Article

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Research
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Conception and Exploration of Using Data as a Service in Tunnel Construction with the NATM

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ABSTRACT

The New Austrian Tunneling Method (NATM) has been widely used in the construction of mountain tunnels, urban metro lines, underground storage tanks, underground power houses, mining roadways, and so on. The variation patterns of advance geological prediction data, stress-strain data of supporting structures, and deformation data of the surrounding rock are vitally important in assessing the rationality and reliability of construction schemes, and provide essential information to ensure the safety and scheduling of tunnel construction. However, as the quantity of this data increases significantly, the uncertainty and discreteness of the mass data make it extremely difficult to produce a reasonable construction scheme; they also reduce the forecast accuracy of accidents and dangerous situations, creating huge challenges in tunnel construction safety. In order to solve this problem, a novel data service system is proposed that uses data-association technology and the NATM, with the support of a big data environment. This system can integrate data resources from distributed monitoring sensors during the construction process, and then identify associations and build relations among data resources under the same construction conditions. These data associations and relations are then stored in a data pool. With the development and supplementation of the data pool, similar relations can then be used under similar conditions, in order to provide data references for construction schematic designs and resource allocation. The proposed data service system also provides valuable guidance for the construction of similar projects.

1. Introduction

Along with the development of its transportation infrastructure, China is experiencing increasing and vigorous planning and construction of underground works such as mountain tunnels and urban metro lines, which have greatly improved traffic efficiency. However, the construction of underground works in deep underground spaces with complicated strata results in numerous challenges that include large deformation, collapse, rockburst, gushing