S@founet

Screening for intra-specific diversity via an automated image-based classification approach, application to a tropical fruit tree species

ABSTRACT

Indigenous fruit trees (IFT) are socio-economically important for populations from rural developing countries. The diversity of IFT has been shaped by human during their cultivation/domestication history. This has provided a tremendous diversity of morphological varieties that can now be found in farmers' agroforestry fields, home gardens or even in the cities. Characterizing such a level of diversity at large spatial scales and in sufficient details is particularly challenging using traditional morphological approaches (direct measures in the field). The use of automated and fast- characterization systems based on image acquisition through digital cameras and state-of-the-art deep learning models are very promising in this respect. The Pl@ntNet platform has implemented such an approach with great success. Pl@ntNet has now demonstrated its efficacy to collect, manage, analyse and understand biodiversity data at the species level. Here we propose a challenging extension of this method for the study of biodiversity at an intra-specific level. The development of this method has been impeded by the discrete nature of within-species biological variation, and the limited volume of data and knowledge available at this taxonomical scale.

The new method will be experimented on one of the most important IFT from the Congo Basin, the African plum tree (Dacryodes edulis, Burseraceae). The species has a large distribution, from Nigeria in the West to Angola in the South and Democratic Republic in the East. A large number of morphological varieties exists. These varieties are defined by local people using a set of fruit morphological traits: fruit size and shape, skin and pulp colour. Characterizing the spatial organization of this diversity through an automated approach will offer new opportunities to understand their evolutionary history. By allowing a direct comparison with patterns of spatial genetic diversity as investigated with molecular markers, this will further represent a strong contribution for the implementation of sustainable management and use of IFT. The experimentation of this new method is very promising to characterize, monitor, and identify varieties of IFT at large geographical and taxonomical scales by relying on citizen science approaches.

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GOAL

The risky and innovative project S@fouNet aims at characterizing the biodiversity at an intra-specific level through an evolution of the Pl@ntNet platform in order to better understand the evolutionary

history of IFT species in relation to human management and use, and to orientate strategies of their sustainable management and use. The overall established workflow evaluates on the African plum tree, will serve as a proof of concept, to use deep learning and citizen sciences approaches for intra-specific plant species characterisation in tropical regions.