
Processing Radar Images with Hierarchical Region-Based Representations and Graph Signal Processing Tools

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Abstract

This talk will discuss the interest of hierarchical region-based representations of images such as maxtree, mintree and Binary Partition Trees for radar images. These representations can be considered as an initial abstraction from the signal in which raw pixels are grouped to form regions which are hierarchically structured by inclusion in a tree. They provide multiple resolutions of description and easy access to subsets of regions. This approach and the associated notions will be discussed for both maxtree description of Synthetic Aperture Radar (SAR) image and for Binary Partition Tree for Polarimetric SAR images.

Once constructed, these hierarchical representations can be used for many applications including filtering, segmentation, classification and object detection. Many processing strategies consist in populating the tree with features of interest for the application and in applying a specific graph-cut called pruning. These pruning ideas will be illustrated in particular for polarimetric SAR image segmentation and speckle reduction.

The tree representation itself is a specific graph structure. As a result, an alternative processing strategy consists in populating the tree with attributes but considering the resulting data as graph attribute signals which can be processed with graph filters. The goal of this filtering step is to exploit the correlation existing between attribute values on neighboring tree nodes. Considering that trees are specific graphs where the connectivity towards ancestors and descendants may have a different meaning, several filtering strategies can be defined. Beside classical Graph filters, two new filtering notions can be used: Tree and Branch filters. These ideas will be illustrated in the context of ship detection in SAR images.

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