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Modeling lacunarity functions of LIDAR point clouds for ecological purposes

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Spatial distribution of natural objects in a forest determines the canopy structure which provides the basic set-up of the aboveground environment. So application of structural-based methods focusing on the total area means important opportunity in modern ecology.
Lacunarity measures the deviation from translational invariance in a fractal, a multifractal system or a random pattern. Textures with the same fractal dimension but with different gap-structure can be divided quantitatively using this multiscale property. It has been shown that space-filling characteristics of a natural multi-scale set with mosaic-like structures is related to biodiversity and the behaviour of vegetation and wildlife. Consequently in point of the vertical layering (e.g. emergents, canopy structure, understorey) and the horizontal variations of a forest the spatial distribution of lacunarity is significant. Unless the analyzed texture is fully monofractal, lacunarity functions are nonlinear and generally break due to the scale changes within the natural system.
In this study we analyze and model lacunarity functions related to Hungarian (planted or natural) forested areas. For today Airborne Laser Scanning methods can provide high-resolution point clouds of landscape patterns so the condition to calculate lacunarity in forestry. Our input functions are calculated from binary images of a voxelized LIDAR database.
The lacunarity functions are modeled using nonlinear least-square regression method considering the nonlinearity. The supremely fitted model is defined as a 3-parameter hyperbola-like function, whose parameters are found to be competent to map them together with the residual values in order to relate them to relevant ecology-specific spatial variations.

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