Complexity

Special Issue on

How Human Cognition Handles Complexity in the Age of Big Data

CALL FOR PAPERS

Our society, economy, and life depend increasingly on big data, that is, extremely large data sets characterized by such a high volume, velocity, and variety to require specific Information Technology and Analytical techniques to reveal patterns and associations, especially relating to human behavior and interactions. While Artificial Intelligence (AI) technologies are making impressive progress in harnessing this information cornucopia, little is known about its impact on how human cognition deals with this profusion and whether it has a positive or negative impact on the execution of cognitive tasks such as decision making, problem solving, and creative thinking.

The human mind has been often modeled as a computational device. The normative paradigm in decision science assumes that the quality of our decisions depends strongly on the quality and quantity of available information and that suboptimal or even wrong outcomes can be produced when this information is insufficient, partial, or otherwise biased. Thanks to digital technologies human beings have never had more access to data in quantity and in quality and their actions have never been more public and traceable. However, there is no compelling evidence of improvements in how we think due to the availability of such abundant digital information. One possible explanation for this lack of evidence is that unlike machines human beings are particularly effective at reasoning analogically, with a paucity of information using heuristics, rules of thumbs, and other nonnormative methods.

We argue that this superiority derives from the unique way through which the human brain handles and resolves complexity. First, human beings are particularly able to make choices based on a very limited set of data while relying on simple problem representations. Second, unlike machines, human heuristics are general enough to be applied to a variety of tasks and domains, while machines "catastrophically forget" what they learn in a specific context.

Little is known about the actual cognitive mechanisms through which the human mind simplifies the complexity generated by the information overload deriving from constant exposure to digital data. The evidence available so far rises concern about our ability to cope with such an abundant and incessant information flow without the help of external computational prosthetics and several studies show actually that overexposure to information acquired through digital devices actually can impair critical cognitive capacities such as ability to focus and manage attention.

We argue that there is an unbalance in the current debate towards considering human and machine driven information processing as substitutes as opposed to the identification of their complementary strengths and the creation of effective hybrid cognitive systems integrating human and machine strengths.

The focus of this special issue is twofold: i) how human cognition reacts to the complexity generated by abundant digital information and how it handles this complexity more or less effectively; ii) how theories and computational techniques inspired by complexity science can be used to improve human cognition and create effective hybrid systems integrating machine computational power with human creativity and insights.

We are open to contributions from a variety of disciplines, preferably in the area of Cognitive Science including Cognitive Psychology, Linguistics, Neuroscience, and Artificial Intelligence.

Proposals based on methodological approaches that are typically applied in complexity science, including chaos theory, genetic algorithms, cellular automata, neural networks, and evolutionary game theory, as well as other advanced computational methods will be preferred.

Potential topics include but are not limited to the following:

- Using genetic algorithms and other computational techniques to model how human cognition reacts to and processes abundant digital information
- Mind versus machine-based representation of large amounts of digital data impact of exposure to big data on learning and memory
- Big data visualization and sense-making
- Actual versus perceived complexity in knowledge representation of big data
- Decision making heuristics in presence of big data using complexity theories such as chaos and fractal theories, effective complexity, and other complexity metrics
- Neural networks and other computational techniques for alleviating digital information overflow and support human problem solving and other cognitive skills
- Big data-driven problem solving and creativity
- Analysis of cognitive mechanisms that support effective simplification (simple rules) and design of/comparison with computational techniques and algorithms supporting effective simplification (e.g., summarization)

Authors can submit their manuscripts through the Manuscript Tracking System at https://mts.hindawi.com/submit/journals/complexity/hcabd/.

Papers are published upon acceptance, regardless of the Special Issue publication date.

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Submission Deadline
Friday, 22 June 2018

Publication Date
November 2018