



Kandidat

Dimitris Marmanis

Masterthesis (Jahr: 2012)

Evaluation of Intra-Object Segmentation Methods for Identification and Landuse Classification of Mixed Agricultural Parcels

Referent

Prof. Dr. Heinz Saler, Prof. Dr. Luis Angel Ruiz Fernandez

Keywords

Mixed Landuse Classification, Automatic Segmentation, Agricultural Databases, Matlab, Automatic Landuse Detection, Feature Extraction

Zusammenfassung

This Master Thesis work is focused on the creation of a robust algorithmic workflow for feature extraction and classification of landuse/ landcover data, contained within mixed agricultural parcels, in agricultural geodatabases. This scientific work resembles a small part of a larger project which has as an ultimate goal to fully automate the update processes of agricultural geotabases found in multiple agricultural regions in Spain. This Master Thesis has been conducted at the Department of Geodesy, Cartography and Topography, Polytechnic University of Valencia, Spain.

Agricultural landuse database are an essential source of information for natural resource management and landscaping. Under this scope, their contained information can be used for crucial decision making such as, disaster management, subsidies calculation, crop calculation or irrigation water needs. This essential source of information, closely interrelated to the precision of landuse representation, can be used for planning both in local or national level and significantly affect the future farming policies. All the above clearly underline the importance of having an accurate information within the limits of such databases, as wrong data would lead to wrong decisions.

As agricultural databases are very dynamic systems, they are constantly change and evolve through time rapidly. This points out the necessity of updating their contained information on a regular base so it can be accurate. As the update requires a manual human interaction (professional image analyst) for interpreting each agricultural parcel separately, the process is transformed to a very expensive and time consuming procedure. This drawback introduces a boundary in their broad implementation and extensive use, due to economic constrains. This problem can be easily solved by the introduction of a fully automated computer process, which would mimic the human interpretation and accurately update the database regularly.

This thesis focuses on the creation of a fully automated algorithm that would allow such a process of feature extraction and landuse classification, in a intra-object level (inside the parcel), within the limits of an agricultural database. This means that our process targets to the detection of changes within small regional areas and the update of this information through a classification process.

The workflow procedures of the designed algorithm can be divided in three distinct categories. In sequential order these are the segmentation, the post-segmentation processing and the classification. In the segmentation phase the entire parcel data are segmented individually based on a RGB and a NDVI generated images over multiple segmentation scales, revealing different scale of details on each case. In the next step of post segmentation processing, the generated adjacent segments are merged in between them, based on their spectral and size

characteristics. Also a set of height derived segments are extracted based on nDSM models and fused with the previous image segment information, creating a richer representation of the image objects. All these information during the third phase are passed to a classifier, where a set of 314 geometric, spectral, textural and height parameters are calculated for each image segment. These information can now be used to the adequately classify the data in six distinct landuse classes and update in such a way the parcel's information.

To test the results and accuracy of the designed algorithm an extended testing phase was implemented and a set of 364 mixed landuse agricultural parcel were designed, classified and assessed. As many improvements and advances have occurred during the construction of the automated algorithm, the evaluation process has been conducted multiple times, assessing its approach individually.

The outcome of the evaluation stage has revealed some very promising results by even outperforming popular commercial tools that are specially designed for such processes.

For the realization of this work the programming language Matlab has been mainly used in combination with small integrations from commercial spatial and image analysis tools, such as Erdas Imagine and ESRI ArcGIS. In addition to the later a sequence of side process were conducted by a research lab-assistant, using FETEX 2.0 attribute feature extraction and See5 classification software.



Figure 1: An initial agricultural mixed landuse parcel on the left side and its classified result on the right. All the colors in the classified result are standardize, so brown stands for soil, green for vegetation, white for shadow and red for building.

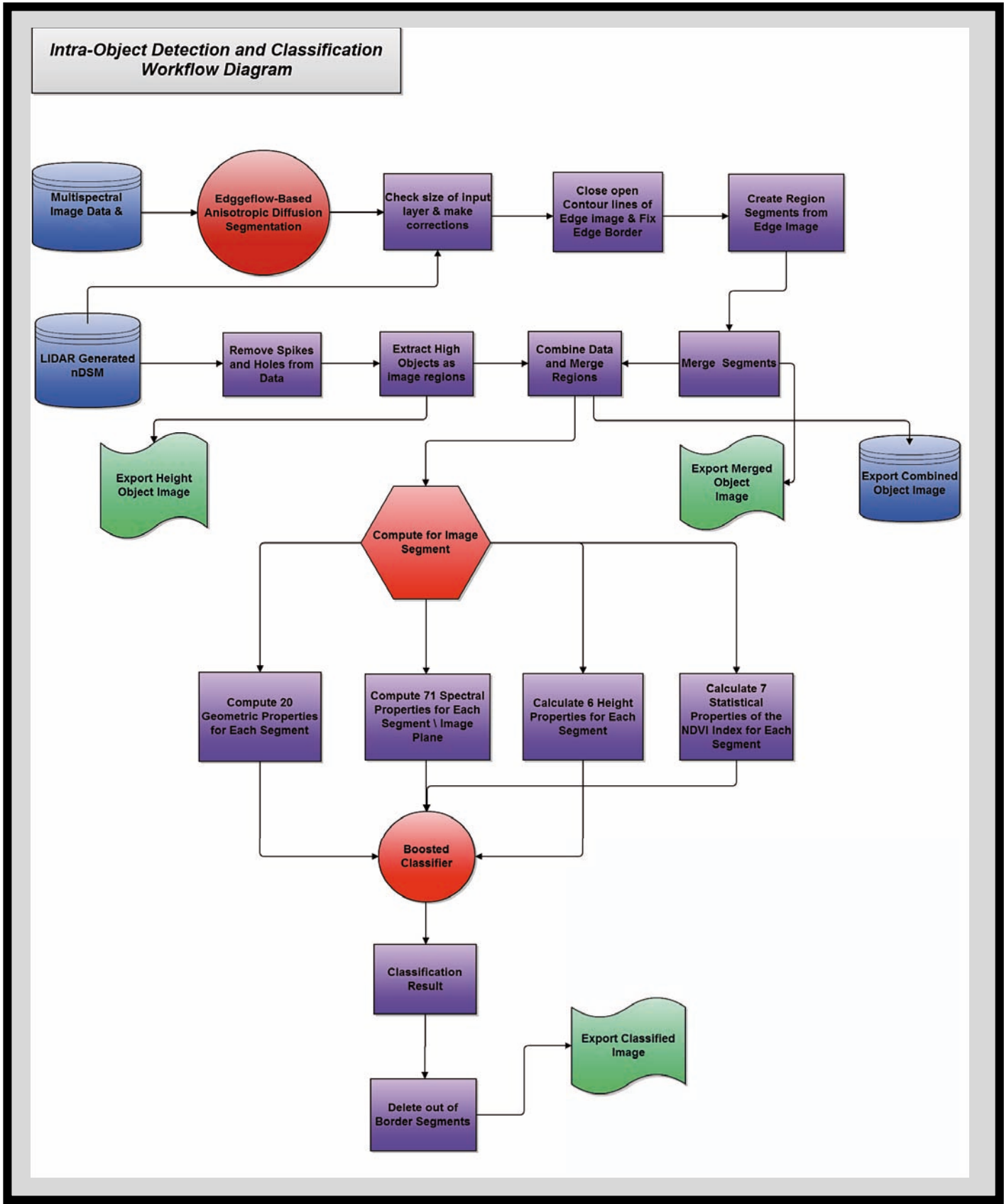


Figure 2: Individual processes implemented by the designed algorithm in Matlab