

Cartographic Approach to Knowledge Representation and Management in KASEA*

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Within the PIPS (*Personal Information Platform for life and health Services*) project a novel knowledge representation method, called Knowledge Cartography has been developed. It allows for inference and for storing inferred results. Knowledge Cartography aims at storing in a knowledge base as many conclusions about concepts and individuals as possible. The conclusions can be quickly retrieved in the process of query answering and remain valid as long as a terminology is not changed. The Knowledge Cartography takes its name after a map of concepts. A map of concepts is basically a description of interrelationships between concepts in a terminology. The map is created during the knowledge base creation. A map of concepts can be graphically represented in a form similar to a Venn diagram. Each atomic region (i.e. a region that does not contain any other region) represents a unique valid intersection of base concepts. By valid we mean an intersection that is satisfiable with respect to a given terminology. Intersections of concepts that are not allowed by terminological axioms are excluded from the map, where two additional axioms eliminated four regions from the map). The Cartographer algorithm calculates a number of valid atomic regions n and assigns each atomic region a subsequent integer from the range $[1, n]$. Because any region in the map consists of some number of atomic regions, it can be represented as an array of binary digits of length n with “1”s in positions mapped to contained atomic regions and “0”s elsewhere. Using this technique we can assign any concept in the terminology a *signature* – an array of binary digits representing a region covered by the concept in the map. In this way we can describe any combination of complement, union and intersection of described concepts by simply mapping them to Boolean operations. The map is used in the query answering process. Cartographic Representation was applied and verified in the first version of DL reasoner for the PIPS project, proving its efficiency.

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