The application of deep learning to extract geological information from drill core imagery

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THE APPLICATION OF DEEP LEARNING TO EXTRACT GEOLOGICAL INFORMATION FROM DRILL CORE

Visible photography of drill core imagery is one of the most long-lived sources of geological information, being routinely collected in exploration and mining for decades. Repositories of core imagery contain vast amounts of geological information that are currently underutilised, particularly for quantitative analysis.

The major barriers to using drill core photography as quantitative data source include:

1) Inconsistency in image quality,
2) Time consuming manual processing of images i.e. cropping and depth registration,
3) Limitations of traditional image analysis methods to deal with geological variability

In this paper we will present several examples of how deep learning techniques - specifically image segmentation and classification - can be applied to streamline and remove some of these barriers to the quantitative analysis of drill core photography.

Deep learning-based image segmentation algorithms can assist in image pre-processing by allowing core boxes or rock material to be located and masked from images providing analysis ready images.

Instance and semantic segmentation can be used to extract geological objects from images. Examples of these include joints, fractures and physical rock fragments for geotechnical purposes, as well as veins, grain components and other geological objects.

Image classification can be used to assist geological logging efforts. Supervised classification can be performed by utilising existing geological logs as labels or images can be clustered into domains using unsupervised classification techniques.

These applications of deep learning suggest that human level or better accuracy is achievable in all our applications provided the phenomenon being analysed is clearly observable in the imagery and the model was provided with an appropriate training set. These models were often able to be applied to backlogs of historical images provided additional training data were supplied to the model and image quality was not significantly different.

The application of deep learning algorithms to extract geological and geotechnical information from drill core photography will give geologist more quantitative information on which to base their decisions as well as potentially automate elements of the more routine aspects of geological logging.