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Soil CT–scan images with scaling properties

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Computed tomography (CT) soil images has been used more common in soil science as software-based image analysis has more robust methods and lower costs. Pore space structure can be realistically visualized. However, binarization of these grey images, mainly based on thresholding methods (Sezgin and Sankur, 2004), is a crucial step in processing prior to analysis. However, in soil science context, in order to check several thresholding methods it is necessary to create a synthetic image as a trial due to the ground truth soil image is unknown.

Depending on the type image that scientists have to study, several methods can be found in the literature to create the ground-truth image (Zhang, 2001). Schlüter et al. (2010) and Wang et al. (2011) focused to build a synthetic image with low porosity (4%) and not a clear binomial histogram for gray values (GV) of the image, as those were the type of CT-scan soil images they used.

Recently, multiscale analyses have been applied to grey scale soil images and several parameters have been extracted from them (Zhou et al., 2011). This could be reread as if 2D CT-scan soil images present a GV multiscaling behaviour then this could be used in the strategy when synthetic images are created in order to evaluate different thresholding algorithms (Torre et al., 2018). Based on these scaling properties, Martin-Sotoca et al. (2017) used it to thresholding CT-scan 2D soil images and to create synthetic (or ground-truth) images. The Combining Singularity-CA method (CS-CA) was successfully applied and the synthetic images using the Truncated Multifractal method (TMM) showed a very similar GV histogram to the real ones.

In this study we compare the scaling behaviour of 2D binary and grey synthetic soil images, created by this method, with real soil grey images and their correspond binarized images applying CS-CA method. More similarity found among them, not only through GV histograms, more realistic the TMM will be.

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