Experiences in the development of commercial web-based data engines to support UK growers within an industry-academic partnership

Y. Shahar[1, 2], C. Blacker[1], S. Leese[1], R. Sanderson[2], R. Kavanagh[1], P. James[2] and J.A. Taylor[2]

[1] Precision Decisions Ltd, Shipton-by-Beningbrough, York, YO30 1BS
[2] Newcastle University, Newcastle upon Tyne
Corresponding author: *yonatan@precisiondecisions.co.uk*

The lifecycle of Precision Agriculture data begins the moment that the measurement is taken, after which it may pass through each multiple data processes until finally arriving as an output employed back in the production system. This flow can be hindered by the fact that many farm datasets have different spatial resolutions. This makes the process to aggregate or analyse multiple Precision Agriculture layers arduous and time consuming.

Precision Decisions Ltd located in Yorkshire, U.K. together with Newcastle University, and co-funded by Innovate UK, formed a Knowledge Transfer Partnership (KTP) project to research and find the best way to provide effective high-level decision services to farmers and growers with guidance, e.g. on yield optimisation, that critically will be straightforward for growers to use. The service will correctly process spatial agronomic data and then condense these layers into a single surface upon which agronomic decisions can be made.

This project develops data frameworks which creates agronomic information layers from a farms data and stores it as Geographic Grids ready to be processed and transformed into the required spatial resolution. Once the datasets are aligned, multiple layers can be condense into a single surface (analytic or aggregated layer), enabling the application of different types of operations and calculations to derive spatial agronomic outputs (e.g. prescription maps).

The accompanying poster will display the cycle and processes of the data and how Precision Decisions' software frameworks process the data and output Precision Agriculture layers as maps or analytic layers for the clients. It will also illustrate the mode of development that balances academic knowledge with the company's (and grower's) requirements for commercial services.

Precision Agriculture Data Lifecycle and Data Frameworks

Authors
Mr Yonatan Shahar, Dr James Taylor, Dr Roy Sanderson, Mr Philip James,
Mr Rich Kavanagh, Mr Clive Blacker, Mr Stephen Leese

This project is supported by Innovate UK to form a Knowledge Transfer Partnership between Newcastle University and Precision Decisions Ltd. York UK, which is a leading retailer of Precision Agriculture technology in the United Kingdom. The project aim is to provide a new start-to-finish service to clean and interpolate spatial agronomic layers to and condense these multiple layers into a single surface that will provide growers with a map upon which agronomic decisions can be made.

Background

Increasingly farmers face difficulties managing the different types of data produced on-farm. This reduces their potential to generate relevant information. These data have many characteristics that are similar, giving the opportunity to generalise and automate data collection, storage and processing into a framework that will facilitate the efficient management of Precision Agriculture data simplifying the task faced by the farmer to interpret and to act on these data within spatial decision support systems

Methodology

Commercially-operated farm sensors, such as the Yara N-sensor, have been connected to a server via Wi-Fi or mobile network communications. Data is automatically uploaded from the field/farm without grower intervention. Once on the server, new data is 'scraped' within 5 minutes and delivered to an analytic and mapping processes (python-based). This moves the data into a geo-database, performs filtering and interpolation using geostatistical approaches (kriging). The output is also stored in a geo-database, mapped automatically and delivered to the grower via a WebGIS platform (MiFarm™). The entire process from field to WebGIS is fully automated (with some checks along the way to avoid mapping 'strange' data) and delivers maps back to the grower within 30 minutes.

References

Whelan, B. & Taylor, J., 2013. *Precision Agriculture for Grain Production Systems.*, Melbourne: CSIRO Publishing

Spatial Data Aggregation — Analysis — Gridded Maps
Outputs

Precision Decisions WebGIS

Precision Agriculture Data Types
Yield Recordings — Optical Crop Scan — Soil Analysis — Geo location — EM

Data is sampled and delivered to Precision Decisions Ltd.

The agronomic layers can be use for agronomic analysis, vectorised or rasterised to deliver as spatial layers to the WebGIS to form a single surface.

The raw data is saved, then cleaned and filtered to remove error, then interpolated and saved into data collections as Agronomic Layers.

Extensible databases have been developed to manage raw and interpolated data structures. Spatial data analysis is based on Python-libraries (e.g. Geo-Pandas, Numpy)

Output

Input

Relational and NoSQL Database Schemas
Analytical and Mapping Processes

Analyse — Visualise — Reports — Spatial Calculations — Spatial Process — Data Delivery

Filter — Clean — Group — Spatial Process — Data Insert