Contribution ID: **167** Type: **Poster Presentation**

Semantic segmentation of rock images from multiple imaging methods using deep learning methods

Tuesday, 23 May 2023 10:30 (1h 30m)

Over the past decade non-destructive imaging methods for materials have been increasingly advanced. Two most notable imaging methods include X-ray computed microtomography (μCT) that can image materials at sub-micron scale to millimeter scale resolutions and focused ion beam-scanning electron microscopy (FIB-SEM) that can image at a nano-meter scale. Hence, the segmentation of images obtained from different imaging techniques is a critical step towards quantitatively describing various features of geomaterials over a range of scales. In this work we evaluate various deep learning methods (e.g., U-Net, Attention U-Net, Efficient net, transformer, VGG16, ResNet, and MultiResUnet) to segment both μCT and FIB-SEM images. Four independent datasets including sandstone, carbonate chalks, and shale are evaluated. Each of these datasets is composed of three-dimensional image stacks and corresponding ground truth segmentation labels obtained using various traditional image processing techniques. Our preliminary results indicate that deep learning architectures can successfully be applied to the task of semantic segmentation for individual dataset with frequency weighted accuracy between 94% and 99% (on testing data) and can perform better than manual segmentation to recover the natural morphology of original images. However, performance is significantly deteriorated by ~ 10-30% in accuracy when mixed images from different imaging methods are used as training data. Here, we will demonstrate the improvement of semantic segmentation of multiple rock images from both μCT and FIB-SEM through transfer learning of transformers and other deep learning methods.
SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

Participation

In-Person

References

MDPI Energies Student Poster Award

No, do not submit my presenation for the student posters award.

Country

USA

Acceptance of the Terms & Conditions

Click here to agree

Energy Transition Focused Abstracts

Primary authors: RINGER, Robert John (Sandia National Laboratories); YOON, Hongkyu (Sandia National Laboratories)

Presenter: YOON, Hongkyu (Sandia National Laboratories)

Session Classification: Poster

Track Classification: (MS15) Machine Learning and Big Data in Porous Media