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Machine/Deep Learning Methods for Pore-Mineral Characterization and Surface Areas Analysis

Tuesday, 31 May 2022 17:00 (15 minutes)

Pore-scale imaging and modeling have advanced crucially through the integration of machine learning (ML) with imaging techniques. These integrated image analysis workflows can accelerate the mineral characterization of a given geological sample. The obtained parameters such as porosity, mineral composition, mineral accessible surface area data, and segmented mineral map are utilized to parameterize reactive transport simulations. This study evaluates the potential of ML methods for parameterizing reactive transport simulations of a given sample over various image resolutions in 2D and 3D. Random Forest and U-Net deep learning methods were trained and evaluated for semantic segmentation of 3D X-ray computed tomography (CT), and a scanning electron microscopy-backscatter electron using energy dispersive x-ray spectroscopy images of thin sections captured at different resolutions. The results showed both methods had an acceptable performance with the U-Net model showing the best results due to the ability to consider spatial as well as pixel-wise information. Considering a specific method but varying resolutions, the results showed a minimum variation for mineral abundances of relatively bigger granular phases (e.g., quartz) calculated from predicted images compared to minority classes. However, considering simulated mineral accessibilities as a metric showed, the simulated accessibility of clay particles (smectite/illite) decreased due to misclassification of pores and clays resulted in higher effective surface areas for the majority classes.

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Time Block Preference

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Participation

Online

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