The Deep2PDE project: Plant growth modeling using neural networks for cocoa agroforestry applications in Cameroon

presented by

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ABSTRACT
Cocoa based agroforestry systems implemented in Cameroon are efficient and sustainable cropping systems. They provide many eco-systemic and socio-economic services like the contribution to food security by diversifying the sources of farmers’ incomes. A good understanding of such systems is required to optimize their management. Mathematical modeling is a great conceptual tool to acquire knowledge that can be used on top of experimental approaches. More specifically, mathematical models based on partial differential equations (PDE) are able to describe the spatio-temporal dynamics of bio-physical phenomenon. Research has been done to adapt this formalism to the modeling of plant growth. Still there are difficulties to identify the right set of equations and to calibrate the parameters. Deep learning and neural networks are now popular tools that are able to answer simple modeling questions after being trained using big sets of data. New technologies such as terrestrial Lidar help us to acquire huge amounts of data from agroforestry systems and those data need to be interpreted. The idea behind the so called Deep2PDE project is to test the ability of neural networks to automatically identify the PDE that best simulates the plant (and particularly cocoa tree) biomass dynamics from data consisting in spatio-temporal measurements of the biomass. In this talk, I will first explain what were the main motivations of this Deep2PDE project which is a joint work done with colleagues from Cameroon and UMR AMAP and supported by a one year CIRAD founding. Then I will present the work done and the first results and conclusions drawn during the project that can be seen as a first step toward tools to help modelers to design continuous plant growth models from both knowledge and data.

KEY WORDS
Agroforestry systems; Cameroon; Modeling; Neural Network; Partial Differential Equation;

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