

Machine Learning Project - Airbus Ship Detection Challenge

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Problem Statement

The Airbus Ship Detection Challenge (hosted on Kaggle) aims to automatically identify ships in satellite imagery. Detecting ships is crucial for maritime safety, surveillance, and logistics monitoring, but manual detection is time-consuming and error-prone. The task involves segmenting ship regions in high-resolution satellite images and producing run-length encoded (RLE) masks for detected ships.

Language/Tools: Python, TensorFlow/Keras, NumPy, Pandas, OpenCV, Matplotlib, scikit-image

Approach

To solve this problem, I developed a deep learning-based image segmentation pipeline using Convolutional Neural Networks (CNNs). The workflow involves:

1. Data Preprocessing:
 - Loaded the training images and the corresponding train_ship_segmentations_v2.csv file containing RLE-encoded ship masks.
 - Implemented a decoding function to convert RLE strings into binary masks.
2. Model Architecture:
 - Implemented a U-Net style convolutional neural network for pixel-wise segmentation.
 - Used TensorFlow/Keras for model construction and training.
3. Training and Evaluation:
 - Split the data into training and validation subsets.
 - Trained the model to predict binary masks for ship regions.
4. Prediction and Submission:
 - Applied the trained model to test images to generate predicted masks.

Challenges and Lessons Learned

- Managing large dataset size and memory usage required careful optimization.
- Handling images with multiple or no ships was critical for accurate segmentation.
- Learned the importance of data preprocessing and consistent mask encoding/decoding.

Conclusion

This project demonstrated a complete deep learning workflow for object segmentation in satellite imagery. The techniques and insights gained can be extended to other remote sensing and image analysis problems.