

Deriving place graphs from spatial databases

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- Human place knowledge vs spatial databases / maps
 - e.g., The Convention Centre is on the south bank of the Karrawirra Parri, near the InterContinental.
- Place graphs:

An abstract representation of human place knowledge





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Maria Vasardani, Sabine Timpf, Stephan Winter, and Martin Tomko. From descriptions to depictions: A conceptual framework. In Thora Tenbrink, John G. Stell, Antony Galton, and Zena Wood, editors, *Spatial Information Theory*, volume 8116 of *Lecture Notes in Computer Science*, pages 299–319. Springer, 2013. ISBN 978-3-319-01789-1.



Introduction

- Analysing place descriptions / applying place graphs:
 - Extracting landmarks
 - Creating sketch maps
 - Answering place questions
- e.g., Answering place questions:
 - "Where is Faro in Portugal?"
 - Disambiguation and analysis
 - e.g., <Faro, in, Portugal>
 - Answering in natural language
 - e.g., "In the southern part of Portugal"





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- Extraction of human place knowledge for Question-Answering
- Place graphs currently created from collecting place descriptions
 - difficult to collect / sparse
- Complementary approaches needed





Hypothesis and Questions



- Hypothesis:
 - Place graphs can be generated from information stored in spatial databases.

- Research questions:
 - What are the cognitive factors in human place descriptions?
 - How to generate place graphs from spatial databases?



Method





- Cognitive factors:
 - Hierarchical structure in human cognitive map and natural language place descriptions
 - Human short memory capacities (seven plus/minus two)
- Supporting:
 - Only polygons
 - Cardinal directions and topological relationships



Daniela Richter, Stephan Winter, Kai-Florian Richter, and Lesley Stirling. Granularity of locations referred to by place descriptions. Computers, Environment and Urban Systems, 41:88-99, 2013. George A Miller. The magical number seven, plus or minus two: some limits on our capacity for processing information. Psychological Review, 63(2):81, 1956.



- Extracting hierarchical structure:
 - Containment relationships (a topological relation)
 - Based on the point in polygon algorithm





- Updating hierarchical structure:
 - Similar to human cognitive map
 - Quad-tree strategy
 - Dividing the polygon into four meaningful partition





- Extracting qualitative spatial relationships:
 - Between the sibling nodes
 - Cardinal directions and topological relationships







Implementation and Results







Experiments





• #Nodes and #Edges compared to fully connected graph





Conclusions





- Conclusions:
 - Deriving place graphs from spatial databases
 - A complementary approach to generating place graphs from NL place descriptions
 - Designed based on cognitive factors
 - Evaluated regarding the fully connected approach (baseline)
- Future work:
 - Supporting more relationships
 - Relative directions (e.g., left of)
 - Distance relationships (e.g., near)
 - Supporting points and linear features



Thanks

