Web application for automatic creation of thematic maps and management zones - AgDataBox-Map-Fast Track

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Abstract.

Agriculture is challenging to produce more profitably, with the world population expected to reach some 10 billion people by 2050. Such a challenge can be achieved by adopting precision agriculture and digital agriculture (Agriculture 4.0). Digital agriculture (DA) has become a reality with the availability of cheaper and more powerful sensors, actuators and microprocessors, high-bandwidth cellular communication, cloud communication, and Big Data. DA enables information to flow from used agricultural equipment and new services that transform data into valuable intelligence. In this new paradigm, large amounts of data are available, and the challenge is to add value to them. The availability of platforms (data transformation is essential for precision and digital agriculture. Our free web platform, called AgDataBox (ADB, http://adb.md.utfpr.edu.br/map), aims to integrate data, software, procedures, and methodologies. This work presents a new module for ADB, called ADB-Map Fast-Track (ADB-MAP-FT), which allows the creation of thematic maps (TMs) and delineation of management zones (MZs) automatically by a web-friendly interface platform, ideal for users who do not have all the technical knowledge in this area. The choice of the algorithms sequence and their parameters in each process was based on a literature search. ADB-MAP-FT allows changing the default values/algorithms for people with advanced knowledge or those who want to test other configurations or algorithms. Once the new settings are selected, the ADB-MAP-FT can execute the entire procedure sequentially without user intervention. The resulting TM or MZ is a new layer that can have its style personalized, such as changing color schemes, subtitle texts, and subtitle ranges. It can also be exported in CSV, TXT, and image formats. The platform stores all project information in the cloud, allowing for later consultations, and, as it is a web platform, it removes the processing cost on the client-side since the procedure is performed on the server-side. The only device restrictions are a web browser and an internet connection.

Introduction

Digital agriculture (DA) enables information to flow from used agricultural equipment and new services that transform data into valuable intelligence. In this new paradigm, large amounts of data are available, and the challenge is to add value to them. The availability of platforms (data transformation is essential for precision and digital agriculture, and our free web platform, called AgDataBox (ADB, http://adb.md.utfpr.edu.br/map), aims to integrate data, software, procedures, and methodologies. This work presents a new module for ADB, called ADB-Map Fast-Track (ADB-MAP-FT), which allows the creation of thematic maps (TMs) and delineation of management zones (MZs) automatically by a web-friendly interface platform, ideal for users who do not have all the technical knowledge in this area.

Material and Methods

The ADB-MAP-FT functionalities are divided into different layers, composed of a back-end, which contains the business's algorithms and rules of operation, and the front-end, the interface of interaction with the user. The back-end is composed of R language and R packages, specialized in statistics and the analysis of spatial data, Node.JS for building Representational State Transfer (REST) resources and organizing the flow of requests and responses in the microservices of ADB and Apache Tomcat as an application server. The Angular framework version 9, the TypeScript programming language, and the NPM package manager were used to write the front-end. In addition, there is a central system using the PostgreSQL Database Manager System (DBMS), with the PostGIS extension, to store data managed by the ADB-API. Moreover, each microservice can still use the NoSQL database MongoDB, which acts in storing documents in the form of JavaScript objects. The protocol implemented for TMs and MZs was proposed by Souza et al. (2018), with the algorithms and parameters presented by Aikes Junior et al. (2021) as the ideal or, in the absence of them, the most popular ones.

Results and Discussion

Once authenticated in the system, the user must select which operation he wants to perform: a TM or an MZ (Fig. 1). Different procedures and purposes of use, the information requested, and the automatic operations (highlighted by dashed lines) to be carried out will vary according to the applicable option. The default algorithm of each step is described in Fig. 1.

ADB-MAP-FT allows changing the default values/algorithms for people with advanced knowledge or those who want to test other configurations or algorithms. Once the new settings are selected, the ADB-MAP-FT can execute the entire procedure sequentially without user intervention. The resulting TM or MZ is a new layer that can have its style personalized, such as changing color schemes, subtitle texts, and subtitle ranges. It can also be exported in CSV, TXT, and image formats. The platform stores all project information in the cloud, allowing for later consultations, and, as it is a web platform, it removes the processing cost on the client-side since the procedure is performed on the server-side. The only device restrictions are a web browser and an internet connection.

