

Graph Unsupervised Learning: A More Realistic AI/ML Application for Mineral Exploration

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One primary driver of artificial intelligence or machine learning (AI/ML) adoption in mineral exploration is the expectation that AI can help companies discover mineral deposits faster at fewer cost. However, their success remains limited. Challenges such as geological heterogeneity, unrepresentative data sampling, data silos, among others cause prospectivity techniques to hit performance ceiling. Predicting mineral deposits with new data or in greenfield remains inherently difficult. We demonstrate that it is valuable to add or switch focus from prospectivity mapping to unsupervised learning that has more tangible and realistic applications in mineral exploration.

Unsupervised learning tasks are demonstrated here with emphasis on graph-based approach, where exploration data is constructed into graphs/networks. Two exploration challenges beyond prospectivity mapping are addressed here: geological domaining and anomaly detection. Our proposed domaining approach enables better geological domaining on different scale of data. Additionally, graph-based approach might allow the separation of distinct mineral deposition style, which can be used to avoid identification bias when determining the mineral deposition style. Meanwhile the proposed anomaly detection approach that we implemented could highlight area that can become area of interests for further investigation.

While geologists can perform these tasks manually, one key benefit of this approach is its reproducibility, allowing for greater objectivity. Another important unsupervised learning trait is that the computer can only produce preliminary results. The context added by geologists is what actually gives value to the ML output. Therefore, interpretation and final decisions are still held by the geologist, the domain expert. This contrasts with supervised learning where is often perceived as a black box that takes away geologist's role in mineral exploration. Ultimately, unsupervised learning offers a safer, more tangible, and less risky first step for exploration companies looking to integrate ML into their exploration workflows.