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LAND COVER CLASSIFICATION *Applied to forest fire management*

As part of the European FireParadox project, the University of Zurich (Dept of Geography) in collaboration with Cemagref (Aix-en-Provence) and Humboldt-Universitaet zu Berlin (Geomatics, Dept.) has achieved an improved land cover mapping by combining SPECIM's AISA Eagle's hyperspectral information and LIDAR data, and classify them with single SVM

Fig. 1. AISA Eagle data geometrically and radiometrically corrected with PARGE*

An enhanced mapping of the wild land urban interface can be a significant input to forest fire behaviour models leading to improved risk assessment and mitigation of forest fires. The University of Zurich obtained an improved procedure for land cover mapping by successfully combining AISA Eagle and a LIDAR system using a SVM classifier. While LIDAR data provides the spatial information dimension categorizing geometric characteristics of the surfaces, AISA Eagle samples the spectral dimension, by classifying surface types and fuel moisture.

In this research, the area under study included Mediterranean vegetation intermixed with urban structures. The LIDAR system and AISA Eagle were mounted together on a helicopter and the airborne survey covered a region of 13.6 x 3.6 km with a spatial resolution of 1 meter. AISA Eagle data was geometrically corrected by PARGE (see Fig. 1).

Both AISA Eagle and LIDAR data were jointly classified by a Support Vector Machines (SVM) classifier. As a non-parametric classifier, SVM are particularly well adapted to classify data of high dimensionality and from multiple sources as presented in this study.

The joint classification of AISA Eagle and LIDAR led to a significant improvement in terms of overall accuracy and kappa (see Fig. 2 and 3). The inclusion of classes with similar geometric but different spectral properties, such as roofs of different materials would even increase this improvement.

Accuracy assessment of SVM classifications

	Overall accuracy	Kappa coefficient
AISA Eagle	69.15%	0.645
LIDAR	31.73%	0.226
AISA Eagle & LIDAR	75.4%	0.716

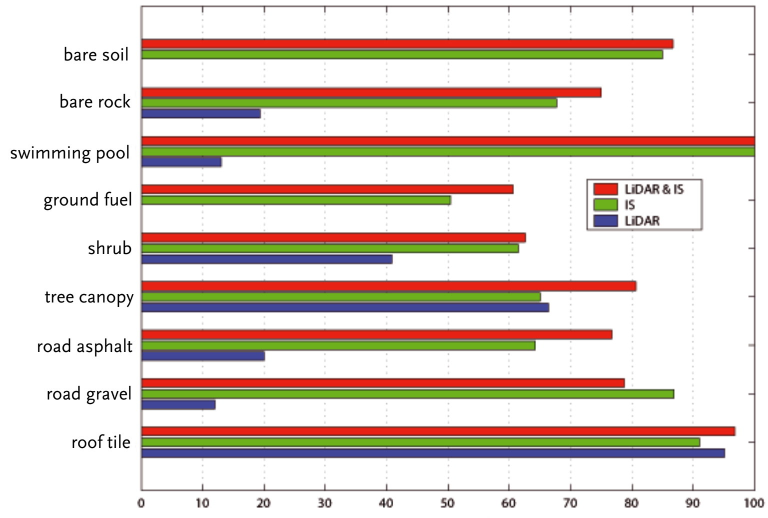

Fig. 2. User accuracy of SVM classification performances based on AISA Eagle and LIDAR

*) PARGE software was developed by the University of Zurich. SPECIM provides CaliGeo software as default with turnkey AISA systems

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Landcover classification scheme

LEVEL 1	LEVEL 2	LEVEL 3
Built up	Buildings/roof	Wood shingle roof
		Tile roof
		Metal roof
		Concrete roof
	Transportation areas	Asphalt road
		Concrete road
		Gravel road
		Parking lot
	Sport infraestructure	Tartan court
Vegetation	Ground fuels (<30cm)	Grass & agricultural fields
	Shrub/garriuges (<2m)	
	Tree stands	* Extendable for different vertical structure & species
Non-urban bare surfaces	Bare soil	
	Bare rock	
Water bodies	Swimming pools	
	Natural water bodies	

A classification scheme specifically adapted to the characteristics of the wildland urban interface was developed based on the fuel type classification of the European PROMETHEUS project (see table).

