

Problem Statement: Ship Detection in SAR Imagery Using Deep Learning

Job Location - Delhi

Objective

The objective of this task is to design, train, and evaluate a deep learning-based ship detection model using Synthetic Aperture Radar (SAR) imagery. The trained model must be capable of performing inference on real-world SAR data acquired from the Sentinel-1 satellite.

Task Description

The candidate is required to:

1. Dataset Selection and Preparation

- Use an open-source SAR ship detection dataset for training and validation.
- Suitable datasets include, but are not limited to:
 - SSDD (SAR Ship Detection Dataset)
 - HRSID
 - OpenSARShip
- Perform necessary preprocessing steps such as normalization, annotation parsing, data augmentation.

2. Model Development

- Select and implement an appropriate deep learning-based object detection architecture (e.g., YOLO, Faster R-CNN, RetinaNet, or similar).
- Train the model to detect ships in SAR imagery (The candidate can use colab notebooks if GPUs are not available).
- Clearly document model architecture, hyperparameters, and training strategy.

3. Sentinel-1 Data Acquisition

- Download at least one Sentinel-1 SAR scene from an open-access source such as:
 - Copernicus Open Access Hub
 - ASF DAAC
 - Google Earth Engine
- The scene should preferably contain maritime regions where ship targets are expected.

4. Inference on Sentinel-1 Imagery

- Preprocess the Sentinel-1 data to make it compatible with the trained model.
- Perform inference on the Sentinel-1 scene using the trained model.
- Visualize and interpret detection results by overlaying predicted bounding boxes on the SAR image.

5. Evaluation and Analysis

- Evaluate model performance using appropriate metrics (e.g., Precision, Recall, mAP) on the validation dataset.
- Discuss challenges encountered when transferring the model from curated datasets to real Sentinel-1 imagery (domain shift, resolution differences, noise, etc.).

6. Deliverables

- Source code for data preprocessing, model training, and inference.
- A brief technical report in pdf format describing:
 - Dataset used
 - Model architecture and training details
 - Sentinel-1 data source and preprocessing steps
 - Inference results and observations
- Visual results showing ship detections on Sentinel-1 SAR imagery.