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# An Improved Pore-scale Rock-typing Method using Minkowski maps for the Sensitivity of Regional Support Size

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The rapid advancement in digital core analysis has greatly promoted the research development of flow and transport in porous media. However, the field of interest revealing pore level information that can be processed through standard digital core analysis workflow is rather limited for practical purposes. The integration of pore-scale information into continuum scale is widely concerned as it associates deeply with the future development of digital core analysis. For hierarchical porous structure, pore-scale rock-typing and upscaling of petrophysical properties is a promising solution to bridge the gap between microscale and continuum scale. Morphological and topological parameters associating data clustering methods are popularly utilized for the pore-scale rock-typing on 3D digital samples. However, the size of regional support window through which the fields of the parameters are generated greatly affects the descriptive capacities of the parameters on the structural characteristics, thus the classification using traditional unsupervised clustering methods such as Gaussian Mixture Models (GMM) is hard to deliver optimal performance. Towards the issue, we propose in this work to apply a supervised method called Support Vector Machine (SVM) for rock type classification. Minkowski functionals are determined as robust descriptors for the morphological and topological characteristics of porous structures, and a fast computational method utilising Fast Fourier Transform (FFT) has been applied for the generation of the fields of the regional Minkowski measures. On the basis of the Minkowski fields generated through different regional support sizes from the target porous structures, comparative experiments between the two different classification methods SVM and GMM have been conducted on two complex artificial porous systems and one digital image of a laminated sandstone. Throughout the tests, SVM has illustrated obvious advantage on overcoming regional support size effect even with limited labelling information. The combination of regional morphological and topological descriptors with SVM method could provide extraordinary convenience for the realization of pore-scale rock-typing on large 3D digital images with excellent computational efficiency.

## Participation

In-Person

## References

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