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Unsupervised identification of snow covered areas by decision tree classifier

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The analysis of remotely sensed images is a powerful tool for monitoring the snow cover extension and typology over mountainous areas where often the in situ measurements are difficult. This work focuses on the problem of identifying snow-covered areas. A particular attention is devoted to transition regions which are only partially covered by snow and which play a relevant role in the snowmelt process. Such regions are often badly discriminated in the global snow cover products. The objective of this work is to propose a method to map the snow cover from multispectral images by an unsupervised approach. The effectiveness of a Decision Tree Classifier (DTC) to tackle the considered classification problem has been previously verified. Specifically the topology of the decision tree was based on the properties of the spectral responses of snow covered/non-snow-covered areas, but a drawback of the method was the presence of internal threshold parameters to be empirically set by the user. We propose here to combine this decision tree approach with an unsupervised technique to automatically select optimal values for the above mentioned thresholds. In particular a Bayesian approach is adopted which expresses the problem of threshold selection as the minimization of a functional related to the probability of classification error. Experiments on an one-year MODIS multichannel data set with a frequency of 1-2 images per day are presented. The experimental results are quantitatively tested with nivometric ground data. In addition, a further evaluation of the results is carried out by integrating the snow cover maps into snowmelts models to compute the snow contribution in the runoff process.