Spectrally similar classes such as bare soil and roof tiles made of similar material could be better separated by the vertical information provided by LIDAR. This effect is visible when comparing the final land cover map based on the multi-source data set to a land cover map derived from purely spectral information (Fig. 3).

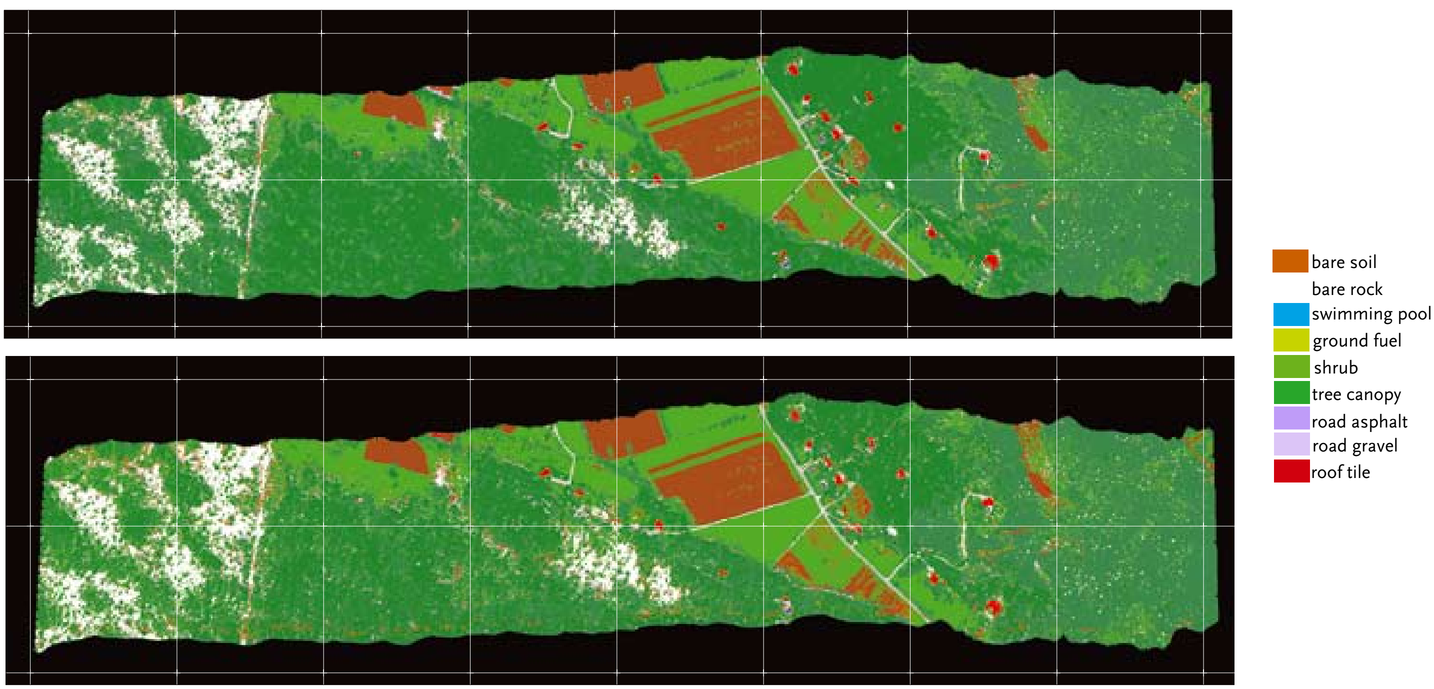

Fig. 3. Upper map: land cover map based on the input sources AISA Eagle and LIDAR
Lower map: land cover map based on the single input source AISA Eagle

Source: B. Koetz, F. Morsdorf, T. Curt, S. van der Linden, L. Borgniet, D. Odermatt, S. Alleaume, C. Lampin, M. Jappiot and B. Allgöwer (2007): FUSION OF IMAGING SPECTROMETER AND LIDAR DATA USING SUPPORT VECTOR MACHINES FOR LAND COVER CLASSIFICATION IN THE CONTEXT OF FOREST FIRE MANAGEMENT. In, The 10th International Symposium of Physical Measurements and Signatures in Remote Sensing (ISPMSRS). Davos, Switzerland.