Application of Machine Learning Algorithms to Predict Rock Types Using Geochemical Data: A Case Study from the Obuasi Gold District, Ghana

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Artificial Intelligence and Machine Learning (AI/ML) have increased precision and productivity in the current big data era. Machine learning has indicated its robustness in geosciences, particularly rock-type classification. The issue of lithological classification in the traditional way has raised critical concerns and the need to curb the limitations it breeds, such as time consumption and subjective results. The gold mineralisation occurrence is structurally controlled in the district. It exhibits complex patterns and relationships that may not be readily discernible through traditional methods, leading to geologists missing out on discovering new resources or potential exploration targets. Consequently, this research attempts to create a predictive model by exploring the best machine learning algorithms to predict rock types in the Obuasi Gold District using X-ray fluorescence (XRF) geochemical data. Comparative predictive modelling was established using four supervised classification algorithms: Gradient Boosting (GBoost), Adaptive Boosting (AdaBoost), Support Vector Machine (SVM), and Random Forest (RF). The acquired XRF data was integrated with the model using the Orange Data Mining software. The performance evaluation of the models indicated RF as the best algorithm for deployment with a Classification Accuracy (CA) of 0.952. Therefore, ML algorithms have been a great tool in rock-type classification, whereby RF emerged the best in the case of the Obuasi Gold District. However, it is encouraged to understand the geology of a particular area before employing the tool. The datasets must be balanced to yield good results and avoid model overfitting.