A Spatiotemporal Analysis of Membership: Formalizing the Space-Time Elements of Connection for Groups

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Keywords: Membership, Ontology, Spatiotemporal Relationships, Group, Semantic

This research aims to formalize the spatiotemporal relationships of membership between individuals and the groups to which they belong. Specifically, we analyze how the membership to a community evolves over time considering past, present and future connections. The framework developed for this research is presented using an ontological approach. We demonstrate a specific domain ontology application for spatiotemporal membership using BFO2, an updated version of the Basic Formal Ontology. Key to this work is the representation of *membership*, modeled through different kinds of mereological relations possible with a group, for example, *pre-member*, *active member,* and *alumni* that capture how membership evolves and changes over time. The semantic web rule language (SWRL) is used to express the different spatiotemporal events that relate to membership and their consequences on membership such as *subscription*, *graduation* and *reunion events*. Mobility events are also included in the model. SWRL supports reasoning using the ontology and studying the evolution of membership between people and their various groups. We use the environment of a university community as an exemplar to develop and test the formalizations. However, the ideas are generalizable to a wide range of spatiotemporal domains, for example, these ideas hold for citizenship modeling or for consumers shopping at certain retail chains. The study of the evolution of membership connections between these entities and groups lends important insights for many different kinds of event planning.