Machine Learning Based Systems Application to Mineral Resource Estimation and Compliance with Reporting Codes for Mineral Resources

Ioannis Kapageridis[1], Ioannis Sinatkas[2], Argyro Asvesta[1], Agni Patra[1]

[1]Department of Mineral Resources Engineering, University of Western Macedonia, Koila, Kozani, 50100, Greece

[2]Department of Informatics, University of Western Macedonia, Fourka Area, Kastoria, 52100, Greece

Abstract

Machine learning algorithms have been used in various steps of mineral resource estimation in the last four decades - from regression algorithms in variogram model fitting to implicit geological modelling using radial basis functions, and grade estimation using artificial neural networks. In most cases reported in scientific literature, machine learning algorithms succeeded to some degree in completing a modelling task - part of a mineral resource estimation study, by outperforming conventional methods either in the time taken to complete the task or the accuracy of the produced results. It is a common claim in most machine learning applications in mineral resource estimation, that machine learning algorithms achieve this performance improvement against conventional methods, based on less assumptions on the input data distribution and requiring minimum expertise by those who apply them. The speed of current computing systems, personal or cloud based, has allowed for complex models to be built using machine learning algorithms within minutes, leading to a few commercial implementations becoming available to mineral resource estimation practitioners and gaining their acceptance as reliable systems. In the last decade, several mineral resource estimation reports, part of various levels of study from preliminary economic assessments to feasibility studies, were based on the results of machine learning algorithms application. These reports are commonly released as compliant with one of the internationally acceptable reporting codes, such as JORC or NI 43-101. Therefore, it is important to examine how machine learning algorithms are applied to mineral resource estimation, and how this application complies with the guidelines of international reporting codes for mineral resources, particularly with the requirements for transparency and competence. This paper gives an overview of machine learning algorithms and systems used in mineral resource estimation and discusses possible compliance issues with international reporting codes for mineral resources.

Keywords: machine learning, reporting codes, mineral resources