An Approach to Qualitative Emergency Management

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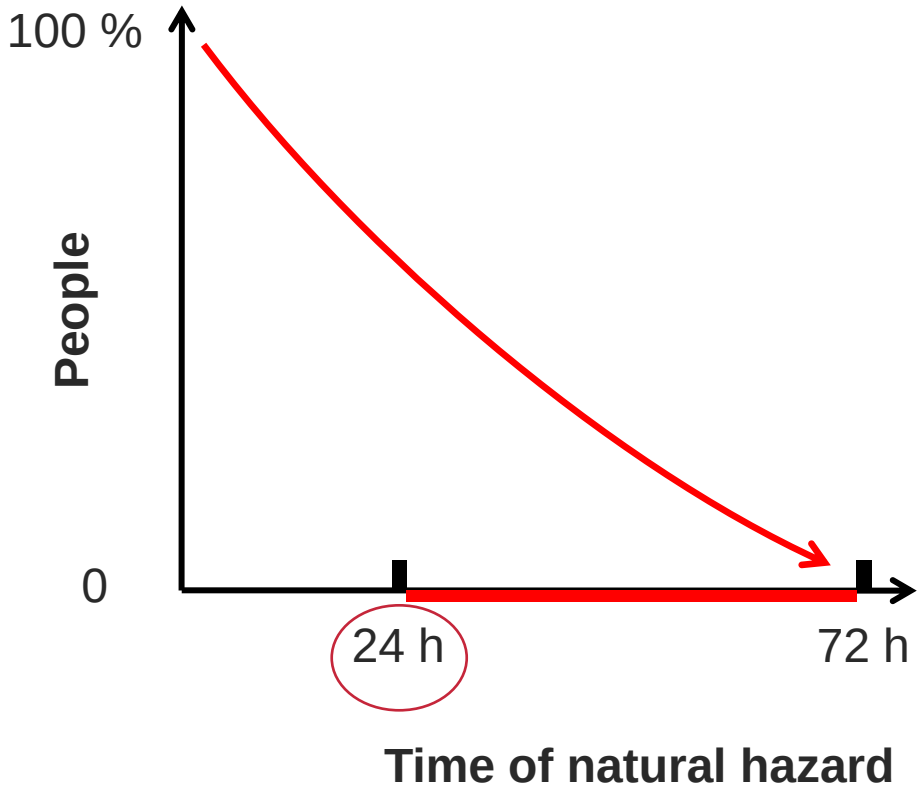
The effect of strong natural hazard



Introduction

- Current Emergency Management Systems:
  - Huge amount of spatial data.
  - Quantitative format (raster and/or vector formats)

- Users or Emergency Managers (EMs):
  - Description of situations by qualitative spatial terms
  - Usage of (linguistic) spatial concepts:
    - inaccurate
    - ambiguous
    - vague

Introduction

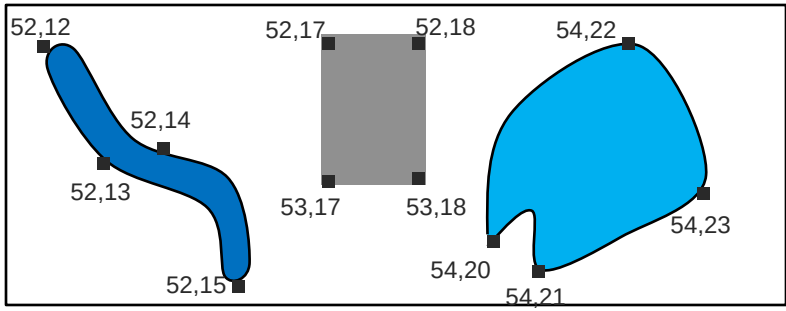
I need a **building *near*** a **riverbank**

I need **building *left*** of lake

I need a **building *disjoint*** a **riverbank**

gap

?



Emergency manager

Emergency management system

Qualitative descriptions

Qualitative spatial layer

gap

?

