern on videos to determine similar behaviors.
- Tracking done using KLT.



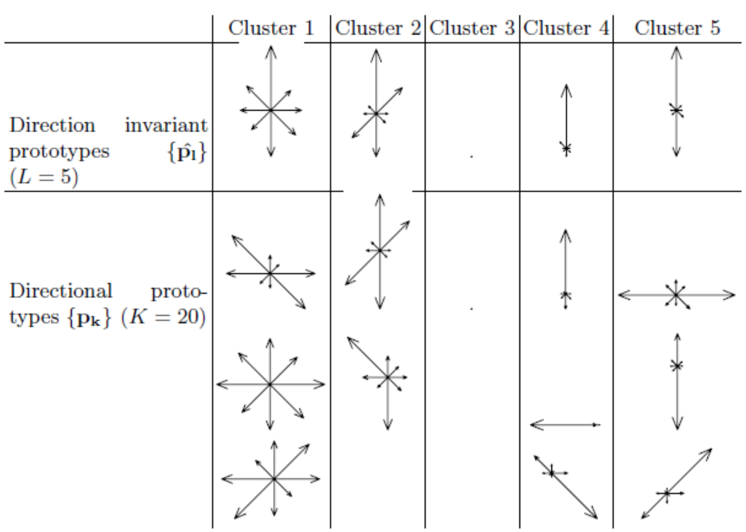


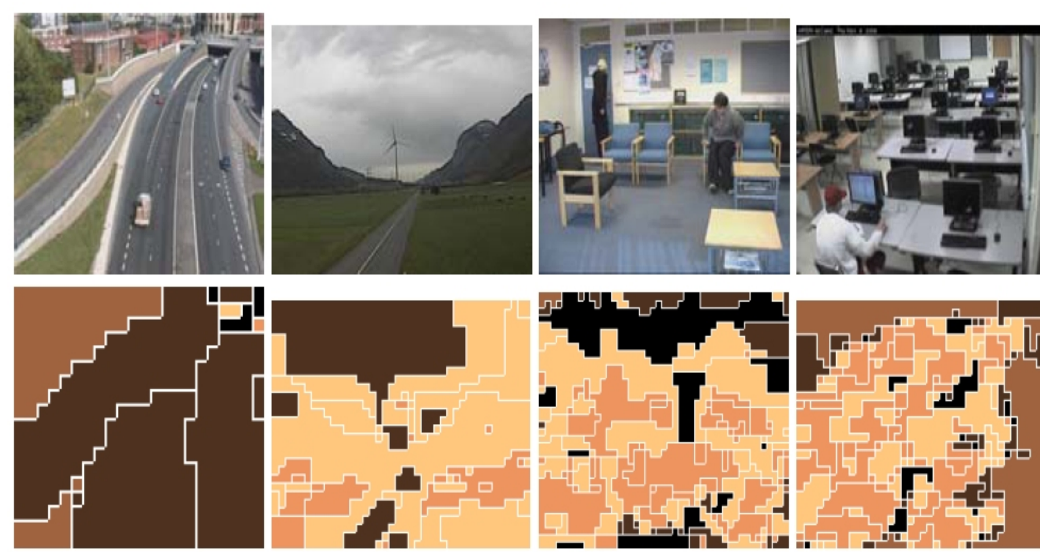
Scene Modelling and Classification Using Learned Spatial Relations.

H.M. Dee, D.C. Hogg and A. Cohn



- Give a model of the scene in terms of types of motions.
- Capture similar movements in different directions





Scene Modelling and Classification Using Learned Spatial Relations.

H.M. Dee, D.C. Hogg and A. Cohn

- See how regions of different classes are found together -> learn spatial relations from the set of learned regions.

