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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 1
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Abstract 8

In this study, the application of a transductive support vector machine (TSVM), an 9
innovative semi-supervised learning algorithm, has been proposed for mapping the potential 10
drill targets at a detailed exploration stage. The semi-supervised learning method is a hybrid 11
of supervised and unsupervised learning approach that simultaneously uses both training and 12
non-training data to design a classifier. By using the TSVM algorithm, exploration layers at 13
the Dalli porphyry Cu-Au deposit in the central Iran were integrated to locate the boundary 14
of the Cu-Au mineralization for further drilling. By applying this algorithm on the non- 15
training (unlabeled) and limited training (labeled) Dalli exploration data, the study area was 16
classified in two domains of Cu-Au ore and waste. Then, the results were validated by the 17
earlier block models created, using the available borehole and trench data. In addition to 18
TSVM, the support vector machine (SVM) algorithm was also implemented on the study 19
area for comparison. Thirty percent of the labeled exploration data was used to evaluate the 20
performance of these two algorithms. The results revealed 87 percent correct recognition 21
accuracy for the TSVM algorithm and 82 percent for the SVM algorithm. The deepest 22
inclined borehole, recently drilled in the western part of the Dalli deposit, indicated that the 23
boundary of Cu-Au mineralization, as identified by the TSVM algorithm, was only 15 meter 24
off from the actual boundary intersected by this borehole. According to the results of the 25
TSVM algorithm, six new boreholes were suggested for further drilling at the Dalli deposit. 26
This study showed that the TSVM algorithm could be a useful tool for enhancing the 27
mineralization zones and consequently, ensuring a more accurate drill hole planning. 28

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