What is Knowledge in Industry 4.0?

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Abstract

This is a fundamental study addressing the articulation of knowledge from the context of the fourth industrial revolution (Industry 4.0). Industry 4.0 employs embedded systems (e.g., cyber-physical systems) to perform cognitive tasks. These systems cannot work without applying digitized knowledge. As a result, the digitization of knowledge-intensive activities (knowledge acquisition, representation, dissemination, utilization, and management) is critical for Industry 4.0. Before digitizing the knowledge and knowledge-intensive activities, a fundamental question arises: What is knowledge in Industry 4.0? This study answers this question. In doing so, this study first reviews the definitions of knowledge reported in the extant literature of epistemology, engineering design, manufacturing, organization science, information science, and education science. This study then defines that a piece of knowledge consists of three elements, namely, claim, provenance, and inference. Such a definition helps overcome the circularity and ambiguity in the definitions of knowledge reported so far. This definition results in four types of knowledge, namely, definitional, deductive, inductive, and creative knowledge. These types of knowledge are exemplified using some real-life scenarios relevant to engineering design and manufacturing. The exemplified pieces of knowledge are also represented by using knowledge graphs (concept maps) so that the contents can easily be digitized for human and machine learning. The outcomes of this study are the fundamentals based on which more sophisticated methods and tools can be developed to perform the cognitive tasks relevant to Industry 4.0.

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