Collaborative Learning Discussion 1

Discussion Topic

Knowledge Representation is a recent phenomenon – it only became a topic of discussion with the development of computing technology and the need to represent knowledge in computer systems.

1. Discuss this assertion. Do you agree or disagree with this opinion? Justify your position, supported with at least two academic references.
2. How is reasoning related to knowledge representation (KR)? Is KR still useful without reasoning support? Justify your answer supported by two academic references.

Learning Outcomes

- Critique the need for formal approaches to knowledge representation and reasoning.
- Review critical properties of a knowledge-based system.
- Appraise critically modelling techniques for knowledge representation and reasoning.

Initial Post

by Anastasia Rizzo - Tuesday, 5 September 2023, 3:12 PM
Number of replies: 1

I firmly hold the belief that the term "Knowledge Representation" has indeed garnered widespread recognition due to the advancements in computer technologies and the necessity to represent knowledge in computer systems.

The concept of "knowledge representation" in the context of artificial intelligence (AI) can be traced back to John McCarthy's seminal paper titled "Programs with Common Sense," published in 1959 (McCarthy, 1959). This paper stands as one of the earliest works in logical AI, highlighting the use of logic as a means to represent information within computer memory. McCarthy's paper also introduced the crucial idea that

common-sense reasoning ability was pivotal in AI development, marking a pioneering contribution to the field's foundational concepts.

In the realm of artificial intelligence and information systems, reasoning and knowledge representation are inextricably linked (Brachman & Levesque, 2004). Knowledge representation serves as a fundamental mechanism for describing and structuring information, enabling computers to comprehend and apply knowledge to problem-solving. On the other hand, reasoning is the process by which this represented knowledge is employed to derive new information or logical outcomes. In the context of artificial intelligence, reasoning empowers systems to draw conclusions, analyse data, and make decisions based on the knowledge at their disposal.

Therefore, knowledge representation forms the essential underpinning for reasoning. Without well-structured and appropriately represented knowledge, reasoning would lack the necessary foundation for operation (Brachman & Levesque, 2004). It is crucial for systems to present knowledge in a format conducive to reasoning, thereby facilitating the analysis, comparison, and conclusion-drawing processes based on that knowledge.

Nevertheless, I maintain the view that the concept of representing knowledge and reasoning about these representations has deep historical roots within various ancient sciences and fields of knowledge. It is worth exploring how elements and ideas from these areas have contributed to the formation of concepts and methodologies for knowledge representation and reasoning:

Philosophy: Ancient philosophical traditions, such as Aristotelianism, have made substantial contributions to logic and logical reasoning. Aristotle's introduction of concepts like syllogisms, categories, and logical relationships among ideas laid the foundation for logical knowledge representation (Stanford Encyclopedia of Philosophy, 2007).

Mathematics: Ancient mathematicians developed formal systems for studying numbers, geometry, and algebra. These formal methods for representing and reasoning about numbers and structures became the bedrock for modern mathematical logic and knowledge representation (Boyer & Merzbach, 1991).

Writing: The invention of writing allowed humanity to preserve knowledge and pass it down from one generation to the next. Writing is closely associated with the concept of knowledge representation (Doug, 2006).

Music: Systems of musical notation enabled the formal representation of musical compositions, akin to knowledge representation in other domains (Adler, 2016).

Cryptography: Throughout history, various encryption methods have been developed to obscure information, sharing it only with those possessing the requisite knowledge. This ties into the idea of safeguarding and representing knowledge securely (Stallings, 2013).

Agriculture: Ancient agricultural practices and calendars were based on observations and the transmission of knowledge regarding crop cultivation and seasonal cycles. This can also be regarded as a form of knowledge representation and utilisation (Francis, 2008).

References:

Adler, S. (2016) The study of orchestration / Samuel Adler. Fourth edition. New York: W. W. Norton and Company.

Boyer C. B. & Merzbach U. C. (1991) A history of mathematics (2nd ed. [rev.]). Wiley.

Brachman, R. & Levesque, H. (2004) Knowledge Representation and Reasoning, Morgan Kaufmann, Amsterdam.

Doug, H. (2006) Review: Writing Systems: A Linguistic Approach (Henry Rogers 2004). International Journal of American Linguistics - INT J AMER LINGUIST. 72. 539-542.

Francis, C. (2008) Agricultural Systems: Agroecology and Rural Innovations for Development. Edited by Sieglinde Snapp and Barry Pound. 2008. Elsevier, Amsterdam, The Netherlands.

McCarthy, J. (1959) Programs with Common Sense. In Proceedings of the Teddington Conference on the Mechanization of Thought Processes (pp. 75–91). Her Majesty's Stationery Office: London.

Stallings, W. (2013) Cryptography and Network Security: Principles and Practice (6th. ed.). Prentice Hall Press, USA.

Stanford Encyclopedia of Philosophy, (2007) Aristotle's Logic. Available from: https://plato.stanford.edu/archives/win2008/entries/aristotle-logic/ [Accessed 29 August 2023].