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Comparing compositional multivariate outliers with autoencoder networks in anomaly detection at Hamich exploration area, east of Iran

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Abstract

Newly presented machine learning methods based on deep belief networks like autoencoders have opened a new window on anomaly identification in different fields of the science. They reconstruct the normal probability distribution pattern of the input data using stacks of Continuous Restricted Boltzmann Machines (CRBM) and thus determining the outliers. Therefore using this machine on geochemical samples taken in regional exploration scale, might be an acceptable way to delineate the multivariate anomalies and propose the next targets for detailed exploration. On the other hand, due to compositional nature of geochemical data, compositional data analysis (CoDa) has been developed to identify multivariate outliers or anomalies in recent years.

A comparison between both methods has been made applying them on lithochemical samples of Hamich area in Southern Khorasan, East of Iran. The area was explored in details some years ago and veinlets of galena-sphalerite-pyrite at depth, based on the outcrops of Cu-Pb, were verified by additional core drillings. We used its final report to validate the results of both methods. They showed that the two completely different methods could get the same acceptable targets. However the CoDa approach needs less parameters and shows which elements are responsible for the anomalies.

Keywords: Lithochemical exploration, autoencoder, compositional data, Hamich, CRBM

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