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Machine learning models for Hg prospecting in the Almadén mining district

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Traditionally, prospectivity models were designed using approaches mainly based on expert judgement. These models have been widely applied and they are also known as knowledge-driven prospectivity models (see Harris et al. (2015)). Currently, artificial intelligence approaches, especially machine learning models, are being applied to build prospectivity models since they have been proven to be successful in many other domains (see Sun et al., 2019 and Guerra Prado et al., 2020). They are also known as data-driven prospectivity models. Machine learning models allow to learn from data repositories in order to extract and detect relationships from the data to predict new instances.

In this work, a geological dataset was collected by a team of expert geologists. The data collected includes the geographical coordinates as well as several geological features of points belonged to seventy-seven different mercury deposits in the Almadén mining district. The resulting dataset is composed by a total of 24798 points and 24 attributes for each point. In particular, we have collected geological and mining-related data regarding the Almadén mercury (Hg) mining district; these data include the location of the several Hg mineralizations, including their typology, size, mineralogy, and stratigraphic position, as well as other information associated to the metallogenetic model set up by Hernández et al. (1999).

Later, few machine learning models are built to select the one which offers the best results. The aim of this work is twofold: on the one hand, it is intended to build a machine learning model capable of, given the geological features of a data point, to determine the mercury deposit to which it belongs. On the other hand, the aim is to build a machine learning model capable of, given the geological features of a data point, to identify the kind of deposit to which it belongs. The experiments conducted in this work have been properly designed, validating the results obtained using statistical techniques.

Finally, the models built in this work will allow to generate mercury prospectivity maps. The final aim of this process is to get and train a system able to perform antimony prospection in the nearby Guadalmez syncline.

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