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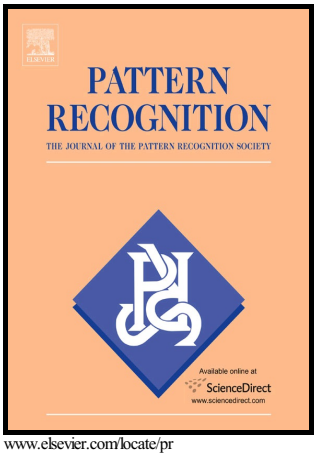

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SAR Image Segmentation Based on Convolutional-wavelet Neural Network and Markov Random Field

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Abstract— Synthetic aperture radar (SAR) imaging system is usually an observation of the earths' surface. It means that rich structures exist in SAR images. Convolutional neural network (CNN) is good at learning features from raw data automatically, especially the structural features. Inspired by these, we propose a novel SAR image segmentation method based on convolutional-wavelet neural networks (CWNN) and Markov Random Field (MRF). In this approach, a wavelet constrained pooling layer is designed to replace the conventional pooling in CNN. The new architecture can suppress the noise and is better at keeping the structures of the learned features, which are crucial to the segmentation tasks. CWNN produces the segmentation map by patch-by-patch scanning. The segmentation result of CWNN will be used with two labeling strategies (i.e., a superpixel approach and a MRF approach) to produce the final segmentation map. The superpixel approach is used to enforce the smooth nature on the local region. On the other hand, the MRF approach is used to preserve the edges and the details of the SAR image. Specifically, two segmentation maps will be produced by applying the superpixel and MRF approaches. The first segmentation map is obtained by combining the segmentation map of CWNN and the superpixel approach, and the second segmentation map is obtained by applying the MRF approach on the original SAR image. Afterwards, these two segmentation maps are fused by using the sketch map of the SAR image to produce the final segmentation map. Experiments on the texture images demonstrate that the CWNN is effective for the segmentation tasks. Moreover, the experiments on the real SAR images show that our approach obtains the regions with labeling consistency and preserves the edges and details at the same time.

Keywords： Convolutional Neural Network, wavelet transform, Markov Random Filed, SAR image segmentation.