



## Dealing with Semantic Heterogeneity of Geographic Concepts: A Geometric Algebra-Based Encoding Method

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A conceptual consensus, as well as a unified representation, on a certain geographic concept across multiple contexts, can be of great significance to the communication, retrieval, combination, and reuse of geographic information and knowledge. However, geographic concept is a rich synthesis of semantics, semiotics, quality (e.g., vagueness or approximation). The generation, representation calculation and application of a certain geographic concept, consequently, can be of great heterogeneity, especially considering different interests, domains, language, etc. In light of these semantic heterogeneity problems, to code core concepts uniquely can be a lighter alternative to tradition ontology-based method, the reason for which is numeric codes can be a symbolism of consensus on concept across domains and even languages. Consequently, this paper proposed a unified semantic model as well as an encoding framework for representation, reasoning, and computation of geographic concept based on geometric algebra (GA). In this method, a geographic concept can be represented as a collection of semantic elements, which can be further encoded based on its hierarchy structure, and all the semantic information of the concept can be preserved across the encoding process. On the basis of the encoding result, semantic information can be reasoned backward by some well-defined operators, semantic similarity can also be computed for information inference as well as semantic association retrieval. In the case study, the implementation of the proposed framework shows that this GA-based semantic encoding model of can be a promising method to the unified expression, reasoning, and calculation of geographic concepts, which, reasonably, can be further regarded as a prospect lighter alternative of the solution to semantic heterogeneity.