Abstract

Computational modelling of biological dynamics using 3D computer vision: application to microbial decomposition in soil.

Olivier MONGA (IRD, France)

Information technology is becoming more and more a key tool to address global life sciences challenges. Within this context, computational biology is a growing area mainly due to the today crucial ecological questions such as for instance carbon sequestration. This talk deals with the simulation of microbial decomposition in soil at microscopic scale using advanced computer vision algorithms to represent 3D soil microstructures. In particular, this issue faces the still open problem of the intrinsic and compact representation of 3D complex natural geometrical structures.

Our simulation tools based on graph and Partial Differential Equations are validated using real experimental data. This work belongs to the very first ones aiming at simulating, using real data, microbial decomposition in soil at micro scale (1-5 micron m) by taking into account 3D pore space representation.

Such cross roads research can be very valuable for soil science in order to understand better soil microstructure impact on biological dynamics and also to evaluate biological scenarios difficult to implement experimentally. Same as for macroscopic physics versus quantic physics the final challenge is to understand relationships between biological phenomena at microscopic scale and at macroscopic scale. This refers to emerging properties, which is a fundamental issue in life sciences.

Our methodology applies for any modelling problem where transformation, transport and diffusion processes occur simultaneously within complex 3D geometrical shapes. Therefore, it can be easily adapted for many other environment and medical applications.

References:

• Ngom N. F., Garnier P., Monga Olivier, PETH S. Extraction of three-dimensional soil pore space from microtomography images using a geometrical approach. Geoderma, 2011, 163 (1-2), p. 127-134. ISSN 0016-7061