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Surface roughness classification using polarimetric radar data and ensemble learning techniques

Jesus Alvarez-Mozos (1), Jan Peters (2), Arantzazu Larrañaga (3), Maria Gonzalez-Audicana (1), Niko E.C. Verhoest (2), and Javier Casali (1)

(1) Public University of Navarre, Projects and Rural Engineering, Pamplona, Spain (jesus.alvarez@unavarra.es), (2) Laboratory of Hydrology and Water Management, University of Ghent, Ghent, Belgium, (3) Tracasa, Sarriguren, Spain

The availability of space-borne radar sensors with polarimetric capabilities, such as RADARSAT-2, brings new expectations for the retrieval of soil moisture and roughness from remote sensing. The additional information provided by those sensors is expected to enable a separation of the confounding effects of soil moisture and roughness on the radar signal, resulting in more robust surface parameter retrievals.
In this study we analyze two RADARSAT-2 Fine Quad-Pol scenes acquired during October 2008 over an agricultural area surrounding Pamplona (Spain). At that time of the year agricultural fields were bare and showed a variety of roughness conditions due to the different tillage operations performed. Approximately 50 agricultural fields were visited and their roughness condition was qualitatively evaluated. Fields were classified as rough, medium or smooth and their tillage direction was measured. The objective of this study is to evaluate the ability of different polarimetric variables to classify agricultural fields according to their roughness condition.
With this aim a recently developed machine learning technique called 'Random Forests' (RF) is used. RF is an ensemble learning technique that generates many classi[U+FB01]cation trees and aggregates the individual results through majority vote. RF have been applied to a wide variety of phenomena, and in the recent years they have been used with success in several geoscience and remote sensing applications. In addition, RF can be used to estimate the importance of each predictive variable and to detect variable interactions.
RF classification was applied at the pixel and at the field scale. Preliminary analyses showed better classification results for smooth and medium roughness fields than for rough ones. The research is ongoing and the influence of tillage direction and surface slope needs to be studied in detail.