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Higher-level cognition by maintaining a higher level of integration

Examples from spatial problem solving

Christian Freksa
University of Bremen

Abstract

My contribution presents the cognitively motivated *Strong Spatial Cognition* (SSC) paradigm to geometric problem solving. Unlike classical knowledge representation approaches in AI and computer science that analytically *describe* spatial structures in terms of spatial relations by means of formal representation languages SSC *maintains* spatial structures (e.g. in networks of interacting spatial relations) for spatial problem solving in order to make direct use of space-inherent affordances and constraints.

The SSC paradigm involves perceiving and acting agents (such as humans and robots) that exploit spatial structures and spatial affordances in their environment or in mildly abstracted spatial replicas *(knowledge in the world)* instead of operating on a *digital twin* of the world. In the approach, computation requirements shift from object-level reasoning by means of spatial calculi to meta-level reasoning that controls perception and operations in space.

As an answer to the COMCO 2019 workshop question about how high-level cognition may arise from low-level mechanisms we suggest that structural correspondence between mental and environmental structures and processes may provide a crucial key to the answer.

I will present spatial problems and demonstrate how they can be solved in SSC. I will explain how the cognitively motivated approach avoids the computational complexity trap in spatial reasoning and will argue that the SSC paradigm is suitable for future autonomous robot systems. The principles underlying the SSC paradigm, however, may have uses well beyond the spatial domain.

References.

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