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Semantic-driven Geospatial Data Visualization Approach for an Agricultural Use Case: Apple-growing in South Tyrol, Italy

Darya Lapo [a,b]*, Ekaterina Chuprikova [a], Abraham Mejia-Aguilar [a], Roberto Monsorno [a], Liqiu Meng [b]

[a] *Center for Sensing Solutions, Eurac Research, Darya.Lapo@eurac.edu, Ekaterina.Chuprikova@eurac.edu., Abraham.Mejia@eurac.edu, Roberto.Monsorno@eurac.edu*
[b] *Chair of Cartography and Visual Analytics, Technical University of Munich, Liqiu.Meng@tum.de*

* Corresponding author

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Abstract:

The achievement of SDG 2 – Zero hunger requires the widespread promotion of sustainable agriculture. Smart Agriculture practices aim to enhance the sustainability of Agri-Food systems and provide solutions for increasing crop production while minimizing the environmental footprint and maximizing the quality and quantity.

The latest development in Smart Agriculture and the Internet of Things (IoT) have enabled scientists and farmers to collect agricultural data using various sensors and devices. As a result, the Agri-Food datasets have become complex and heterogeneous in terms of their spatial, temporal, and spectral resolution and scale. Therefore, agricultural data is considered Big Data in terms of volume, variety, velocity, and veracity and aims to support the decision-making process; however, it is often a challenging task to get insights into multi-source and multi-scale data sources.

Semantic Technologies provide scientists and decision-makers with the opportunity for data integration and automatic information extraction and unlock insights into Big Geospatial Data. Cartography and geospatial data visualization, in turn, allow an end-user to discover the hidden content visually and therefore enhance information exploration and knowledge construction. Furthermore, being an interdisciplinary domain, cartography has the potential to satisfy the demand for visualization of Big Geospatial Data and, thus, can support sustainable agriculture.

This work in progress will unite both semantic technologies, e.g., semantic-driven data integration, and geospatial data visualization. The main goal is to design a semantic-driven geospatial data visualization approach for the needs of the Agri-Food domain, with a particular focus on apple growing in South Tyrol, Italy.

To accomplish the primary goal of this study, the ontology-driven geodata visualization pipeline will be developed and implemented using the case study of apple-growing in South Tyrol, Italy. The visualization pipeline will consist of two parts: (1) the ontology-based data integration part in which mappings define the relationship between environmental data and specific ontology; (2) the geospatial data visualization part for exploring the integrated data. The Geospatial data visualization part will be presented as an interactive dashboard to enable geovisual analytics for agricultural data. The interactive dashboard will “visually” answer questions related to apple growing in South Tyrol with help of the corresponding maps and graphs. As a result, an end-user will be provided with the opportunity to visually discover hidden content.

As a result, this research will contribute at two interconnected levels: a) at the domain level (cartography), we will develop a semantic-driven geospatial data visualization approach to environmental and agricultural data; b) at the organizational level, this work will create an added value to European priority and food sector and bring forward the scientific topic of digital transformation in agriculture using geospatial visualization techniques. Thereby, this research will commit to the digital transformation of the European Agricultural Sector.

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