Conclusion or Summary

An Internet connection and a web browser are enough to access the ADB-MAP-FT through the link https://adb.md.utfpr.edu.br/map, where one can create a completely free account; there is no need to download or install any program. In addition, the application is compatible with different platforms (e.g., Windows, Linux, macOS, Android, and iOS).
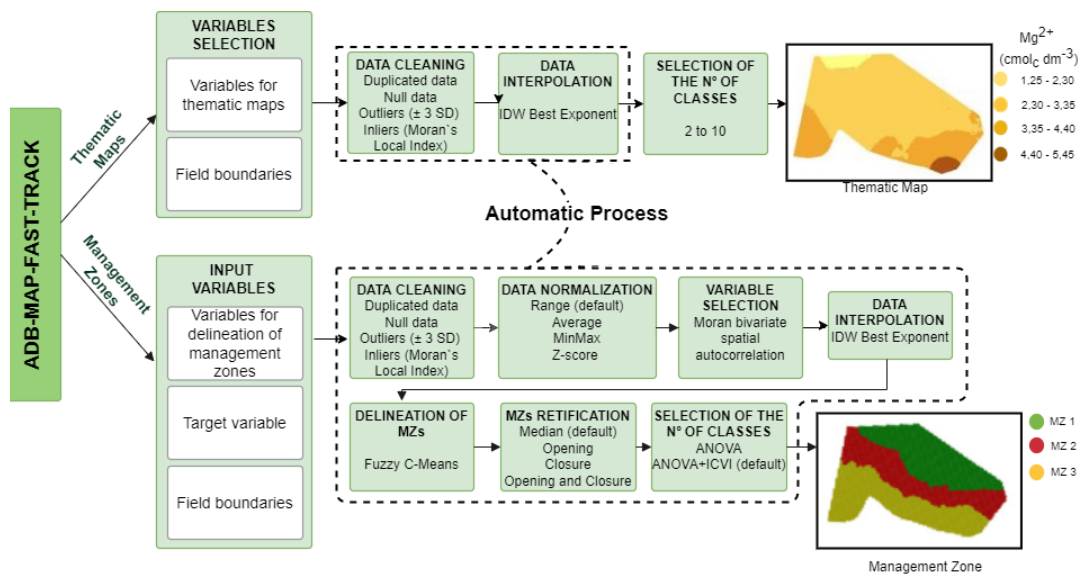
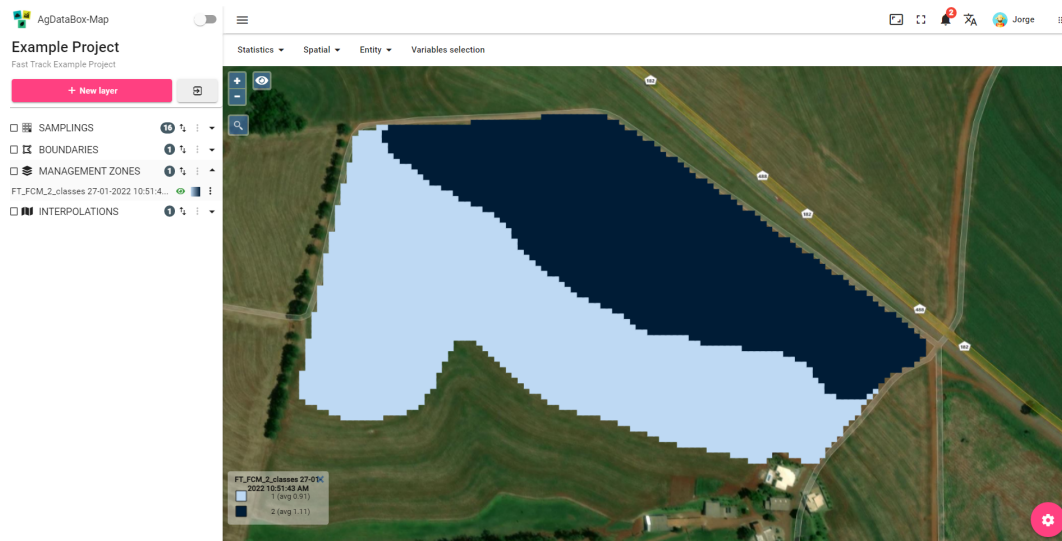**Fig 1. Overview of ADB-Map-Fast Track (ADB-MAP-FT) operation**

Fig 2. Example of management zone delineated

Acknowledgments

References

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