DATA-DRIVEN DECISION MAKING IN MINING EXPLORATION: AN INTEGRATED APPROACH FOR ASSESSING THE VALUE OF ADDITIONAL DRILL HOLES

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In mining industry, acquiring and interpreting geological data must be informative, cost-effective, and delivered on time and at the expected quality to support multidisciplinary analyses required for stating Mineral Resources according to industry standards.

Although the importance of high-quality geological data is well-recognized, continuous robustness measurements during general and detailed exploration phases remain limited due to time and resource constraints. Implementing more frequent robustness measurements could enable timely data publication for interdisciplinary analysis and provide decision support for optimizing drilling campaign timelines and costs.

To achieve this, we applied unsupervised machine learning clustering, global bias assessment and variography comparison for continuous measurement of geological data robustness, considering execution time and human effort feasibility.

The proposed approach involves comparing two sets of geological data: one with data up to a specific time and another with the additional newly acquired data. The comparisons focus on two aspects: the effect on data grouping using the adjusted Rand index and the impact on grade spatial distribution using global bias.

The paper outlines a workflow, algorithms, metrics calculation, proposed thresholds, and a decision matrix for visualization and monitoring. We present the results for three deposits: two copper and one iron ore deposit located in Brazil.

Based on our analysis, we conclude that:

• Automated robustness measurement achieves expected quality while optimizing time and effort.

• The decision matrix is useful for guiding decisions on geological data publication and influencing drilling campaigns.

• Analysis shows no confirmation bias, ensuring objective quality assessments.

This approach contributes to ensure timely data publication with expected quality for interdisciplinary analyses, improve drilling campaign decisions regarding costs, timing and data quality in both general and detailed exploration phases, and mitigate the risk of rework due to inappropriate data quality.