Spectral Characteristics of Hypespectral and Multispectral Sensors for Area Based Tree Species Classification

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Area based tree species classification using spectral characteristics of hyperspectal (HS) sensor and the simulated spectral characteristics of four band *Vexcel UltraCam-D* (UCD) and *UltraCam-X* (UCX) multispectral sensors was studied. Airborne hyperspectral images of the tree canopy were acquired in Hyytiälä forest [1] using SPECIM, AisaEAGLE line scanning hyperspectral camera. The flight campaign was organized on July 22, 2011 from 6:44 to 7:38 GMT. HS images with 64 spectral bands were acquired in the wavelength region 400 nm to 1000 nm using spectral sampling of 9.3 nm. The pixel size at ground was approximately 0.5 m. The camera field of view (FOV) was 35.8°. The forest was imaged in nine strips. Strips were radiometrically calibrated to radiance and geometrically rectified into WGS84 UTM zone 35 projected coordinate system [2]. In total, 577 forest plots (each plot has single species) of three tree species (254 pines, 177 spruces and 146 birches) visible in HS image strips were identified by an expert using previously acquired LiDAR and other aerial images. For each plot 21×21 pixels window (10.5m^2 area) was extracted from HS image, the mean spectrum was calculated and used as a feature in classification process. The quadratic discriminant analysis (QDA) was used as the classifier. To measure the classification performance of the sensors the classification rate (CR) and the kappa value (KA) were calculated. Leave-One-Out classification results for spectral characteristics of HS sensor and the simulate spectral characteristics of UCD, UCX sensors (for the 577 plots extracted from 9 strips) are shown in Table.1. There are no significant differences in the classification results between the UCD and UCX sensors both were around 89.5% and kappa 0.84. The HS sensor gives the best classification accuracy (98.4%). With HS sensor, there is around 16% increment in pine class and 5% in spruce class. These high classification accuracies are partly due to limited view-illumination geometries and short measurement time intervals between the strips.

Table 1: Leave-One-Out classification results for the simulate spectral characteristics of UCD, UCX sensors and spectral characteristics of HS sensor for the 577 plots extracted from 9 strips.

Sensor	**Total**		**Pine**	**Spruce**	**Birch**
	CR [%]	**KA**	**CR [%]**	**CR [%]**	**CR [%]**
UCD	89.4	0.84	83.1	89.8	100.0
UCX	89.6	0.84	83.5	89.8	100.0
HS	98.4	0.98	100.0	94.9	100.0

References

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