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Information technology — Artificial intelligence — Reference architecture of knowledge engineering

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Foreword

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Introduction

Knowledge-driven AI applications have gradually gained attention. In knowledge engineering (KE), knowledge is automatically or semi-automatically acquired from information sources, which in turn are generated by processing huge-scale multi-source heterogeneous data. The knowledge is integrated into knowledge-based systems and used to provide intelligent knowledge-driven services. One of the objectives of KE is to represent and transfer human knowledge within industries such as finance, medical care, transportation and manufacturing to machine knowledge with representations understandable by both humans and AI systems. Now, KE, along with big data, deep learning, natural language processing etc., has become one of the core driving forces of AI development.

Key technologies of KE include knowledge representation, knowledge modelling, knowledge acquisition, knowledge storage, knowledge fusion, knowledge calculation, knowledge maintenance, knowledge visualization, etc. In addition, many knowledge service platform products and solutions have been developed to permit KE implementations to be more agile in organizations. The distributed KE systems can be integrated and deployed through knowledge exchange and knowledge maintenance among the systems. The distributed, autonomous agent systems and their collaboration across system of systems can further generate the necessary intelligence and knowledge driven behaviours for collaboration and cooperation.

Resource description framework (RDF),[1] resource description framework schema (RDFS),[2] RDFS-PLUS, ontology web language (OWL),[3] SPARQL protocol and RDF query language (SPARQL)[4] and ontology-related theories and standards[5-7] provide a solid foundation of tools and theories in the aspects of knowledge representation and knowledge modelling. Other related KE standards have been developed.

KE has been successfully applied to many industries including financial fraud identification, remote operation and maintenance of equipment, user profile and product recommendations, research focus tracking and forecasting, smart credit analysis, legal dispute and case prediction based on similar cases, intelligent distribution of news, intelligent computer-aided diagnosis and treatment, etc. Many organizations regard platforms or systems based on KE as important knowledge infrastructures. However, KE vocabularies, basic KE constructional components, KE processes and their relationships are not yet clearly defined. This causes misunderstandings and unnecessary communication and deployment costs amongst the data supplier, fundamental technology supplier, algorithm supplier, system coordinator and other stakeholders of KE systems.

To facilitate collaboration amongst KE stakeholders, KE characteristics and applications can be comprehensively described and categorized. Expected use of the document is to guide the construction of KE systems.

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Information technology — Artificial intelligence — Reference architecture of knowledge engineering

1 Scope

This document defines a reference architecture of knowledge engineering (KE) in artificial intelligence (AI). The reference architecture describes KE roles, activities, constructional layers, components and their relationships amongst themselves and other systems from systemic user and functional views. This document also provides a common KE vocabulary by defining KE terms.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 22989:2022, *Information technology — Artificial intelligence — Artificial intelligence concepts and terminology*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 22989 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
architecture
fundamental concepts or properties of an entity in its environment and governing principles for the realization and evolution of this entity and its related life cycle processes

[SOURCE: ISO/IEC/IEEE 42010:2022, 3.2]

3.2
architecture view
information part comprising portion of an architecture description

EXAMPLE An Information or Data View addresses information-relevant concerns framed by an Information viewpoint. It contains as view components, a conceptual data model, a data management model and a data access model and correspondences linking those components together.

[SOURCE: ISO/IEC/IEEE 42010:2022, 3.7]

3.3
data
reinterpretable representation of information in a formalized manner suitable for communication, interpretation, or processing

Note 1 to entry: Data can be processed by humans or by automatic means.

[SOURCE: ISO/IEC 20546:2019, 3.1.5]

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