- Evaluation:

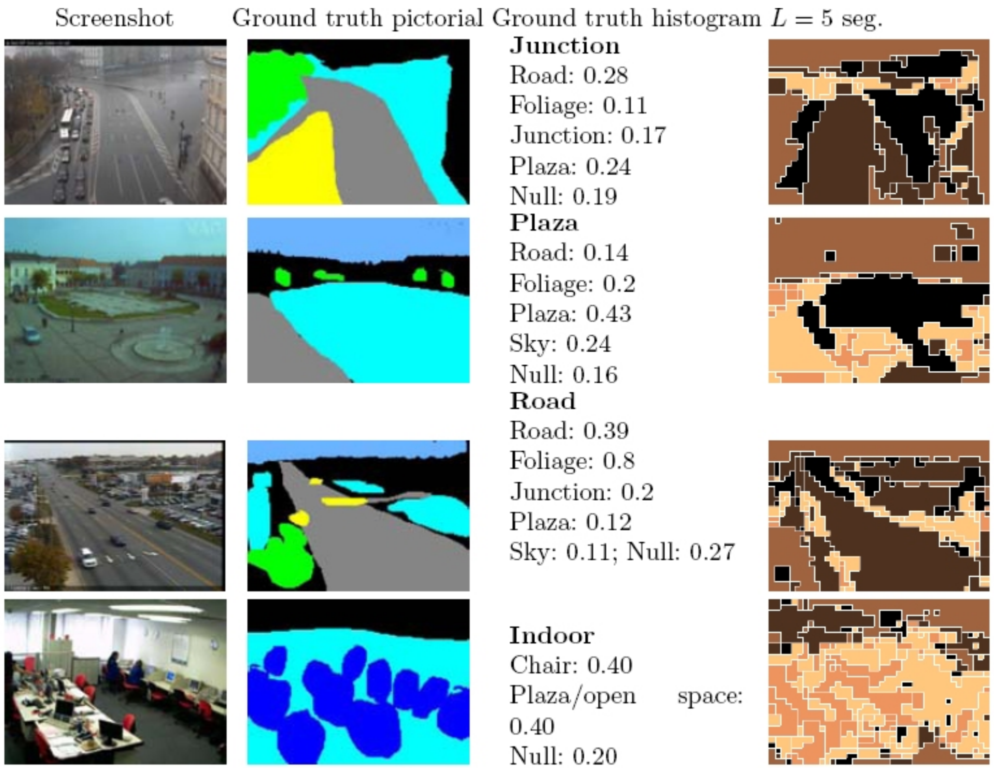


Fig. 9. Pictorial (column 2) and histogram (column 3) ground truth shown alongside segmentations and screen shots for sample scenes. The histogram ground truth is represented as text with empty categories omitted for space reasons. The top row shows a scene classed "junction", but the junction part of the scene comprises 17%, and the video also includes elements of road and plaza. This shows that single-class ground truth must be an approximation.

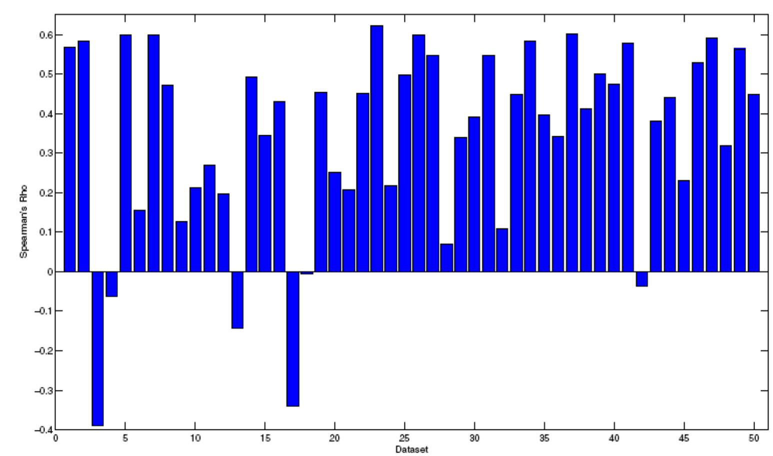


Fig. 12. Correlation results between rankings derived from histogram ground truth and rankings derived from spatial relationships using $L = 10$