Automatic image processing for agriculture through specific ENVI modules (add-on)

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Automatic image processing for agriculture through specific ENVI modules (add-on)

Content

1) ENVI, a powerful image processing programme

2) Complementary ENVI modules are **NEEEDED for Agriculture/ Precision Agriculture** (why?/ which?)

3) *Specific ENVI modules* (‘add-on) developed by IAS-CSIC
   3a. Orchards trees assessment (CLUAS®)
   3b. Herbaceous crop assessment (SARI®)
   3c. Cropping systems classification (CROPCLASS®) and parcel isolation (CROPCLASS++, under development)
   3e. Automatic image georeferentiation/ co-registration AUGEO-2.0®
   3f. Automatic modules integration (AMI, under development)

4) **AIM:** to contribute to the automatic designing of agricultural operations through remote images, ENVI and new specific “ENVI-add-on”

5) Publications, registrations, patents and project (IAS/ CSIC)
Remote sensing:

Very useful for agriculture and environment studies
Highly informative
Economically feasible at large and reduced scale

ONLY IF IMAGE PROCESSING IS FULLY AUTOMATED
(adequately managed through specific menus)
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AIM

We intend to contribute to automate the design of agricultural operation through remote sensing images

WHICH agricultural operations?: ALL, seeding, fertilization, herbicide application, etc.

WHAT IS NEEDED?

Specific modules (add-on) to complete and automate ENVI image processing

Any remote image can provide potentially tremendous amount of information for farmers, however its processing, sectioning and assessment at reduced scale (micro-parcel, micro-plot scale) is needed:

To provide useful/ manageable information
To achieve the processes economically feasible to be used for farmers......
1) ENVI/ Interfaces: many processing options…. But lack specific menus for agricultural
2) ENVI/ Interfaces: many processing options. But it lacks specific menus for agricultural uses…

…so we solved this inconvenience by adding our own tools.
3) AMI: Automatic designing of agricultural operations through remote images
4. Precision Agriculture through remote sensing
(sophisticated technology, environmental-friendly, and economics)

a) Spatial variability of biotic (weed patches) and abiotic (nutrient, water) factors
b) Biotic/abiotic map
c) Treatment map
d) Variable rate application equipment
e) Site-specific treatments (micro-plots)
3) **Specific ENVI modules ("add-on") developed by IAS-CSIC**

   3a. Orchards trees assessment (CLUAS)

   3b. Herbaceous crop assessment (SARI)

   3c. Cropping systems classification (CROPCLASS)

   3d. Isolation of individual agricultural parcel (CROPCLASS++)

   3e. Automatic image georeferentiation/co-registration AUGEO-2.0

   3f. Automatic modules integration (AMI, under development)
3a. Software CLUAS®: Assessment of land uses in tree orchards (at tree and parcel level)

<table>
<thead>
<tr>
<th>Plot</th>
<th>Area (ha)</th>
<th>Olive trees (%)</th>
<th>Vegetat. Cover (%)</th>
<th>Bare soil (%)</th>
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<tbody>
<tr>
<td>A</td>
<td>5.23</td>
<td>24.6%</td>
<td>50.1%</td>
<td>25.2%</td>
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<tr>
<td>B</td>
<td>4.65</td>
<td>6.7%</td>
<td>61.1%</td>
<td>32.4%</td>
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<td>54.2%</td>
<td>5.6%</td>
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<tr>
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<td>67.4%</td>
<td>0.4%</td>
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<tr>
<td>E</td>
<td>4.31</td>
<td>38.0%</td>
<td>47.1%</td>
<td>15.0%</td>
</tr>
</tbody>
</table>

IAS- CSIC.
Peña-Barragán et al. 2005, Agric., Environment & Ecosystems

Microplot length and height is arbitrarily defined. Indicators calculated by SARI:

- Integrated pixel digital values (IDV)
- Percentage of pixels (%PI) with DV ≠ 0

Classify the microplots in defined classes

3b. Precision agriculture, software SARI® to define and assess “micro-plots”
To design any agricultural operation at farm/parcel level
(Input parcel prescription map)
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3c. Cropping systems classification (CROPCLASS®)
   (Specific ENVI module, “add-on”)

- Multi-temporal classification of crop fields.
- User-defined plot size and geometry.
- Import/export related only to georeferenced coordinates.
- Spatial and digital information retrieval from each plot.
- Reports for each plot and the image as a whole.
3c. Software CROPCLASS®: to automatically isolate, classify and analysis each parcel

High spatial resolution, multispectral and multi-temporal series of images

1) Plot/parcel isolation
2) Assessment and export of digital values
3) Analysis and interpretation of “its” agricultural status
4) Export of the information generated
3e Automatic image georeferencing/ co-registration AUGEO-2.0®
(Specific ENVI module, “add-on”)

- Only ATT’s within a defined range are mutually detected.
- Different colors work as a filter.
- Minimum and maximum distance
3e Automatic image georeferencing/ co-registration AUGEO-2.0®

- **Dificultad para encontrar señales terrestres georreferenciadas (STG)**
- **Requiere gran cantidad de tiempo de trabajo**

Hard edge points.

- **Mayor precisión**
- **Menor coste de tiempo**

Señales Terrestres Georreferenciadas.
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3f. AMI: Automatic Module Integration (under development)

- All previous modules compiled into one add-on.

- Execution as a sequence.

- Outputs from one module could serve as input data to another.
4. Software CROPCLASS® + AMI: to automatically isolate, classify and analysis each parcel managing multitemporal images series

3f. Automatic modules integration (AMI, under development)
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5) Publications, registrations, patents and projects (IAS-CSIC)

Projects
AGL2010- 15506 (2011-2013)

Papers
-- CLUAS®, Computers & Electronic in Agriculture, 2008
-- AUGEO-2.0®, Precision Agriculture 2011- DOI
-- SARI®, Precision Agriculture 2011a (in print)
-- SARI®, Precision Agriculture 2011b (in print)

Registration
CLUAS® (2008)
SARI® (2008)
AUGEO-2.0® (April 2010)
CROPCLASS® (March 2011)

Patents:
CLUAS PCT/ ES2008/07001
SARI P200801932/ Nº ES 2 332 567