Meyer Wavelet Transform and Jaccard Deep Q-Net for Small Object Classification Using Multi-Modal Images

Authors : Mian Muhammad Kamal

Abstract : Accurate detection of small objects is extremely essential in critical applications like military reconnaissance and emergency rescue. However, owing to the low resolution, occlusion, and background interference, small object detection is a tedious process. One of the most appropriate approaches is to combine the data available in multimodal images to enhance the detection ability. This paper proposes a small object detection technique using three kinds of multimodal images, such as Hyperspectral-Multispectral (HS-MS), HS-Synthetic Aperture Radar (HS-SAR), and HS-SAR-Digital Surface Model (HS-SAR-DSM). The detection is accomplished by utilizing the Jaccard Deep Q-Net (JDQN) that is created by the incorporation of the Jaccard similarity measure and Deep Q-Network (DQN) using Regression modeling. Further, a Deep Maxout Network (DMN) is used for fusing the detected outputs obtained from each modality so as to generate the final output. Moreover, the supremacy of the proposed JDQN in detecting small objects is established by the utilization of metrics, like accuracy, Mean Squared Error (MSE), precision, and Root MSE (RMSE), and experimentation reveals that the JDQN recorded superior accuracy of 0.907, normalized MSE of 0.448, precision of 0.904, and normalized RMSE of 0.670.

Keywords : small object detection, Multimodality, deep learning, Jaccard deep q-net, deep maxout network

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