UC Merced

Proceedings of the Annual Meeting of the Cognitive Science Society

Authors

Meunier, Anja
Markham, Alex
Grosse-Wentrup, Moritz

A theory of algorithms and implementations and their relevance to cognitive science

Anja Meunier
University of Vienna, Vienna, Austria

Alex Markham
University of Vienna, Vienna, Austria

Moritz Grosse-Wentrup
University of Vienna, Vienna, Austria

Abstract

The question of how algorithms in general and cognitive skills in particular are implemented by our nervous system is at the core of cognitive science. The notions of what it means for a physical system (such as our nervous system) to implement an algorithm, however, are surprisingly vague. We argue that a rigorous theory is needed to formulate and evaluate precise hypotheses about the brain's cognitive functions and propose a definition of the term algorithm as a chain of functions. Subsequently, we define the term implementation via a sequence of projections from a dynamical system, represented by a Markov process, to the algorithm. We furthermore show the practical applicability of this approach in a simulated example. We believe that the theory proposed here contributes to bridging the gap between the algorithmic and the implementational level by rendering the task at hand theoretically precise.