# Deep learning - a new paradigm for resource geology

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## ABSTRACT

As miners look to new strategies to exploit valuable resources, issues such as stakeholder demands, talent shortages and risk management must be addressed. In an increasingly digital industry, information is demanded at a faster rate, and changes must be responded to instantly. The strategic planning cycle can no longer be tied up by cumbersome approaches to resource modelling.

A resource model should portray the best understanding of geological observations and facts. The resource does not change over time, just the understanding of its characteristic idiosyncrasies. Computer-based modelling has traditionally replicated hand-drawn methods. Recently, other approaches - simulation of categorical variables and implicit techniques - have been adopted.

To survive, companies will need to embrace new technologies and advances in digital transformation. Automated resource modelling underpins the digital mine platform. New methods can contribute to new understanding.

This paper introduces using deep learning to revolutionise geological modelling. The resource modelling process is a bottleneck in most operations, taking weeks or months to complete. Machine learning will assist in debottlenecking processes at all mining operations, improving the timeliness of geological data delivery and its potential impacts on upstream applications, such as mine planning, scheduling and process plant performance.

The deep learning approach correlates geological database codes direct into a 3D block model, and then uses resulting domain codes to constrain grade estimation. The deep learning domain determination is fast, taking minutes to assess and generate the results from thousands of drillholes.

The authors have modelled many deposits from around the world and most can be modelled using deep learning to a competent standard within 30 minutes, with the largest orebodies completed in hours. Case histories will be presented which show the application of deep learning in different geological settings - stratigraphic, vein, porphyry and breccia deposits - with comparisons against traditional techniques.