Abstract # 26
Category: *Technical developments in exploration including AI / ML studies*

Title: *Application of deep neural networks and transfer learning for exploration targeting in the Swayze and Matheson greenstone belts, Ontario, Canada*

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Abstract: The way that we do mineral exploration today has evolved thanks to the application of data integration and machine learning (ML) techniques, however, ML typically requires that the region of interest have a reasonable number of known deposits for training a ML model in order to make subsequent predictions. Deep transfer learning which involves the use of deep neural networks (DNN) and transfer learning (TL) are proposed and used in this paper to help geoscientists use pre-trained models to help make predictions on areas with very little to no labeled (training) data. DNN are known for their capability to analyze large and complex datasets and TL is a technique that harnesses weights and features extracted from a deep learning model pre-trained on one set of data and applies the learned information over another area without being given deposit information for that area. The deep transfer learning experiments conducted over the Swayze greenstone belt (SGB) and the Matheson greenstone belt (MGB) show that: 1) Training and validation accuracies for a model trained on 16 input evidential layers (geological, geochemical, geophysical, and structural maps) from the SGB are 97% and 92% respectively while the model's training and validation losses are 0.08 and 0.1 respectively. 2) Transfer learning was applied over the MGB using the weights and features obtained from the pre-trained SGB model. The pre-trained SGB model made excellent and accurate predictions of the potential for gold mineralization in the MGB. A receiver operator curve (ROC) was used to evaluate the pre-trained models' ability to define true positives and false positives. The area under the ROC curve for prediction of prospectivity in the MGB using an SGB pre-trained model is 81%, indicating that the pre-trained model did an excellent job in predicting mineral deposits over an area without prior knowledge of deposit locations. Overall, harvesting the power of deep learning and deep transfer learning yields excellent predictions that could help geoscientists to do machine learning for mineral exploration over areas that previously had very little input data and no target information to train on..

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