Qualitative spatial layer

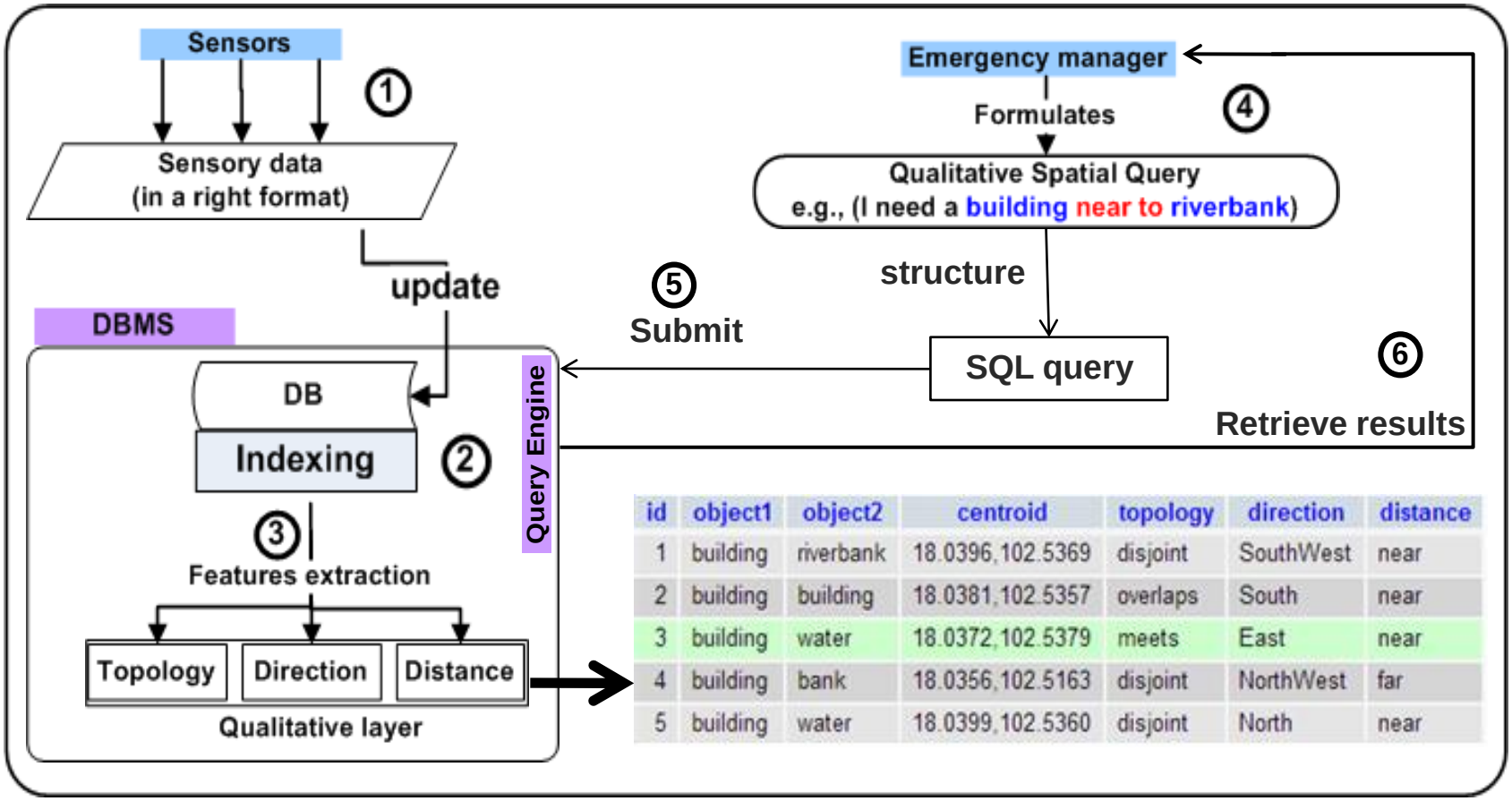
Quantitative data

Geospatial database

A Framework for Qualitative Emergency Management

- Goal:
  - Overcomes the limitations of the current GIS or EMS.
- Approach:
  - Translation of qualitative descriptions of users into geospatial queries.
  - Visualisation of query results to emergency managers
- Intuitive interface to query Geo-Spatial databases using qualitative terms (e.g., left, and near).

