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Language resource management — Semantic annotation framework (SemAF) — Part
14: Spatial semantics

Gestion des ressources linguistiques — Cadre d'annotation sémantique (SemAF) —
Partie 14: Sémantique spatiale

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**Language resource management —
Semantic annotation framework
(SemAF) —**

**Part 14:
Spatial semantics**

*Gestion des ressources linguistiques — Cadre d'annotation
sémantique (SemAF) —*

Partie 14: Sémantique spatiale

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 37, *Language and terminology*, Subcommittee SC 4, *Language resource management*.

A list of all parts in the ISO 24617 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document establishes a semantic ground for supporting ISO 24617-7 (spatial information), which specifies an abstract syntax for the annotation of spatial information in language. It also specifies a way of translating the annotation structures generated by the abstract syntax of ISO 24617-7 into well-formed semantic forms. These semantic forms are represented in a type-theoretic first-order logic and made interpretable according to a model.

This document:

- validates the abstract specification of ISO 24617-7 for the annotation of spatial information in language on semantic grounds;
- specifies an interoperable format for interpreting spatial information, both static and dynamic.

Dynamic spatial information involves spatio-temporal information as well as information about motions in space and time. This document aims at satisfying such needs. An understanding of information in natural language is necessary for many computational linguistics and artificial intelligence (AI) applications. An explicit semantics is necessary for the specification provided by ISO 24617-7, as the representations created in accord with that language will not have a significant impact on AI and automatic inference without explicit interpretation.

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Language resource management — Semantic annotation framework (SemAF) —

Part 14: Spatial semantics

1 Scope

This document extends ISO 24617-7:2020, which specifies ways of annotating spatial information in natural language such as English, by establishing a formal semantics for its abstract syntax. The task of the proposed semantics is of two kinds:

- a) translation of annotation structures to semantic forms;
- b) model-theoretic interpretation of semantic forms.

Semantic forms are represented in a type-theoretic first-order logic. These semantic forms are then interpreted with respect to a model for part of the world to which an annotated language is referentially, or denotationally, anchored.

NOTE The basic framework and content of this document is based on Reference [1].

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 24617-7:2020, *Language resource management — Semantic annotation framework — Part 7: Spatial information*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

annotation structure

information structure created by marking up some linguistic expressions with relevant (semantic) information

Note 1 to entry: ISO 24617-7:2020, for instance, creates such annotation structures by marking up place names or motions and their spatial relations with relevant spatial information.

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3.2

eigenplace

eigenspace

region or path occupied by an object

Note 1 to entry: A region may be considered as a particular finite path matching to an interval $[x,x]$ such that its start and endpoint match or are identical. In that case, a region is considered as a point.

3.3

event-path

region of space occupied by a mover (moving object) throughout an event

3.4

first-order logic

formal language, artificially built for reasoning, with the values of its terms, particularly variables, ranging over individual objects only

Note 1 to entry: Second-order variables such as P , which ranges over properties of an individual, are temporarily introduced to allow the λ -operation in the process of deriving *semantic forms* (3.7), see 7.2, Note and Example 2, b) and c).

3.5

interpretation

function that maps a *semantic form* (3.7) to its denotation

Note 1 to entry: The interpretation function is represented by $\llbracket \]$ and, for each semantic form a , its denotation or the value of the interpretation, is represented by $\llbracket \sigma(a) \rrbracket$.

Note 2 to entry: In a model-theoretic semantics, the interpretation function $\llbracket \]$ is constrained by a model M and, for each semantic form a and a model M , such an interpretation is represented by $\llbracket \sigma(a) \rrbracket^M$.

3.6

model M

set-theoretical construct that represents part of the real or possible world denoted by *semantic forms* (3.7)

3.7

semantic form

logical form

representation of the semantic content of an *annotation structure* (3.1) of expressions in natural language

Note 1 to entry: The semantic form of an annotation structure a is represented by $\sigma(a)$, where σ is a function that maps an annotation structure a to a semantic form that carries the semantic content of a .

Note 2 to entry: Semantic forms are often called “logical forms” because semantic forms are represented by a logical language such as *first-order logic* (3.4).

3.8

type

semantic type

kind or sort of an object denoted by a linguistic expression

4 Metamodel

This document shall be used together with ISO 24617-7:2020.

The metamodel presented in this clause outlines the basic semantic structure for the abstract syntax of ISO 24617-7 for easy reference, which specifies an annotation scheme for the markup of spatial relations,