Computational cognitive requirements of random decision problems

Juan Pablo Franco
University of Melbourne, Melbourne, Australia

Karlo Doroc
University of Melbourne, Melbourne, Australia

Nitin Yadav
University of Melbourne, Melbourne, Australia

Peter Bossaerts
University of Melbourne, Melbourne, Australia

Carsten Murawski
University of Melbourne, Melbourne, Australia

Abstract

Previous studies have found that for electronic computers the computational requirements of solving an instance of a problem are related to a specific set of features of the problem. This mapping has been shown to apply to electronic computers on a multitude of problems and is referred to as Instance Complexity (IC). However, it remains an open question whether IC applies to humans. For this purpose, we ran a set of experiments in which human participants solved a set of instances of one of three, widely studied, computational problems (Knapsack, Traveling Salesperson and the Boolean Satisfiability). We found that, in line with our hypothesis, IC had a negative effect on human performance in all problems. Our results suggest that IC can be used as a generalisable measure of the computational resource requirements of a task. Moreover, given its properties, IC could serve a crucial role in the cognitive resource allocation process.