Qualitative Emergency Management System (QEMS)



id	object1	object2	centroid	topology	direction	distance
1	building	riverbank	18.0396,102.5369	disjoint	SouthWest	near
2	building	building	18.0381,102.5357	overlaps	South	near
3	building	water	18.0372,102.5379	meets	East	near
4	building	bank	18.0356,102.5163	disjoint	NorthWest	far
5	building	water	18.0399,102.5360	disjoint	North	near

Abstraction (Qualitative Spatial Representations)

- Essential:

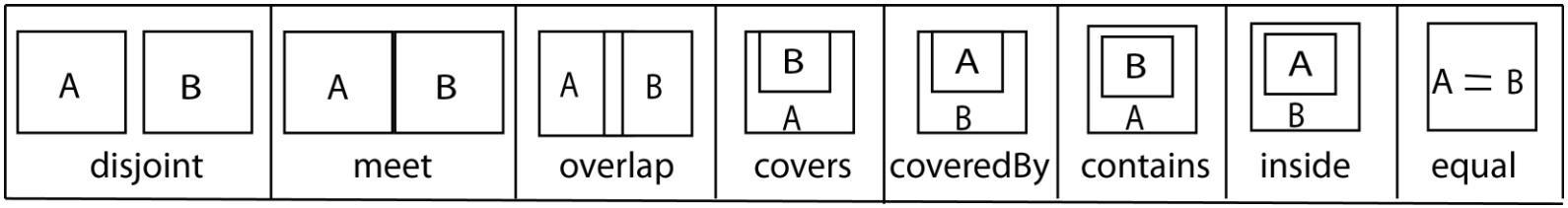
  which kinds of spatial relations need to be represented?

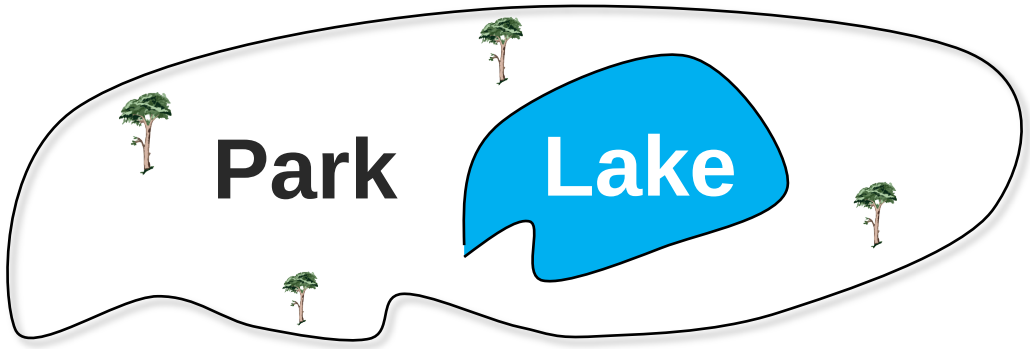
- Qualitative dimensions:
  - Topology (e.g., disjoint ,and overlap)
  - Direction
    - Absolute (e.g. north, east)
    - Relative (e.g., left, and right)
  - Distance (e.g., near, and far)

Topology

- 9-intersection model:

  8 binary relations for pairs of simple (convex) regions without holes.

