Topological relationships between spatio-temporal history of moving points in a primitive space

Pierre Hallot
Geomatics Unit
University of Liège
Outline

• Background and motivations
• Spatio-temporal relationships in a temporal space
• Spatio-temporal relationships of two static points in a 1D space
• Generalization of relationships in a primitive space
• Example of use
• Spatio-temporal relationships of two moving points in a 1D space
• Conclusion and further research
Background and motivations

- Thesis research
- Spatio-temporal reasoning
- Data acquisition techniques (e.g. on-board GPS)
- Spatio-temporal data
- Not yet standard spatio-temporal functionalities
- Increase of complexity when considering time
- Difficulty of representation
Spatio-temporal relationships in a temporal space

• **Temporal space:**
  Representation in a common framework of temporal (Allen’s time intervals) and spatial (topological) relationships.

2D Temporal space

3D Temporal space
Spatio-temporal relationships in a temporal space

Crossing relationships

- $i_A$ overlaps $i_B$
- $r_A$ meets $r_B$
- $r_A$ disjoint from $r_B$
- $i_A$ starts $i_B$
Static points in a 1D space

Possible spatial topological relationships between two points in a 1D space

1D linear space

- disjoint
- equal
Static points in a 1D space

Temporal relationships:
« i_A overlaps i_B »

Spatial relationship:
« r_A equal r_B »

Spatio-temporal history of point A
Spatio-temporal history of point B
Generalization in a primitive space

Primitive space

« Disjoint »
Topological relationships in a primitive space

Spatio-temporal relationships in a temporal space

Time

Space

Spatio-temporal relationships in a temporal space
Example of use

Real world

Road (1D space)

Temporal space

Temporal relationships: « Contains »

Spatial relationships: « Equal »

Primitive space

Relationships: « Contain »

Black ice risk.

Real world

Road (1D space)
Moving points in a 1D space

Working hypothesis

A instantaneous movement
B no continuous movement
C go back in the past
Moving points in a 1D space
Impossible topological relationships between two spatio-temporal histories

Moving points in a 1D space
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Conclusion and further research

• Description of all spatio-temporal relationships between two static points in a 1D space.
• Generalization in a primitive space.
• Description of all topological relationships between two spatio-temporal history of two moving points.

• Possible way of simplification for spatio-temporal analysis.

• Extension of the to regions, …
• Use of more descriptive relationships than the topological ones.
• Test of pertinence on remaining information after generalization.
Thanks for attention.

Questions ?