Reasoning about Qualitative Representations of Space and Time

Anthony G. Cohn

School of Computing, University of Leeds, England.
agc@comp.leeds.ac.uk

In this talk I survey Qualitative Representations of Space and Time which have formed an increasingly active area of Knowledge Representation recently. Although most of the work has concerned topology and mereology (theories of parthood), known collectively as mereotopology, a variety of calculi have also addressed distance, size, orientation and, more generally, the notion of qualitative shape. Increasingly, calculi are now being designed to represent and reason about more than one such aspect simultaneously.

I report on some of the complexity results known, and I discuss some of the approaches to the usual tradeoff between expressiveness and tractability, including the use of special purpose logics and reasoning procedures, including composition tables, constraint based reasoning, and the use of intuititionistic and modal zero-order logics.

Spatial change is of great applicability in a variety of possible application domains, for example in reasoning about high level computer vision, or in geographic information systems. I present the notion of a conceptual neighbourhood which can be used to capture continuous transitions of spatial entities over time. Traditionally, these have been hand computed, rather than being formally derived from more primitive notions. I first discuss some alternative notions of qualitative continuity and then I describe the challenge of using of machine reasoning tools techniques to verify the correctness of a conceptual neighbourhood graph. In this context, I report on recent work conducted at Leeds addressing this challenge using the automated theorem prover SPASS.

F. Baader (Ed.): CADE-19, LNAI 2741, p. 334, 2003.