PARAMETER-FREE SAR IMAGES ANALYSIS USING DATA COMPRESSION

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Classic SAR image analysis methodologies require strong a priori knowledge of the data, which put undesired limitations in the applications. In the case of high resolution SAR images such as the data acquired by TerraSAR-X, the great variety, diversity, and irregularity of the observed scenes make the number of semantic classes which can be distinguished within a scene increase exponentially, with respect to what was observable in the past. In addition, both the definition and setting of parameters have a strong subjective component, and may either underfit the data, failing to capture relevant information, or overfit them, introducing nuisance. This drawback would especially affect image information mining applications, which usually process large volumes of data. Therefore a data-driven approach, independent of any statistical model, and requiring few parameters (ideally none) to be set, would help in overcoming these problems: this can be achieved by extracting information and computing similarities within the data on the sole basis of their computational complexity, estimated with solutions based on algorithmic information theory. We apply the proposed technique to automatically separate different urban structures within a TerraSAR-X scene (Fig. 1).

![Diagram](image)

Figure 1. Classes used (right) with hierarchical decomposition for sport structures and Eiffel tower (sample subsets, bottom) and dendrogram (left) representing the result of an unsupervised hierarchical clustering applied to manually chosen 128x128 tiles belonging to the classes of interest. The class “sport structures” presents different built areas belonging to the same sport complex. A good separation between classes, and between different structures belonging to the same class, is achieved. The only false alarm is marked.

The interesting aspect of the classes of interest is that it is possible to consider sub-classes within them, which are correctly separated in the final dendrogram. Therefore, SAR images varying greatly in content, resolution, and also acquired by different sensors, may be analyzed with the same tools, allowing discovering patterns and similarities within the data.