Research on Construction Methods of Landslide Knowledge Graph for Engineering Geology: Postprint

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Abstract

Big data has brought new opportunities to landslide research; however, due to issues such as complex data types, diverse semantic relationships, and unclear sharing mechanisms, deep mining of landslide data remains limited, and the advantages of big data are difficult to realize in landslide research. This paper proposes a knowledge graph construction method for landslides oriented toward the engineering geology domain, which extracts, fuses, and structures multi-source heterogeneous landslide knowledge to achieve querying, association, and reasoning of landslide knowledge big data. Employing a combined top-down and bottom-up approach, landslide concepts and ontologies are delineated to form a landslide knowledge system based on ten major categories: landslide field investigation, landslide assessment, landslide types, landslide geomorphological characteristics, landslide morphological features, landslide disaster information, landslide activity states, landslide genetic mechanisms, landslide stability analysis methods, and landslide prevention measures. A knowledge graph schema layer including a concept layer, attribute layer, relationship layer, rule layer, and instance layer is established; landslide knowledge information is extracted from extensive data sources to construct a semantic network, redundant knowledge is fused, and the knowledge graph data layer is built; the Neo4j platform is utilized to store landslide knowledge, achieving knowledge visualization and retrieval, which provides new ideas and methods for landslide mechanism research and disaster prevention and mitigation. The proposed landslide knowledge graph construction method can be extended to research on knowledge graphs for other types of disasters and can establish connections with other disciplinary fields, promoting deep interdisciplinary integration and fusion.

Full Text

Construction of a Landslide Knowledge Graph in the Field of Engineering Geology

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Abstract

Big data has created new opportunities for landslide research; however, the advantages of big data remain difficult to realize due to challenges such as complex data types, diverse semantic relationships, and unclear sharing mechanisms. Deep mining of landslide data is still limited, constraining the full potential of big data in landslide studies. This paper proposes a novel method for constructing a landslide knowledge graph tailored to the field of engineering geology. The approach extracts, fuses, and structures multi-source heterogeneous landslide knowledge, enabling efficient querying, association, and reasoning of large-scale landslide knowledge bases.

The methodology combines top-down and bottom-up approaches to systematically categorize landslide concepts and ontologies. We establish a comprehensive knowledge system encompassing ten major categories: field investigation, landslide assessment, landslide classification, geomorphological characteristics, morphological features, disaster information, activity status, causal mechanisms, stability analysis methods, and prevention measures. Based on this foundation, we construct a knowledge graph schema comprising five layers: the concept layer, property layer, relationship layer, rule layer, and instance layer. Knowledge is extracted from extensive data sources to build a semantic network, with redundant information fused to create a robust data layer. Utilizing the Neo4j graph database platform, we store landslide knowledge and achieve visualization and intelligent retrieval, offering new perspectives and methodologies for landslide mechanism research and disaster mitigation.

The proposed construction method can be extended to other types of disaster knowledge graphs and can foster connections with other disciplines, thereby promoting deep interdisciplinary integration and collaboration.

Keywords: Knowledge graph; Landslide; Neo4j graph database

Note: Figure translations are in progress. See original paper for figures.