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A data-driven economic filter for mineral resource assessments

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Few published studies model the economic feasibility of a mineral resource assessment. We present a new data-driven approach as an alternative to the set of out-dated economic regression equations developed in the early 1990's. In this approach, a type of unsupervised artificial neural network is used to project sparse data from global copper porphyry deposits onto a two-dimensional grid called a self-organized map (SOM). The data comprise dependent binary values (no missing data) indicating the economic outcome, and values associated with seventy independent variables from ten categories (open pit, underground mine, ore characteristics, flotation metallurgy, heap leach metallurgy, vat leach metallurgy, deposit, economic factors, resource grade and tonnage, and reserves grade and tonnage). Based on pattern analysis in the SOM-based component planes, the statistically significant and nonlinear correlation among variables are extracted and interpreted. Clustering of the SOM topography identifies ten distinct copper porphyry attribute combinations comprising the economic filter. Of these clusters, four comprise attributes that are economic and six uneconomic. Stochastic cross-validation of the economic filter reveals that median economic values are about 95% accurate as a binary classifier. The filter is applied and results presented for determining the economic feasibility of a stochastic coppery porphyry assessment.