Abstract IGARSS 2009

POLSAR AND POLINSAR MODEL BASED INFORMATION ESTIMATION

Carlos López-Martínez[1,2], Xavier Fàbregas[1], Luca Pipia[1]

[1]Universitat Politècnica de Catalunya (UPC)
Signal Theory and Telecommunications Department (TSC)
Active Remote Sensing Group
Campus Nord, Bldg. D3, Room 203
1-3 Jordi Girona, 08034, Barcelona, SPAIN
Email: {carlos.lopez,fabregas}@tsc.upc.edu

[2]Institut d'Estudis Espacials de Catalunya IEEC - CRAE/UPC

Synthetic Aperture Radar (SAR) has demonstrated its maturity as a remote sensing technology if one observes the large amount of applications presented in the literature. The availability of operational SAR systems has made possible to make some of these applications operative, with a clear benefit for the society. In this context, the SAR missions presenting polarimetric capabilities, as for instance, the Japanese ALOS-PALSAR or the German TERRASAR-X, opens the door for novel applications and the possibility to better understand the features and dynamics of the Earth surface.

It is well accepted that the real benefit of SAR systems lies on the possibility to extract multiple views of the observed scene under some type of diversity. Diversity in space makes possible SAR interferometry (InSAR), diversity in polarization leads to SAR polarimetry (PolSAR), the combination of both refers to polarimetric SAR interferometry (PolInSAR), etc… All these techniques may be defined collectively as multidimensional SAR techniques, giving as a product multidimensional SAR data. Due to the complex nature of the SAR technology, multidimensional SAR data are affected by speckle noise. Consequently, the extraction of information from multidimensional SAR data represents a compromise between the complete reduction of speckle noise and the maintenance of spatial resolution and spatial details.

The present paper will examine the problem of the correct estimation of information in multidimensional SAR data. In previous occasions, the authors have demonstrated that a not correct estimation may result into biased information [1][2]. Some recent advances on the modelling of speckle noise in multidimensional SAR data [3] have shown that these flaws may be explained through a more detailed knowledge of the speckle noise effects on multidimensional SAR data. These advances have shown that multidimensional speckle noise results from the combination of multiplicative and additive noise sources, which combination is determined by the correlation structure of the data. This paper will consider the advances on multidimensional speckle noise modelling, to present novel strategies to eliminate this noise component. It will be demonstrated that the availability of an accurate multidimensional speckle noise model allows additional speckle noise reduction respect to standard techniques. This additional

reduction of noise makes possible to reduce the number of pixels necessary for a correct estimation of the data, with the consequent gain on spatial resolution.

The presented speckle filtering approach extends the multidimensional speckle noise filtering principles, as defined by Lee et al. in [4]. As a result, the main objective of the present work is to demonstrate that this extension does not induce a lost of useful information. The capability to retain and to improve the estimated information shall be considered first in the frame of PolSAR data, considering the main polarimetric indicators. This demonstration process shall be also extended to consider PolInSAR data. In this case, it is demonstrated that the presented filtering approach improves the estimation of physical information considering forested areas.

Results in the retention of useful information shall be performed considering simulated as well as experimental PolSAR and PolInSAR data.

References:

[1] C. López-Martínez, E. Pottier, "Statistical Assessment of Eigenvector-Based Target Decomposition Theorems in Radar Polarimetry," Proc. PolInSAR 2005, Frascati, Italy, Jan. 2005.

[2] C. López-Martínez, E. Pottier and S. R. Cloude "Statistical Assessment of Eigenvector-Based Target Decomposition Theorems in Radar Polarimetry," IEEE Trans. Geosci. Remote Sensing, vol. 43, no. 9, pp. 2058 – 2074, Sept. 2005.

[3] C. López-Martínez and X. Fàbregas, "Polarimetric SAR Speckle Noise Model," IEEE Trans. Geosci. Remote Sensing, vol. 41, no. 10, pp. 2232 – 2242, Oct. 2003.

[4] J.S Lee, M. Grunes and G. de Grandi, "Polarimetric SAR speckle filtering and its implication for classification", IEEE Trans. Geosci. Remote Sensing, vol. 37, no. 5, pp. 2363-2373, Sept. 1999.