THE STEM PROJECT: AN OPEN SOURCE SOLUTION FOR AGRICULTURAL MONITORING

Michele Dalponte[1], Francesco Nex[2], Luca Delucchi[1], Markus Neteler[1], Fabio Remondino[2], Luca Pedron[3], and Damiano Gianelle[1]

1 Dept. Agro-ecosystems and sustanable bioresorces, Resercha nd Innovation Centre, Fondazione Edmund Mach, San Michele all'Adige (TN), Italy

2 Fondazione Bruno Kessler, Trento, Italy

3 Provincia Autonoma di Trento, Trento, Italy

In the last decade, the use of open source solutions is becoming an important issue to reduce the costs and improve the efficiency for many public administration all over Europe. This trend has been further pushed by the inception of the economic crisis in the very last years. Moreover, the offices involved in the land administration need to efficiently process an increasing amount of data from heterogeneous sources, ranging from simple declaration provided by land owners to vector maps, satellite / aerial images or LiDAR data. Therefore the choice of an efficient software becomes very important to properly allow all these tasks, especially when low cost, or worse, open solutions are considered.

The STEM project, funded by the Autonomous Province of Trento (Italy) aims at implementing algorithms and tools for the efficient processing of remotely sensed data for forestry and agricultural applications. All the implemented tools are integrated in the open source Q-GIS software using a dedicated plug-in developed in the project. External open source libraries such as GRASS and R, as well as in-house algorithms, are integrated in the plug-in in order to fulfil all the required functionalities of the systems. All the algorithms were developed to use already available data as input and to prevent the additional costs of further acquisitions. Supervised classification algorithms and well-tested procedures were chosen in order to assure the maximum reliability and stability of the provided results in every operative condition. The final goal is the development of a turn-key systems for public administration technicians allowing easy and transparent classification of wide areas and their simple query to define the land use and in particular the orchard and plantation typologies.

The development of the tool is still an ongoing and the paper presents the first promising results. The main plug-in functionalities for agricultural applications are:

- remote sensing data preprocessing, i.e. to be used for the image preparation;
- image segmentation, i.e. to extract uniform areas corresponding to plantation, fields, etc.;
- feature extraction, i.e. to extract features to be used in the classification step. Features can be spectral, geometrical, and textural.
- image classification, i.e. to produce classification maps of the analyzed agricultural areas;
- classification maps post-processing, i.e. aggregation of the pixel level maps in object maps, computation of the classification accuracies, computation of the extent of each type of plantation.

For the evaluation of the procedure, two test areas (one flat and one mountainous) are considered and a set of RGB-NIR ortho-images at 50 cm spatial resolution are used as input data. The SVM (Support Vector Machine) algorithm was adopted as classifier in the data processing: both multi-level spatial and texture features are extracted and a minimum of well distributed training areas is considered for each class. On both test areas the

classification accuracies of the different land covers and orchard types (vineyard, apple plantation, etc.) is higher than 90%.

All the technical details of the developments, the achieved results, the pros and cons of the STEM tool and its future developments will be presented and discussed.

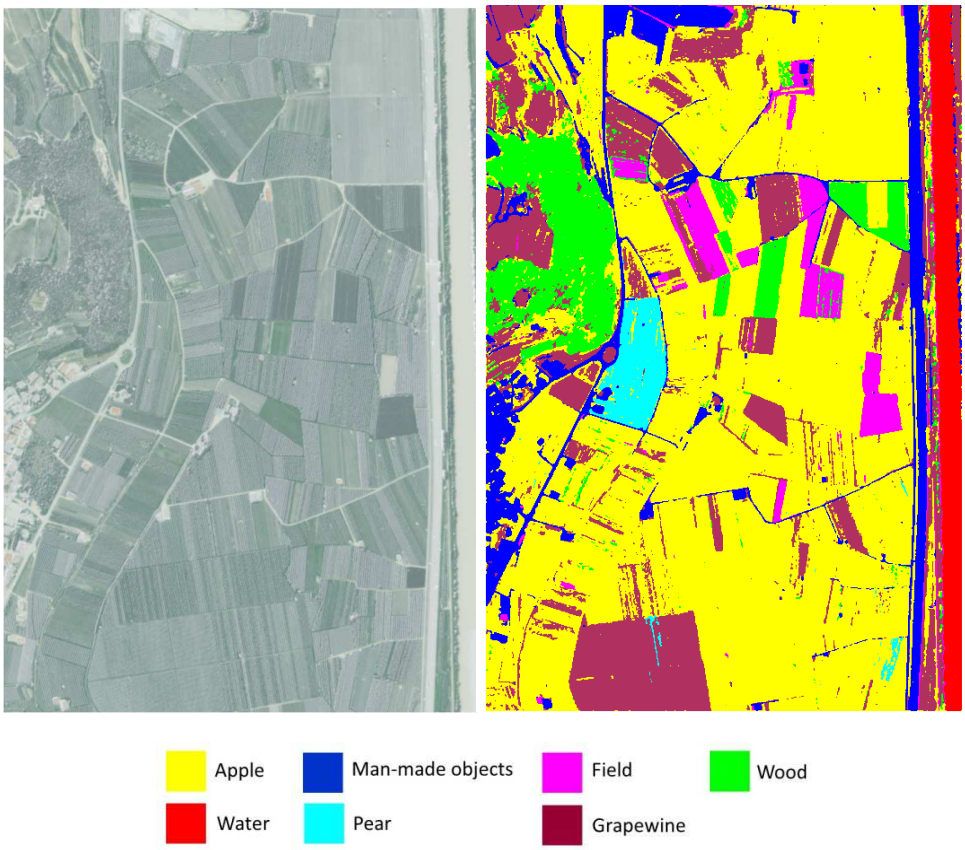

Figure 1 – Example of ortho-images used in the classification and the corresponding classification map at pixel level over the Adige Valley, Italy