Synergizing Digital, Biological, and Participatory Sciences for Global Plant Species Identification: Enabling access to a worldwide identification service

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Abstract

Human activities have a growing impact on global biodiversity. While our understanding of biodiversity worldwide is not yet comprehensive, it is crucial to explore effective means of characterizing it in order to mitigate these impacts. The advancements in data storage, exchange capabilities, and the increasing availability of extensive taxonomic, ecological, and environmental databases offer possibilities for implementing new approaches that can address knowledge gaps regarding species and habitats. This enhanced knowledge will, in turn, facilitate improved management practices and enable better local governance of territories. Meeting these requirements necessitates the development of innovative tools and methods to respond to these needs.

Citizen science platforms have emerged as valuable resources for generating large amounts of biodiversity data, thanks to their visibility and attractiveness to individuals involved in territorial management and education. These platforms present new opportunities to train deep learning models for automated species recognition, leveraging the substantial volumes of multimedia data they accumulate. However, effectively managing, curating, and disseminating the data and services generated by these platforms remains a significant challenge that hinders the achievement of their objectives. In line with this, the GUARDEN and MAMBO European projects aim to utilize the Pl@ntNet participatory science platform (Affouard et al. 2021) to develop and

implement novel computational services to enable the widespread creation of floristic inventories.

In the pursuit of this project, various standards and reference datasets have been employed, such as the POWO (Plants of the World Online) world checklist and the WGS RPD (World Geographical Scheme for Recording Plant Distributions) standard, to establish a foundation for creating a global service that aids in plant identification through visual analysis. This service relies on a NoSQL (Not Only Structured Query Language) data management system ArangoDB (Arango Database), utilizes state-of-the-art automated visual classification models (vision transformers), and operates on a distributed IT (Information Technology) infrastructure that leverages the capabilities of collaborative stakeholders interested in supporting this initiative.

Global-scale automated workflows have been established specifically for the collection, analysis, and dissemination of illustrated occurrences of plant species. These workflows now enable the development of new IT tools that facilitate the description and monitoring of species and habitat conservation statuses. A comprehensive presentation highlighting the significant advancements achieved will be provided to share the lessons learned during its development and ensure the widespread adoption of this service within the scientific community.

Keywords

citizen science, plant species identification, deep learning-based species identification, big data

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Conflicts of interest

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