

### **Ore Vectoring Using Machine Learning: Case Study of Copper Occurrences in Northern Ireland**

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Machine learning can be implemented in mineral exploration mapping activities, such as for mineral prospectivity mapping (MPM) and geochemical anomaly detection. The approach can also be integrated into other targeting frameworks such as mineral exploration targeting (MET) and exploration information system (EIS). In this study, we present a new approach for applying machine learning in mineral exploration by using it for ore vectoring. In this approach, machine learning is tasked with predicting numerical distance from proximal to distal zones, which could help indicate the center of mineralization. We demonstrate this method using case study of copper occurrence in Northern Ireland. The new and emerging techniques of graph deep learning was employed for this approach. Additionally, we employ random forest (RF) which has been more commonly used in MPM study. Our study demonstrates that graph deep learning techniques can properly generate vectoring maps aligned well with the geological setting of the deployment region. In contrast RF produces map that poorly reflect geological condition and more difficult to interpret for guiding the exploration. Additionally, one prospective zone mapped by graph deep learning can be confirmed by a newer data from the deployment region. This 'virtual' discovery highlights the potential for combining ore vectoring with graph deep learning can be useful for future exploration efforts.