Reasoning on the Patterns of Spatial Arrangements between a Path and a Region-Like Landmark

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Research Goal

We develop a foundation of spatial reasoning on the patterns of path-landmark arrangements modeled by RfDL_{3-12}.

What is RfDL_{3-12}?

- The finest model in the RfDL model series [1], which consists of eight models that categorize the spatial arrangements between a straight path and a region-like landmark with different levels of granularities
- RfDL = Region-in-the-frame-of-Directed-Line
- RfDL_{3-12} considers left-right, front-side-back, and entry-interior-exit distinctions with respect to the path
- 3 fields on the path + 12 fields around the path
- Essentially, RfDL_{3-12} is an extension of Double Cross [2]

- RfDL_{3-12} is useful for capturing the motion concepts that concern the direction and extent of the landmark as seen from the path [3]
  - e.g., ‘go toward’, ‘pass ... on the left’, ‘go until ... comes to the right’, ‘go across’, ‘go into...’, and ‘go out of...’

Inversion, Homing, and Shortcut

I walked until a yard comes to my left. Now I got some questions:

We develop a foundation of spatial reasoning on the patterns of path-landmark arrangements.

i) If I turn back to the bus stop, in which direction I see the yard?

- Given $ab : R$
  - Inversion returns $ba : R$
  - Homing returns all possible $bc : a(x \in R)$
  - Shortcut returns all possible $ab : b(x \in R)$

For instance, given $ab : R$, the possible cases are:

- $bc : a(x \in R)$
- $ab : b(x \in R)$

The answer to these questions are derived computationally by the inversion, homing, and shortcut of an RfDL_{3-12} pattern $ab : R$, respectively.

Derivation Processes

Condition for $ab : R$

- Inversion
- Homing
- Shortcut

Composition

(i) Composition of a Double Cross Pattern and an RfDL_{3-12} Pattern

Two Double Cross patterns $ab : R$ and $bc : R$ can be combined to form a single pattern $abc : R$.

(ii) Composition of Two RfDL_{3-12} Patterns

Two RfDL_{3-12} patterns $ab : R$ and $bc : R$ can be combined to form a single pattern $abc : R$.

The answer to this question is derived computationally by the composition of two RfDL_{3-12} patterns $ab : R$ and $bc : R$.

Composition in Double Cross $abc : R$

Composition of Double Cross $abc : R$

The answer to this question is derived computationally by the composition of a Double Cross pattern $abc : R$ and an RfDL_{3-12} pattern $bc : R$.

References