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Maximizing the Value of Geoscience Databases: A Comprehensive Review of Advanced Data Processing Techniques

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As a part of recent mineral exploration, the mining and exploration industry is investing considerable money and time in having powerful exploration databases. While the availability of such data is undoubtedly a significant advancement for mineral exploration, the question remains: does everyone utilize the data to its full potential?

The value of data is not just based on the large volumes of data in the exploration database; the actual value of the database comes from the objective information that is extracted based on the insight and knowledge of data processing, analysis, and interpretation.

Exploration databases are expected to support exploration success through better decision-making, efficient exploration targeting, and enhanced productivity while reducing risks, times, and costs. They can streamline exploration workflows, ensuring that exploration efforts are targeted in the most promising areas.

This paper aims to provide an overview of the different geoscience data processing methods and discuss the advantages and limitations of each method. Three main types of data processing methods are used in mineral exploration: knowledge-driven methods rely on expert knowledge, data-driven methods use machine learning algorithms to analyze data sets and identify patterns and relationships that are not apparent to human analysts, and hybrid methods incorporate expert knowledge into the machine learning algorithms. With geoscience data growth, artificial intelligence (AI) and data mining techniques are used to automate data processing, feature detection, and modeling. These methods are beneficial for processing robust volumes of geoscience data quickly and efficiently. However, expert knowledge in all stages is crucial for accurate and relevant results.

This paper will discuss the methods and techniques used in mineral exploration through different case studies to provide mineral exploration professionals with a better understanding of the available tools and techniques.