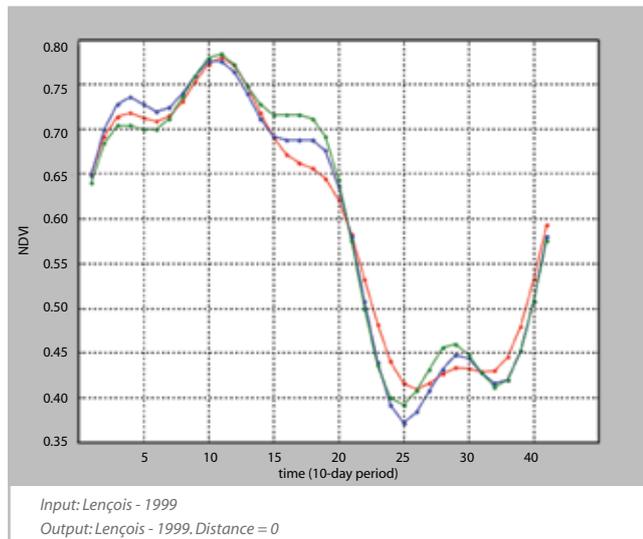




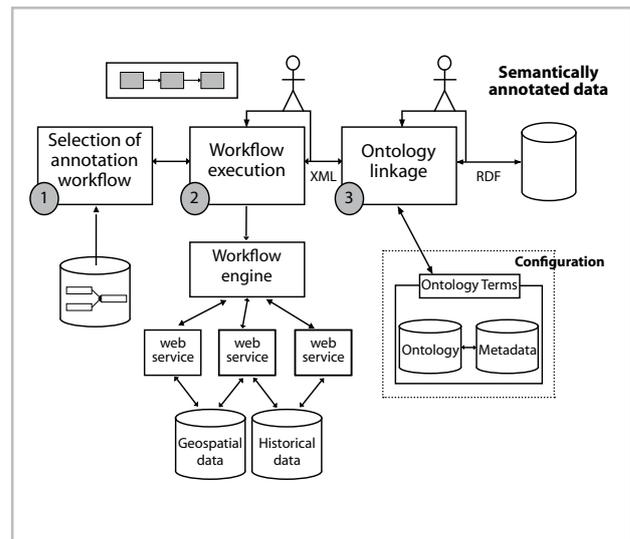
E-FARMS: A 2-WAY ROAD FROM SMALL FARMS INTO THE NETWORKED WORLD

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Screen copy from the eFarms site – co-evolution of NDVI time series, extracted from pixels of satellite images



Workflow-directed semantic annotation of geospatial digital sources

e-Farms was a multidisciplinary project conducted between Nov. 2007 and May 2010, combining research in computer science and agriculture. Its goal was to attack theoretical and practical problems involving sensor-based data management and wireless data communication in rural areas in Brazil. The project was centered on two needs of the Brazilian population: investigate low cost solutions for data communication in rural areas where data transmission is still very limited (due to cost and/or geographic factors); and provide models, methods and algorithms to support management, integration and analysis of sensor data, for decision support in crop management and agricultural planning. The research team was composed of computer scientists and researchers in agricultural sciences. The Cooxupe coffee cooperative, the largest of its kind in the world, with over 14.000 cooperating farms, was a partner of the project. Not only did it provide the basic case study, but also part of the software modules developed within the project was designed and validated within this large real context.



MAIN RESULTS

The project covered two kinds of activities: a) development and deployment of a wireless data communication network, from sensors to a central database server; and b) research on data structures, models, and algorithms applied to sensor and satellite data.

PRODUCTS/PUBLICATIONS

PUBLICATIONS

The main results of the project were reported in five journal papers in computer science, 15 conference papers, 13 of which in computer science and 2 in agricultural sciences. Five of the conference papers are in Brazilian conferences (in databases, image processing, and eScience), and 9 in international conferences (in databases, image processing, computer networks and GIS). These publications report theoretical and applied results in: a) databases (time series mining and correlations, workflow-driven annotation of geospatial data sources, query processing and real-time processing of sensor network data); b) satellite image processing (including new segmentation algorithms and automatic recognition of vegetation cover, for coffee crops, based on genetic programming); c) sensor network deployment and management; and d) methodologies for agricultural planning and crop productivity analysis from remote sensing data.

DEFENCES

The project was directly linked to the following defences: 1 MSc and 1 PhD in agricultural engineering; 3 MSc and 2 PhD in computer science. At the end of the project, additional graduate students were involved in research concerning project ramifications, namely 2 PhD in agricultural engineering; 3 PhD and 1 MSc in computer science.

TOOLS AND INFRASTRUCTURE

Part of the project consisted in the design and implementation of a multi-tier wireless sensor network, involving heterogeneous sensors, providing real time data that are relevant for crop monitoring – in particular, temperature, moisture and light. A first prototype of this network was deployed in Unicamp's experimental farm grounds. Sensor data are fed to the project's repositories, where they are cleaned, pre-processed, mined and analyzed by software tools. These tools implement new methodologies and algorithms for decision support in agriculture.

PROJECT SITE

www.lis.ic.unicamp.br/projects/efarms and
<http://proj.lis.ic.unicamp.br/efarms>

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