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Application of Machine Learning to Generate Multiphase Pore-Scale Images

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Machine learning has been applied successfully, using three-dimensional images as training datasets, to generate realizations of the pore space, as well as to produce super-resolution images. We extend this work, using GANs to generate images both of the pore space but also two fluid phases within the pore space, using experimental high-resolution three-dimensional X-ray images of the pore space and fluids at different fractional flows as training datasets. We demonstrate that using GANs we can generate images for a range of saturation and compare the quality of the realizations against experimental data in terms of Minkowski functionals: saturation, interfacial area, mean curvature and connectivity (Euler characteristic) as well as contact angle. We discuss the use of this methodology to complement pore-scale displacement and imaging experiments, to generate images of arbitrary size and for a wide saturation range. These images provide a basis for further analysis and pore-scale modelling, including prediction of averaged multiphase flow properties, such as capillary pressure and relative permeability.

Participation

In-Person

References

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