

Applying machine learning to mineral exploration and geological mapping

David Cole¹, Lachlan McCalman¹, Vasek Metelka², Alexander Otto², and Andrew Rodger²

¹ Data61, CSIRO

² Mineral Resources, CSIRO

david.cole@data61.csiro.au

The rate of new major mineral discoveries within Australia is decreasing as most deposits identifiable through existing techniques have already been found. At the same time the amount of available information relevant to mineral exploration is increasing. Machine learning (ML) techniques have the potential to address both these problems by incorporating all available data and identifying complex patterns not easily discernible by traditional approaches.

Such techniques can provide additional insight to geologists to complement their existing knowledge and expertise and can help inform better decision making. This talk will overview some examples of data-driven/ML algorithms applied to problems relating to mineral exploration, focusing on the analysis of public datasets in Queensland's North West Minerals Province. Examples include geological classification, geochemical prediction, and anomaly detection within interpreted geology models.

While these examples show the potential value of machine learning, also discussed are some common issues and considerations which arise when applying ML algorithms to geoscience problems. These include algorithmic assumptions, training data biases, model evaluation, and model generalisation/interpretation. An understanding of these issues, in conjunction with geological expertise, is required to derive meaning from ML outputs.

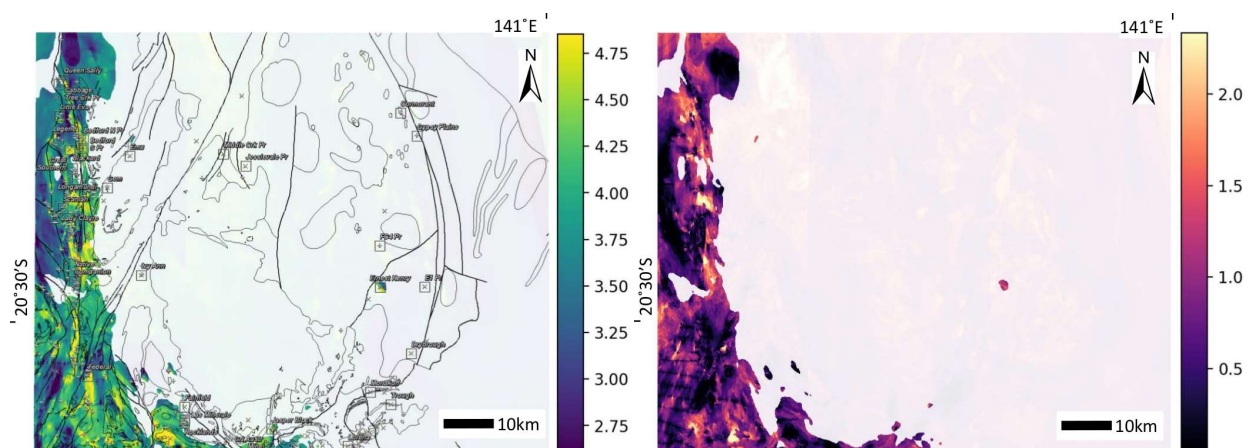


Figure 1: Machine learning model prediction (left) and uncertainty (right) of $\log(\text{Cu})$ concentration using magnetics and gravity datasets.