



## **Mapping natural and urban landscapes using airborne remote sensing data fusion**

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The recent and forthcoming availability of very high spatial resolution imagery from satellite and airborne sensors offers the possibility to generate an increasing number of remote sensing products and opens new promising opportunities for land-cover mapping applications. Data fusion strategies, applied to modern airborne Earth observation systems, including the MIVIS hyperspectral sensor, the ADS40 color-infrared camera, and LiDAR sensors, are explored in this work for fine-scale mapping of heterogeneous urban/rural landscapes. An over 1000-element array of supervised classification results is generated by varying the underlying classification algorithm (Maximum Likelihood/Spectral Angle Mapper/Spectral Information Divergence), the remote sensing data stack (different multi-sensor data combination), and the set of hyperspectral channels used for classification (hyperspectral feature selection). The analysis focuses on the identification of the optimal data fusion configuration, with respect to the optimality criterion of the classification accuracy, and investigates marginal improvements derived from each considered sensor. Numerical experiments, performed on a 20-km stretch of the Marecchia River (Italy), allow for a quantification of the synergies of multi-sensor airborne data. The use of Maximum Likelihood and of the feature space including ADS40, LiDAR-derived normalized digital surface features, texture layers, and 24 MIVIS bands represents the scheme that maximizes the classification accuracy on the test set. This configuration provides high accuracy (92.57% overall accuracy) and suggests the potential of the proposed approach to multisource data classification in capturing the high spatial variability of natural and human-dominated environments. Significant inter-class differences are also found within the explored configurations, thus indicating possible sub-optimal solutions of interest for landscape-driven mapping of specific classes, such as mixed forest, floodplain, urban, and agricultural zones.