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Querying and Integrating Spatial-Temporal Information on the Web of Data via Time Geography

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Abstract

The *Web of Data* is a rapidly growing collection of datasets from a wide range of domains, many of which have spatial-temporal aspects. Hägerstrand's *time geography* has proven useful for thinking about and understanding the movements and spatial-temporal constraints of humans. In this paper, we explore time geography as a means of querying and integrating multiple spatial-temporal data sources. We formalize the concept of the space-time prism as an ontology design pattern to use as a framework for understanding and representing constraints and interactions between entities in space and time. We build on a formalization of space-time prisms and apply it in the context of the Web of Data, making it usable across multiple domains and topics. We demonstrate the utility of this approach through two use cases from the domains of environmental monitoring and cultural heritage, showing how space-time prisms enable spatial-temporal and semantic reasoning directly on distributed data sources.

Keywords: Time Geography, Web of Data, Ontology Design Patterns, Data Integration, Linked Open Data, Federated Querying

1. Introduction

The World Wide Web is currently undergoing a rapid change from an information resource primarily targeted at human users towards a distributed knowledge base that provides structured, machine-readable information. This *Web of Data* covers an increasing breadth of topics, ranging from museum collections [26] and drug databases [51] to humanitarian aid data [29] and real-time sensor data [46]. Many of these data sources follow the Linked Open Data (LOD) principles [4] that allow for the integration of initially isolated *data silos*. The number of applications leveraging this large distributed database is

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