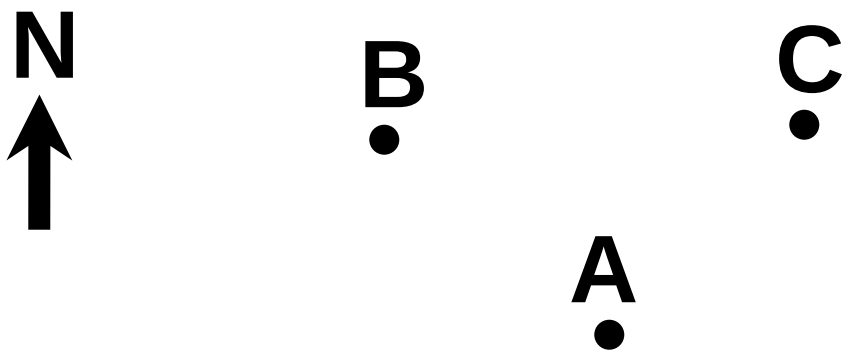




Park contains Lake

Direction

- Cardinal Directions (for point objects)



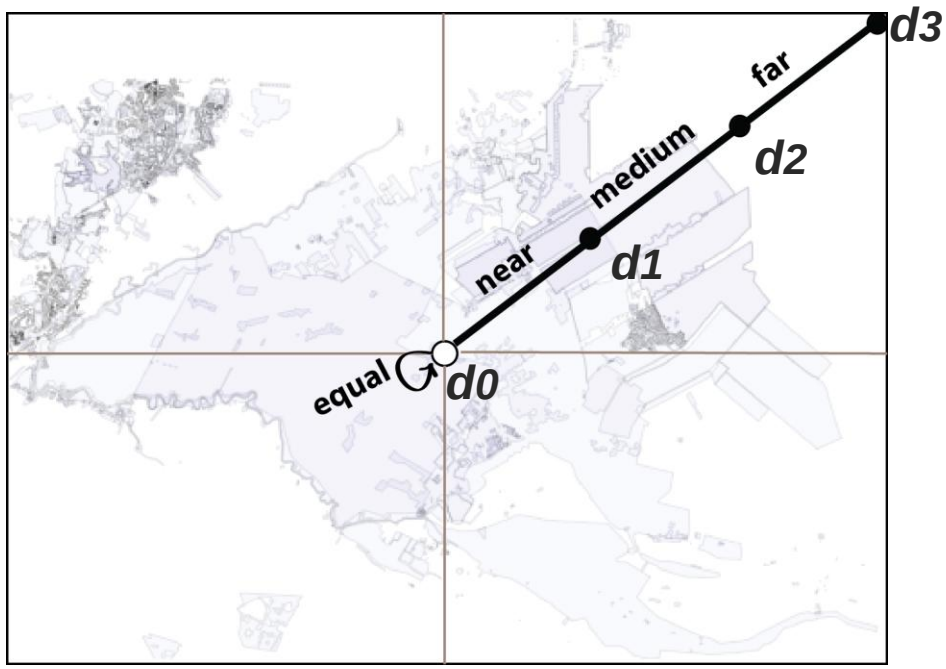
B {[NW]} A and C {[NE]} A

- Cardinal directions model for extended objects (CDC).

