# WEAKLY SUPERVISED POLARIMETRIC SAR IMAGE CLASSIFICATION WITH MULTI-MODAL MARKOV ASPECT MODEL

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**ABSTRACT:**

Terrain classification is an important polarimetric synthetic aperture radar (PolSAR) application. However, most of existing supervised classification methods require accurate pixel-level labeled training data obtained by a labor intensive and time-consuming process. In this work, we are interested in weakly supervised classification of PolSAR images, which is aimed at partitioning a PolSAR scene into their constituent semantic-level regions with only keywords labeled training data. We present a weakly supervised classification method for a large PolSAR imagery using multi-modal markov aspect model. Given a training set of subimages with the corresponding semantic concepts defined by the user, learning is based on markov aspect model which captures spatial coherence (local correlations between labels) and thematic coherence (image-wide correlations). The whole classification process consists of four cascaded stages. In the first stage, we partition the whole PolSAR scene into hundreds of subimages. From each subimage we extract overlapping patches on a grid, representing them by polarimetry, intensity and texture descriptors. We assume that each patch belongs either to one of the predefined terrain classes or to a vague background class “void”. Then, we model each subimage as a mixture of latent aspects with a multi-modal markov aspect model which can be learnt from image-level keywords. Next, we use an efficient expect maximization algorithm to learn the model and employ the loopy belief propagation algorithm to infer the semantic label of each patch in the test subimages with the trained model. Finally, we apply a over-segmentation based soft mapping to propagate patch-level labelings to pixel-level classification, and group the large PolSAR scene classification result from the arranged labeling subimages. Classification experiments on RadarSat-2 PolSAR data show that this approach improves region discrimination and produces satisfactory results. Furthermore, multiple diverse features can be efficiently combined with multi-modal aspect model to further improve the classification accuracy.

**TOPIC:** Land cover classification
**ALTERNATIVE TOPIC:** Microwave remote sensing

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