



Image Science & Applications Branch

Remote Sensing Division

AI/ML Foundation Models for SAR

OUR RESEARCH AT A GLANCE

Signal Processing

The branch focuses on novel signal processing techniques applied to remotely sensed data, particularly SAR complex data, to extract unique information regarding man-made and environmental phenomena.

Remote Sensing Operations

Working with the remote sensing community, particularly emerging commercial SAR Satellite vendors, the branch is investigating new and innovative approaches to operations and exploitation.

Maritime Surveillance

The branch's ocean surveillance algorithm improves maritime domain awareness for naval operations by providing automated ship detection and characterization from SAR data.

Machine Learning

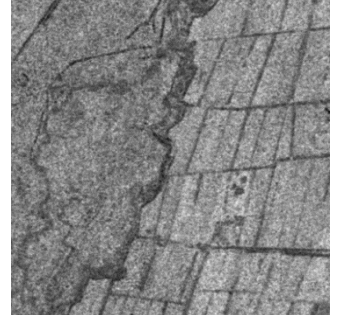
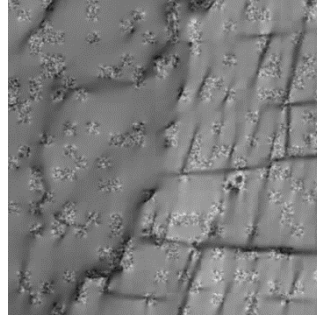
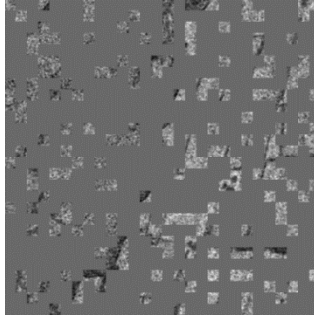
Adapting commercially developed machine learning methods to the unique properties of SAR has provided new insights in streamlining routine image interpretation tasks and is revolutionizing automated target recognition.

R&D Sponsors

ONR, NAVSEA, NAVAIR, DARPA, Intelligence Community

Point of Contact

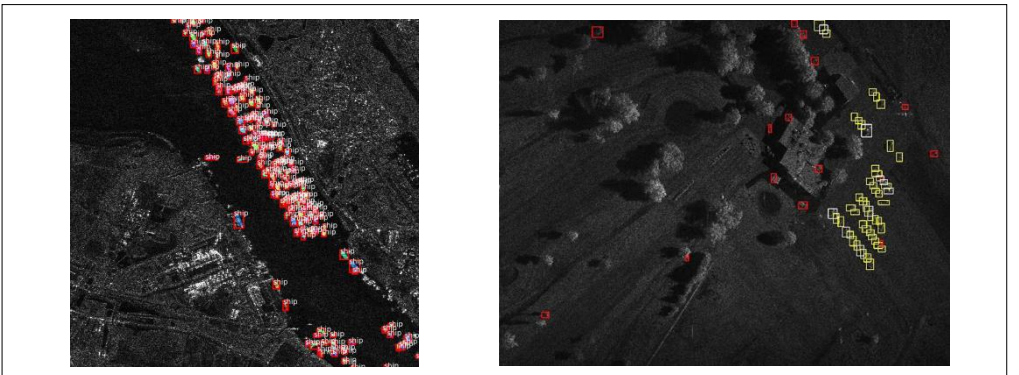
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Masked Autoencoder (MAE) trained using self-supervised learning to reconstruct missing regions of an image. Image source © NeurIPS 2023.

The Image Science and Applications Branch is investigating existing and novel approaches to developing synthetic aperture radar (SAR) specific AI/ML. To that end, the branch is pursuing generic foundation models for imagery using contrastive and generative self-supervised learning (SSL) techniques. Given the large quantity of available SAR imagery and difficulty in collecting reliable annotations, there is a tremendous opportunity to leverage self-supervised and semi-supervised techniques to extract meaningful insights for unlabeled sources. This effort involves combining state-of-the-art machine learning and computer vision techniques with sensor-specific processing techniques to create novel, robust algorithms for a vast problem set.

The nature of SAR offers several unique challenges and opportunities for developing computer vision models. Given the number of ways SAR images can be processed, selecting the preprocessing steps that achieve optimal AI/ML performance is challenging. However, this is also an opportunity for innovation in developing ML augmentation techniques using SAR processing algorithms to expand the dataset and improve generalizability. Moreover, overhead imaging methods like SAR produce large and information dense images, which are challenging for tasks like detection or segmentation.



SAR imagery can contain small, but identifiable targets. Image source: © IEEE.