Classification of Polarimetric SAR Data Using Dictionary Learning

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ABSTRACT

This contribution deals with classification of multilook fully polarimetric synthetic aperture radar (SAR) data by learning a dictionary of crop types present in the Foulum test site. The Foulum test site contains a large number of agricultural fields, as well as lakes, forests, natural vegetation, grasslands and urban areas, which make it ideally suited for evaluation of classification algorithms.

Dictionary learning centers around building a collection of image patches typical for the classification problem at hand. This requires initial manual labeling of the classes present in the data and is thus a method for supervised classification. Sparse coding of these image patches aims to maintain a proficient number of typical patches and associated labels. Data is consecutively classified by a nearest neighbor search of the dictionary elements and labeled with probabilities of each class.

Each dictionary element consists of one or more features, such as spectral measurements, in a neighborhood around each pixel. For polarimetric SAR data these features are the elements of the complex covariance matrix for each pixel. We quantitatively compare the effect of using different representations of the covariance matrix as the dictionary element features. Furthermore, we compare the method of dictionary learning, in the context of classifying polarimetric SAR data, with standard classification methods based on single-pixel measurements.

Keywords: Polarimetric SAR, dictionary learning, Foulum, classification

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