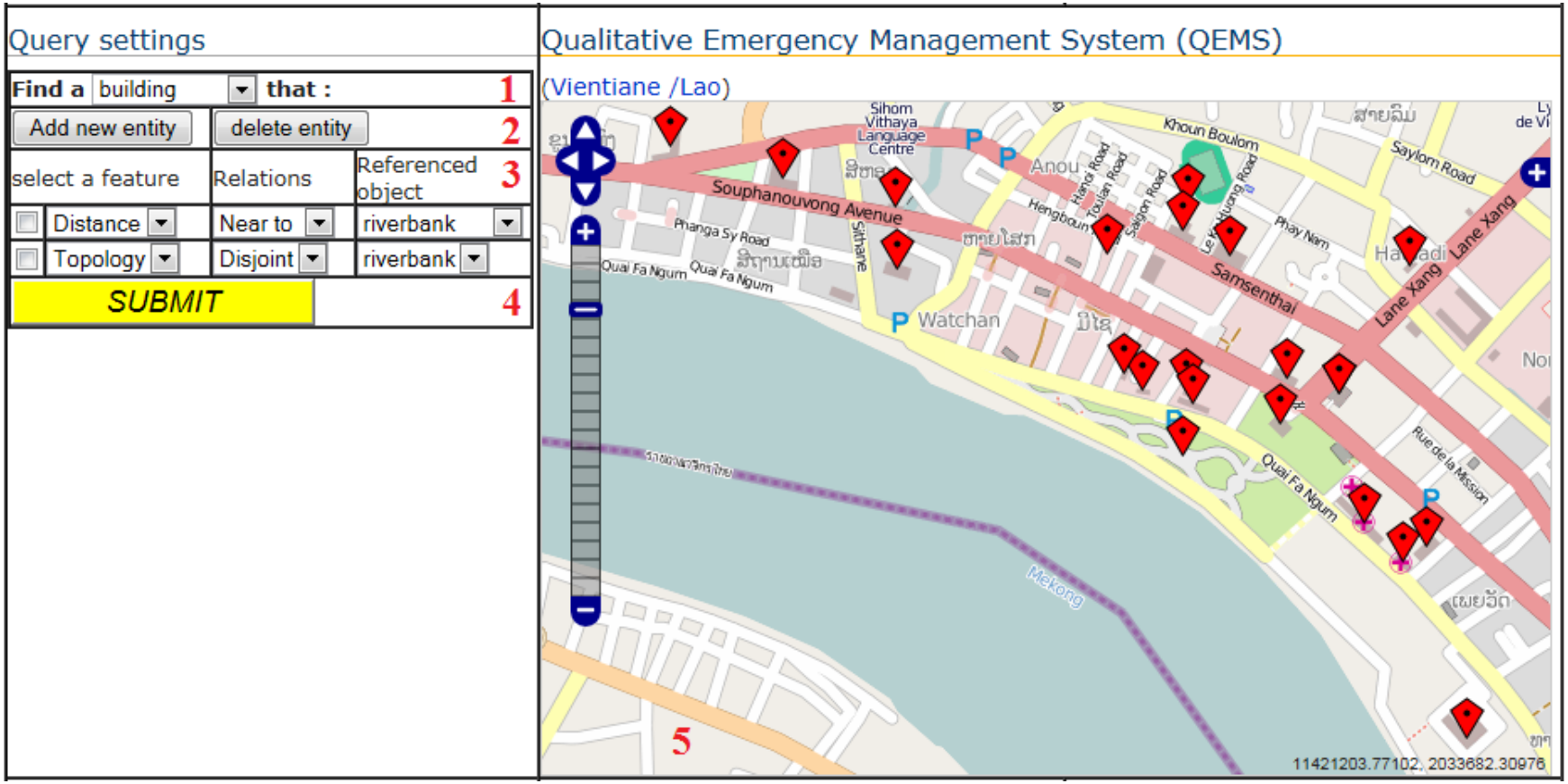
Distance

- Absolute distance model:

  4 binary relations: equal, near, medium, and far
- Basis: Minimum Bounding Box (MBB).



Applications



A snapshot of the graphical user interface of the QEMS, showing the result for the query "**buildings near the riverbank**, but not directly at the riverbank"

Summary

- High demands for querying geospatial databases qualitatively and intuitively.
- Current GIS are not able to handle these demands
- A system that makes the retrieval of geospatial database easier and more intuitive.
- Qualitative Layer：
  - Abstraction of three qualitative dimensions
    - Topology
    - Direction, and
    - Distance
- Matching of qualitative descriptions/queries with geospatial databases by means of Qualitative Spatial Relations.

Cognitive Systems (University of Bremen)

21 Researchers (AI, math, psychology, engineering)

http://cosy.informatik.uni-bremen.de/ cognitivesystems

http://capacitylab.org/ CapacityLab

Thanks for your attention

Questions?