Accepted Manuscript

Data integration modeling applied to drill hole planning through semi-supervised learning: A case study from the Dalli Cu-Au porphyry deposit in the central Iran

Moslem Fatehi, Hooshang H. Asadi

PII: S1464-343X(16)30301-6

DOI: 10.1016/j.jafrearsci.2016.09.007

Reference: AES 2665

To appear in: *Journal of African Earth Sciences*

Received Date: 11 May 2016

Revised Date: 12 September 2016

Accepted Date: 15 September 2016

Please cite this article as: Fatehi, M., Asadi, H.H., Data integration modeling applied to drill hole planning through semi-supervised learning: A case study from the Dalli Cu-Au porphyry deposit in the central Iran, *Journal of African Earth Sciences* (2016), doi: 10.1016/j.jafrearsci.2016.09.007.

Data Integration Modeling Applied to Drill Hole Planning through Semi-Supervised Learning: A Case Study from the Dalli Cu-Au Porphyry Deposit in the Central Iran

Moslem Fatehi [a], *Hooshang H. Asadi* [a,b]

[a] *Department of Mining Engineering, Isfahan University of Technology, Isfahan, 8415683111, Iran.*

[b] *Centre for Exploration Targeting and Australian Research Council Centre of Excellence for Core to Crust Fluid Systems (CCFS), School of Earth and Environment, The University of Western, Australia, Crawley, WA 6009, Australia.*

Abstract

In this study, the application of a transductive support vector machine (TSVM), an innovative semi-supervised learning algorithm, has been proposed for mapping the potential drill targets at a detailed exploration stage. The semi-supervised learning method is a hybrid of supervised and unsupervised learning approach that simultaneously uses both training and non-training data to design a classifier. By using the TSVM algorithm, exploration layers at the Dalli porphyry Cu-Au deposit in the central Iran were integrated to locate the boundary of the Cu-Au mineralization for further drilling. By applying this algorithm on the non-training (unlabeled) and limited training (labeled) Dalli exploration data, the study area was classified in two domains of Cu-Au ore and waste. Then, the results were validated by the earlier block models created, using the available borehole and trench data. In addition to TSVM, the support vector machine (SVM) algorithm was also implemented on the study area for comparison. Thirty percent of the labeled exploration data was used to evaluate the performance of these two algorithms. The results revealed 87 percent correct recognition accuracy for the TSVM algorithm and 82 percent for the SVM algorithm. The deepest inclined borehole, recently drilled in the western part of the Dalli deposit, indicated that the boundary of Cu-Au mineralization, as identified by the TSVM algorithm, was only 15 meter off from the actual boundary intersected by this borehole. According to the results of the TSVM algorithm, six new boreholes were suggested for further drilling at the Dalli deposit. This study showed that the TSVM algorithm could be a useful tool for enhancing the mineralization zones and consequently, ensuring a more accurate drill hole planning.