FUSION OF MULTI-MODAL AND MULTI-TEMPORAL SATELLITE DATA FOR FOREST MANAGEMENT

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ABSTRACT:

We present an automated image analysis scheme for utilizing multi-modal and multi-temporal satellite data for forest inventory management, forest planning, and estimation of impact of storms and other calamities. The increasing availability of high-resolution and fast-revisiting remote sensing satellite systems (e.g., RapidEye, TerraSAR-X, Cosmo-SkyMed) allows to study the supplementary characteristics of different sensors for extracting forest parameters with the ultimate goal of monitoring phenological development of forest. To this end, we focus on different forested areas such as "alpine terrain", "tertiary hills" and "low mountain range terrain". Besides high variety of vegetation types, we also expect large differences in weather conditions depending on the test area. Hence, multi-spectral and SAR data are taken into account, to benefit from their complementary characteristics. Their acquisition schedule is harmonized with the growth period of the respective forest type in the different test sites. The first step of image analysis consists of independently processing the multi-spectral and SAR data by segmentation and texture operators. These are dedicated to extract characteristic forest parameters per season (e.g., tree density, tree height, forest clearings). Then, the parameters are fed into a forest growth simulator, whose results are tested against the simulations based on the standard data set from forest databases. Based on the accuracy of simulator predictions, we will evaluate significance and quality of the extracted parameters and the necessity of additional GIS data. Furthermore, the overall costs of each method will be calculated to economically optimize a strategy for inventory and monitoring for a forest enterprise.