Bayesian Evidential Learning (BEL) Applied to Mineral Resource Modelling to Reduce Uncertainties

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S0320. Bayesian Evidential Learning (BEL) Applied to Mineral Resource Modelling to Reduce Uncertainties

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Mineral resource modelling (MRM) requires enough geological information to define the geological model. The success of a mining project is supported by the accuracy of this model and its interpretation. Major failures can occur as a result of an incorrect degree of uncertainty quantification in the geological/geometallurgical models. There are different techniques in the industry today to reduce uncertainty in MRM. All techniques respect the statistical and geostatistical properties of the constraining data, although they vary in the specifics and the approach and they all rely on the stationarity assumption, which is not a testable hypothesis but rather the choice to collect data from a certain area or domain. This paper aims at developing a framework for reducing associated uncertainties with MRM using Bayesian Evidential Learning (BEL). BEL enables to model posterior distributions in prior model spaces using predefined parameters. It provides an indication of how future data might appear, given the data and model. The Walker Lake dataset is used to test the framework. The objective is to reduce the uncertainty in the prediction of the hardness of the orebody. First, the model is built with data from lithology, mineralogy, penetration rate and grade. These properties are obtained from samples that are spatially correlated. Then, Monte Carlo realizations are obtained based on the exploration data and the assumed uncertainty range. A relationship needs to be obtained between lithology, grade and mineralogy and hardness variables. PCA is applied to get a better visualization by looking at the most influential properties. The observed data are used to compare and see if the prior model needs to get falsified. It is determined that the penetration rate and the lithology are the most influential properties. After that, Canonical Correlation Analysis (CCA) is applied to find the combination of the variables that have the maximized linearity between the penetration data and the prediction data. The predictions are made and then back-transformed to their original space. Finally, the hardness predictions are not falsified by the observed data from the drillholes. These predictions are used to domain the orebody into soft, medium or hard materials.