Data-driven visualisation for the development of mining digital twin

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Keywords: digital twin, data-driven visualisation, real-time visualisation, CAD-based visualisation,

# ABSTRACT

The integration of digital twins in mining represents a significant advancement towards enhancing operational efficiency and decision-making. Central to this development is the role of visualisation, a crucial element in mining digitalisation. This paper delves into the application of data-driven visualisation techniques in the construction of mining digital twins, highlighting how this innovation revolutionises the representation of physical mining environments. Initially, we assess the current landscape of digital twin technology in mining. We spotlight the shortcomings of conventional visualisation methods, particularly their inability to accurately depict complex underground environments and their predominantly historical orientation. To address these challenges, we propose a novel, data-driven approach. This approach extensively utilises CAD files, encompassing everything from geological surveys to intricate mine plans, thereby significantly elevating the precision of digital twins. It facilitates real-time updates and enables flexible interaction with a variety of data types. Our methodology introduces a comprehensive data diagram alongside the adaptation of a 3D tile index. This strategy ensures the efficient rendering of extensive mining environments, allowing for a more dynamic and interactive digital twin model. We discuss how this innovative approach not only enhances the accuracy of digital twins but also contributes to their adaptability and interactivity. In conclusion, the implementation of data-driven visualisation in the construction of mining digital twins marks a pivotal advancement in the industry's digital transformation. It promises a more detailed, accurate, and dynamic depiction of mining operations. This development is a harbinger for heightened safety, efficiency, and sustainability within the mining sector, setting a new standard for digital twin technology.