

Intelligent Ship Detection

Subjects: Others

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Intelligent detection and recognition of ships from high-resolution remote sensing images is an extraordinary useful task in civil and military reconnaissance. It is difficult to detect the ships with high precision because the various disturbances are present in the sea such as clouds, mist, islands, coastlines, ripples and so on. To solve this problem, we propose a novel ship detection network based on multi-layer convolutional feature fusion. Our ship detection network consists of three parts. Firstly, the convolutional feature extraction network is used to extract ship features of different levels. Residual connection is introduced so that the model can be designed very deeply, and it is easy to train and converge. Secondly, the proposed network fuses fine-grained features from shallow layers with semantic features from deep layers, which is beneficial to detect ship targets with different sizes. At the same time, it is helpful to improve the localization accuracy and detection accuracy of small objects. Finally, the multiple fused feature maps are used for classification and regression, which can adapt to ship of multi-scales.

Keywords: remote sensing images ; ship detection ; feature fusion ; affine transformation

- The dataset for ship detection in remote-sensing images (DSDR) is created. Deep learning methods need a lot of training data during the complicated training process. Thus, the ship dataset is badly needed. DSDR contains rich satellite remote sensing images and aerial remote sensing images, which is an important resource for supervised learning algorithms.
- We introduce data augmentation to supplement the lack of ship samples in military application. Thus, preventing the model from overfitting can increase the detection accuracy of ship targets. We adopt an affine transformation method to change the perspectives of ships, thereby increasing the accuracy of ship detection in aerial images.
- Dark channel prior is adopted to solve the atmospheric correction on the sea scenes. We remove the influence of the absorption and scattering of water vapor and particles in the atmosphere by using the dark channel prior. The image quality is greatly improved by atmospheric correction. Atmospheric correction is beneficial to improve the accuracy of target detection in remote sensing images.
- Feature fusion network is used to comprehensive different levels of convolutional features, which can better utilize the fine-grained features and semantic features of the target, achieving multi-scale detection of ships. Meanwhile, feature fusion and anchor design are helpful to improve the performance of small target detection.
- SoftNMS is used to assign a lower score for redundant prediction boxes, thereby reducing the missed detection rate and improving the recall rate of densely arranged ships. The detection accuracy is improved compared to the traditional NMS.
- Our proposed approach can achieve better performance in terms of detection accuracy and inference speed for ship detection in optical remote sensing images compared with previous works. The CFF-SDN model is very robust under different disturbances such as fogs, islands, clouds, sea waves, etc.

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