Deep Learning-Based Predictive Modeling of Mineral Prospectivity with a Class-Balanced Focal Loss Function for Tackling Training Data Inequality

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Because mineralization rarely happens, mineralized localities are extensively less than barren ones. Therefore, a set of geoscience data used for training of a model for predictive mineral prospectivity mapping (PMPM) for exploration targeting is normally imbalanced and poses a problem for PMPM by machine learning (ML) or deep learning (DL). Besides the huge inequality in the amount of training class sample data for mineralized and barren localities, the training data also carry redundant information (i.e., similar attributes), which also impinges on the performance of ML- or DL-based PMPM. This presentation describes a novel class-balanced focal loss function (CBFL) for tackling the above-mentioned problem in DL-based PMPM. The CBFL and the long short-term memory network were employed for 3D exploration targeting by PMPM in the Wulong gold district (China). Bayesian optimization was used for automatic tuning the DL model's hyperparameters. The results of using the CBFL were contrasted with those of using popular focal loss and cross-entropy loss functions in DL-based PMPM. The outcomes reveal the superiority of the CBFL over the mentioned popular loss functions. The 3D exploration targets mapped in this work would benefit follow-up subsurface exploration in the the Wulong gold district.