Spatio-Temporal States

Spatio-temporal (S-T) evolutions of objects can be rather complex, it is not limited to sharing or not sharing common place during given time interval. Questions like existence, appearance, presence ... occur. What is the “spatio-temporal status” of a baby before his birth (a)? Is a key still present when in a pocket (b)? When does a person start to exist for a bank (c)?

A new representation of relationships between objects is presented. It gathers notions of existence, presence and spatial interaction between two objects at a given time into a concept called “spatio-temporal states”. A “S-T state” is defined as a particular relationship between two objects at a given time. The model is currently developed for point objects only.

A set of ten spatio-temporal states is constructed using basic topological relationships and binary properties of presence and existence.

Reasoning on S-T States

S-T states compose a jointly exhaustive and pairwise disjoint set of relationships. They can be organised as decision tree.

A conceptual neighbourhood diagram can be sketched from S-T States set.

Life and Motion Configuration Generation

An infinite number of spatio-temporal histories exists. Formalizing S-T histories with successive S-T states leads to a finite set of Life and Motion Configurations (LMC).

Life and Motion Configuration (A,A,B)

S-T histories with same properties of spatial relation, presence and existence will be formalized in a same Life and Motion Configuration.

Life and Motion Configuration (A,A,A,B)

d, e, d

disparate position

Equal position

disparate position

degenerated space

degenerated space

degenerated space

degenerated space

degenerated space

degenerated space

degenerated space

degenerated space

Life and Motion Configuration Application

Reasoning on LMC provides important information on each similar situation. Three crime mapping examples of S-T relationships between a murderer (blue) and his victim (red) are presented.

These S-T histories present a spatio-temporal meeting, the victim escapes his murderer. These relations could be retrieved with LMC with a (d,e,d) form.

This shows a spatio-temporal interception, the murderer kills his victim. LMC with (BA) just after (e) shows this relation.

Information is provided from analysed area (grey box) where the murderer is tracked. The victim exists but is not present at first. LMC manages this property with the absence sign (A).

These examples show the usefulness of the Life and Motion Configurations constructed on basic operators of topology extended with concepts of presence and existence to reason on spatio-temporal situations.