Building Precision Farming Applications by Integrating Satellite Data and Linked Data

LEO team

In Use Presentation

Summary

Due to the growing world population, the improvement of crop yield from existing agricultural land is an important challenge today. The goal of precision farming is to achieve the maximum sustainable yield through site-specific cultivation of farms. In project LEO we have been developing a precision farming application which integrates satellite data and linked data, and guides farmers in the variable rate appliance of fertilizers on their fields. The application is available on mobile devices such as tablets and smart phones. In addition to the precision farming application, LEO has been developing a set of new tools for publishing, interlinking, searching, browsing and visualizing linked geospatial data. The presentation concentrates on the precision farming application and how it makes use of the developed tools.

The **LEO team** consists of Manolis Koubarakis, Panayiotis Smeros, Charalampos Nikolaou, George Garbis, Konstantina Bereta, Stella Giannakopoulou, Ioannis Vlachopoulos, Dimitrianos Savva, George Stamoulis (National and Kapodistrian University of Athens), Kostis Kyzirakos, Stefan Manegold (CWI) Bernard Valentin, Christophe Vandenberghe (Space Application Services) Heike Bach, Fabian Niggemann, Philipp Klug (VISTA), Wolfgang Angermair and Stefan Burgstaller (PC-Agrar).

Short CV

Manolis Koubarakis is a Professor in the Dept. of Informatics and Telecommunications, National and Kapodistrian University of Athens. He has published more than 150 papers that have been widely cited in the areas of Artificial Intelligence (especially Knowledge Representation), Databases, Semantic Web and Linked Data. His research has been financially supported by the European Commission (projects CHOROCHRONOS, DIET, BRIDGEMAP, Evergrow, OntoGrid, SemsorGrid4Env, TELEIOS, Optique, LEO, MELODIES, WDAqua and BigDataEurope), the Greek General Secretariat for Research and Technology (more recently through the Research Excellence Grant SCARE), the European Space Agency (project Prod-Trees) and industry sources (Microsoft Research and British Telecommunications). He is currently co-ordinating project LEO (http://www.linkedeodata.eu/) which develops tools for linked Earth Observation data and linked geospatial data, and applies them to the development of a precision farming application. Manolis' team develops the linked data infrastructure to be used in project MELODIES (http://www.melodiesproject.eu/) which studies how to exploit linked open data in a variety of environmental applications. He also participates in Optique (http://www.optique-project.eu/), a recent European effort in the area of Big Data with application scenarios from the energy sector (industrial partners Statoil and Siemens). He recently co-chaired the European Data Forum 2014 (http://2014.data-forum.eu/), the top European event aiming towards the development of a strong data economy in Europe.

Extended Abstract

Due to the growing world population, the improvement of yield quantities from existing agricultural land is an important challenge today. The goal of **precision farming** is to accomplish a sustainable balance of quantitative and qualitative crop production. Precision farming can contribute to reducing the global food insecurity by providing farmers with the necessary information to improve the decision making and farm management.

Providing field-level information can support farmers to improve their crop yield and attract long-term investment. The more detailed and exact picture farmers have about their agricultural crop land (e.g., through remote sensing and GPS technologies), the better the decision as to where and when seed, fertilizer and other management measures can be applied. Through the optimal use of these inputs, farmers can use their crop land more effectively and efficiently and increase crop size and quality. Besides this, precision farming can be used to quantify which farming operations are sustainable and economically successful. In summary, precision farming aims to increase farmers' income and crop yield while reducing the negative environmental impacts of farming.

In project LEO we have been developing a precision farming application which integrates satellite data and linked data, and guides farmers in the variable rate appliance of fertilizers on their fields. The application, nicknamed **LEOpatra** (**L**inked **E**arth **O**bservation **p**recision **a**griculture **tra**ctor application), is available on mobile devices such as tablets and smart phones.

LEO has also been studying the lifecycle of linked Earth Observation data and linked geospatial data and developing the following tools:

- The publishing tool **Geotriples** (Kyzirakos et al., 2014). Geotriples takes as input geospatial data in the form of an ESRI shapefile, a geospatial relational database, a KML file or an XML file and transforms it into RDF using the GeoSPARQL vocabulary. Geotriples is an opens source tool available at http://sourceforge.net/projects/geotriples/ .
- An extension to the interlinking tool **Silk** (http://silk-framework.com/) to discover spatial and temporal links among spatiotemporal data sources (Smeros and Koubarakis, 2015).
- The LEO data search engine and the LEODroid Android client. Together these tools allow the searching, browsing and visualization of linked spatiotemporal data using mobile devices such as tablets and smartphones.
- The tool Sextant for visualizing time-evolving linked geospatial data (http://sextant.di.uoa.gr/) .

In the presentation, we will discuss the precision farming application and explain how the various tools developed by LEO are used.

LEO brings together two academic institutions with strong background in the Semantic Web and Linked Data (National and Kapodistrian University of Athens and Stichting Centrum voor Wiskunde en Informatica), two SMEs with lots of experience with satellite data and their applications (Space Application Services and VISTA) and one industrial partner with strong Farm Management Information Systems experience (PC-Agrar). LEO has started on October 1st, 2013 and ends in September 2015.

Bibliography

(Kyzirakos et al., 2014) Kostis Kyzirakos, Ioannis Vlachopoulos, Dimitrianos Savva, Stefan Manegold, Manolis Koubarakis. *GeoTriples: a Tool for Publishing Geospatial Data as RDF Graphs Using R2RML Mappings.* Terra Cognita 2014, 6th International Workshop on the Foundations, Technologies and Applications of the Geospatial Web, in conjuction with ISWC 2014. Riva del Garda, Trentino, Italy, October 19-23, 2014.

(Smeros and Koubarakis, 2015) Panayiotis Smeros and Manolis Koubarakis. *Discovering Spatial and Temporal Links among RDF Data*. Unpublished Paper.