CONTRIBUTION OF THE INTER-CHANNEL POLARIMETRIC COHERENCE FOR SOIL CLASSIFICATION

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1. INTRODUCTION

Fully polarimetric SAR (POL-SAR) images provide a large amount of information through the four channels HH, VV, HV and VH. They proved to be useful in many applications such as delimiting homogenous areas [1], [2]. Such large amounts of data require robust processing algorithms with minimal supervision and low complexity, especially for classification purposes.

Most existing classification algorithms (H/A/alpha for instance [3]) use combinations of some or all the channels as features for classification. In this work, we are interested in the information of the inter-channel polarimetric coherence as a feature for the classification algorithm.
The coherence information is known for being used in multi-temporal acquisitions for its advantage of detecting changes in the scenes during time. It is commonly used in interferometry [4]. In this work, we want to profit from this information in the case of polarimetric images in order to take advantage of the multi-channel property and analyze the polarimetric cross-correlation.

This coherence classification approach (reading images, computing the coherence and the classification) was implemented and tested within the OTB (ORFEO ToolBox), the free software which is dedicated especially for remote sensing imagery processing [5].

2. METHODOLOGY

In our approach, we have considered the multi-channel property of the images to retrieve the inter-channel coherence information used as a feature for our classification algorithm, in our case the k-means [6]. We have chosen this algorithm due to its simplicity and in order to focus on the approach itself (the coherence information) and not on the used algorithm. The inter-channel coherence is computed between every two channels (HH and VV, HH and HV, and VV and HV).

The data we dispose is an airborne CV-580 data acquired near Ottawa, Ontario, Canada, on July 29, 1998 with a resolution of 4 m by 0.43 m. It consists essentially of an agricultural area of soya, bean, barley, wheat and corn. Small urban agglomerations surround this vegetation area. Such high resolutions allow us to detect roads or rivers used to define the portion of image we will be working on. We dispose also a ground-truth image to be used to validate the results.

To test the reliability of the approach, we have applied the same classification algorithm ; k-means, directly to three images (HH, VV and HV) used as features, and compared the results of both classifications.

The comparison of the results of both methods shows better distinction of land fields for the inter-channel coherence approach. The criterion that we have considered in the comparison is the percentage of miss-classified pixels in a chosen class form the ground-truth data. It consists of a soya field delimited by the road in the right side and other fields in the other sides. The percentage of misclassified pixels was 18.9 % for the coherence approach and 19.7 % for the simple approach. The

difference between the two values may seem small, but for images with very high resolutions such as the ones we dispose, it makes a difference.

3. CONCLUSION

The approach adopted in this work seems to be simple and efficient. It can be considered as a fundamental method in different land identification applications. Using the inter-channel polarimetric coherence information, there is no need for multi-temporal follow-up using simple radar images to perform land cartography. Right now, we are focusing our research work on soil salinity cartography and we are projecting to use this coherence approach for classification in order to estimate and characterize soil salinity in the salty lakes of *Sidi Elhani*, Tunisia.

4. REFERENCES

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