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URANIUM EXTRACTION MODELLING USING MACHINE LEARNING

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ABSTRACT

Inception applied advanced machine learning methods to increase the accuracy of a model for uranium extraction for acid leach processing.

The application of machine learning algorithms allowed inclusion of a much larger and broader dataset than previously achievable with traditional analysis techniques. The dataset included in model formation incorporated mineralogy, mineral liberation, and mineral association data, as well as metallurgical response tests and chemical assays. The model reinforced understanding of key metallurgical drivers and ore body characteristics. A more informed model with increased predictive power was produced.

Machine learning tools including principal component analysis and feature selection were applied to expose correlations between chemical elements and uranium minerals, along with key drivers of uranium extraction. This allowed the relevance of attributes in the larger set of test data to be understood and better utilised in the model. The findings also uncovered relationships that may be applied in future work in development of acid consumption models. Cluster analysis reinforced assumptions of the ore body characteristics, and provided a tool for rapid outlier detection in test work datasets. By consolidating the dataset to include only the major uranium extraction drivers, the machine learning model offered an improvement in extraction accuracy, giving greater confidence predicting plant performance.

The application of machine learning methods provided an improved tool to infer uranium extraction, and a better understanding of relationships within the dataset. The use of machine learning algorithms to predict metallurgical response has the potential to distil key drivers from large mineralogical datasets, enabling more accurate models for production planning and plant optimisation.

Keywords: Uranium extraction, modelling, machine learning