Statistics and Information Theory in Remote Sensing with SAR

Alejandro C. Frery

Abstract

Statistics, either implicitly or explicitly, plays a prominent role across several branches of Remote Sensing (RS). This is mostly due to the fact that RS deals with often incomplete and mostly imprecise data. But Statistics aspires to more than being a mere tool for circumventing those unavoidable observational limitations. Statistics is able to provide a complete framework for tackling many relevant RS problems, from a sound mathematical description to tractable computational solutions. This wealth of knowledge is of particular importance when dealing with Synthetic Aperture Radar - SAR images. This kind of imaging produces data with a noise-like pattern, called speckle, which can be well described as a non-Gaussian non-additive contamination to the underlying desired information. Tools firmly grounded in a statistical approach are among the best suited for SAR image processing and analysis. In this talk we present a unified framework for a diversity of problems involving SAR imagery (despeckling filters, classification, segmentation, change detection and edge identification). Using Information-Theoretic tools within a Statistical framework, we show that all these seemingly different problems can be posed and solved as a single one: testing the hypothesis that two or more samples are outcomes of the same distribution. Although the examples are instantiated for SAR, the framework is general enough to encompass a large variety of problems, including other models and types of data. The talk can be given in English, Spanish and Portuguese.

Regional Speaker: Portuguese, Spanish, English

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Alejandro C. Frery received the B.Sc. degree in Electronic and Electrical Engineering from the Universidad de Mendoza, Argentina in 1985. His M.Sc. degree was in Applied Mathematics (Statistics) from the *Instituto de Matemática Pura e Aplicada* (IMPA, Rio de Janeiro, 1990), and his Ph.D. degree was in Applied Computing from the *Instituto Nacional de Pesquisas Espaciais* (INPE, São José dos Campos, Brazil, 1993). He is currently the leader of LaCCAN - *Laboratório de Computação Científica e Análise Numérica*, *Universidade Federal de Alagoas*, Maceió, Brazil. His research interests are statistical computing and stochastic modeling, with emphasis in SAR image processing and analysis.