Jyothi Engineering College
NAAC Accredited College with NBA Accredited Programmes*
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A CENTRE OF EXCELLENCE IN SCIENCE & TECHNOLOGY BY THE CATHOLIC ARCHDIOCESE OF TRICHUR
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NBA accredited B.Tech Programmes in Computer Science & Engineering, Electronics & Communication Engineering, Electrical & Electronics Engineering and Mechanical Engineering valid for the academic years 2016-2022. NBA accredited B.Tech Programme in Civil Engineering valid for the academic years 2019-2022.

Ship Detection Using SAR Imagery

Group No. : 17

Department of CSE
Jyothi Engineering College
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Group Members

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Guide : Mr. Anil Antony

GIT : https://github.com/NithinPeter-GIT/Group-17_final_project

Vision of the Department

- Creating eminent and ethical leaders in the domain of Computational Sciences through quality professional education with a focus on holistic learning and excellence.

Mission of the Department

- To create technically competent and ethically conscious graduates in the field of Computer Science and Engineering by encouraging holistic learning and excellence.
- To prepare students for careers in Industry, Academia and the Government.
- To instill Entrepreneurial Orientation and research motivation among the students of the department.
- To emerge as a leader in education in the region by encouraging teaching, learning, industry and societal connect.

Course Outcomes

C410.1 The students will be able to analyse a current topic of professional interest and present it before an audience.

C410.2 Students will be able to identify an engineering problem, analyse it and propose a work plan to solve it.

C410.3 Students will have gained thorough knowledge in design, implementations and execution of Computer science related projects.

C410.4 Students will have attained the practical knowledge of what they learned in theory subjects.

C410.5 Students will become familiar with usage of modern tools.

C410.6 Students will have ability to plan and work in a team

CO Mapping to POs

	POs											
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
C410.1	3	2	3	2	3	3	2	3	3	2	3	3
C410.2	2	3	3	3	3	3	2	3	2	3	3	3
C410.3	3	2	3	3	3	2	3	3	2	3	3	3
C410.4	3	3	3	2	3	3	3	2	3	3	3	3
C410.5	2	3	2	3	2	3	2	3	2	3	2	2
C410.6	3	3	3	2	2	3	2	3	2	3	2	2
Average	2.67	2.67	2.83	2.5	2.67	2.83	2.33	2.83	2.33	2.83	2.67	2.67

Contents

Introduction

- In this project we present an innovative way to detect ships in the ocean using SAR image
- Detection of ships is complicated, especially under unfavourable conditions, such as during night-time or on cloudy days
- Locations of ships in the ocean can be useful in many situations like finding route,search & rescue, surveillance, fisheries management, etc.

Objectives

- Build a ship detection system for SAR images.
- Make a system that has high accuracy.
- Increase the speed of the system without sacrificing accuracy

Abstract

Ship detection plays an important role in marine transportation, fishery management, and maritime disaster rescue. Nowadays, the current researches almost are focusing on improving detection accuracy while detection speed is neglected. Synthetic aperture radar (SAR) imagery has been used as a promising data source for monitoring maritime activities, and its application for oil and ship detection has been the focus of many previous research studies. YOLO is a network for object detection. The detection task consists in determining the location on the image where certain objects are present, and classifying those objects. This algorithm makes it possible to do real time ship detection in an efficient manner. We are proposing a new and better method for ship detection using YOLO.

Literature Survey

- Improved YOLOv3
- YOLOv3-Ship
- Using CNN approach for ship detection in Sentinel-1 SAR imagery
- Significance of ship based detection from SAR imagery
- Classification of Patterns

Proposed System

- High speed ship detection using YOLO
- Fast detection means we can have real time detection is possible
- SAR images are used so that we can detect ships even in adverse weather conditions

Requirements

Functional Requirement

- Ship detection from SAR Images
- Detection of ships in adverse weather conditions

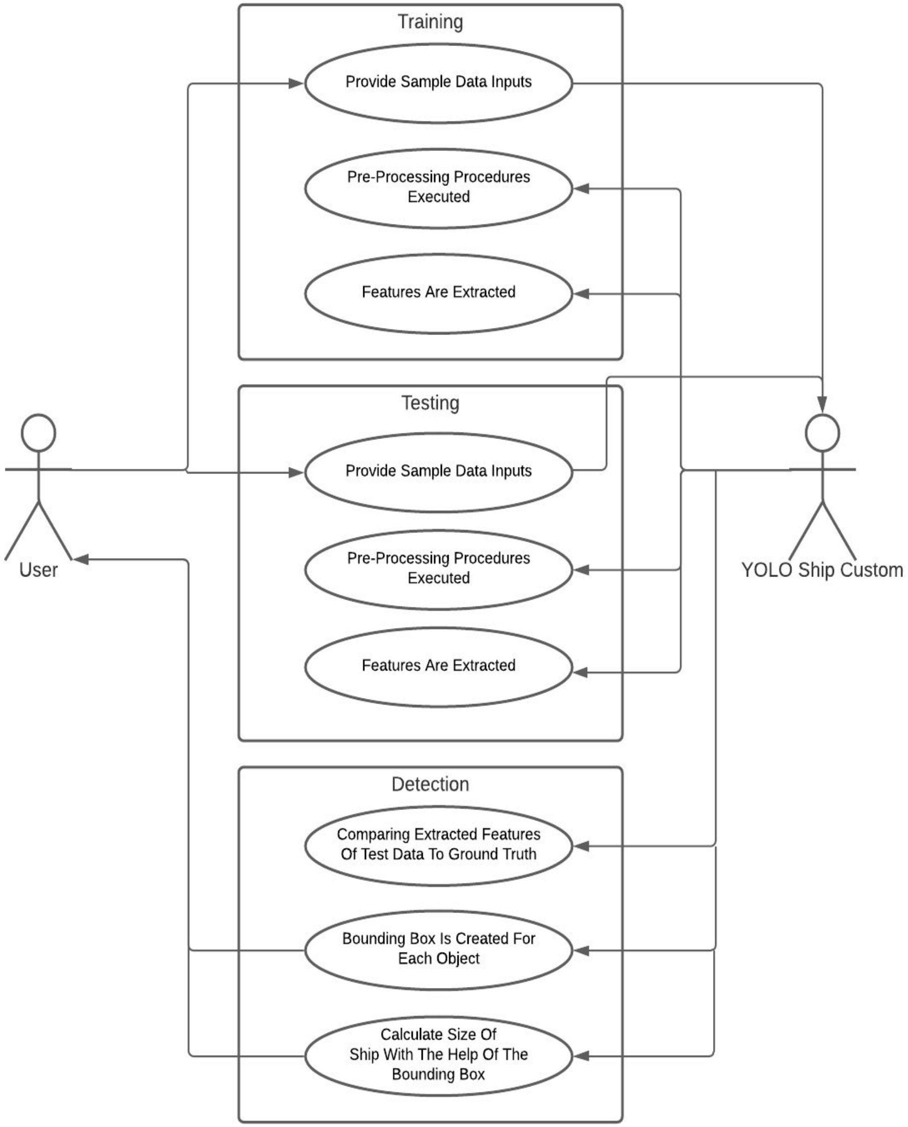
Non-Functional Requirement

- The System should be scalable
- The system should be secure

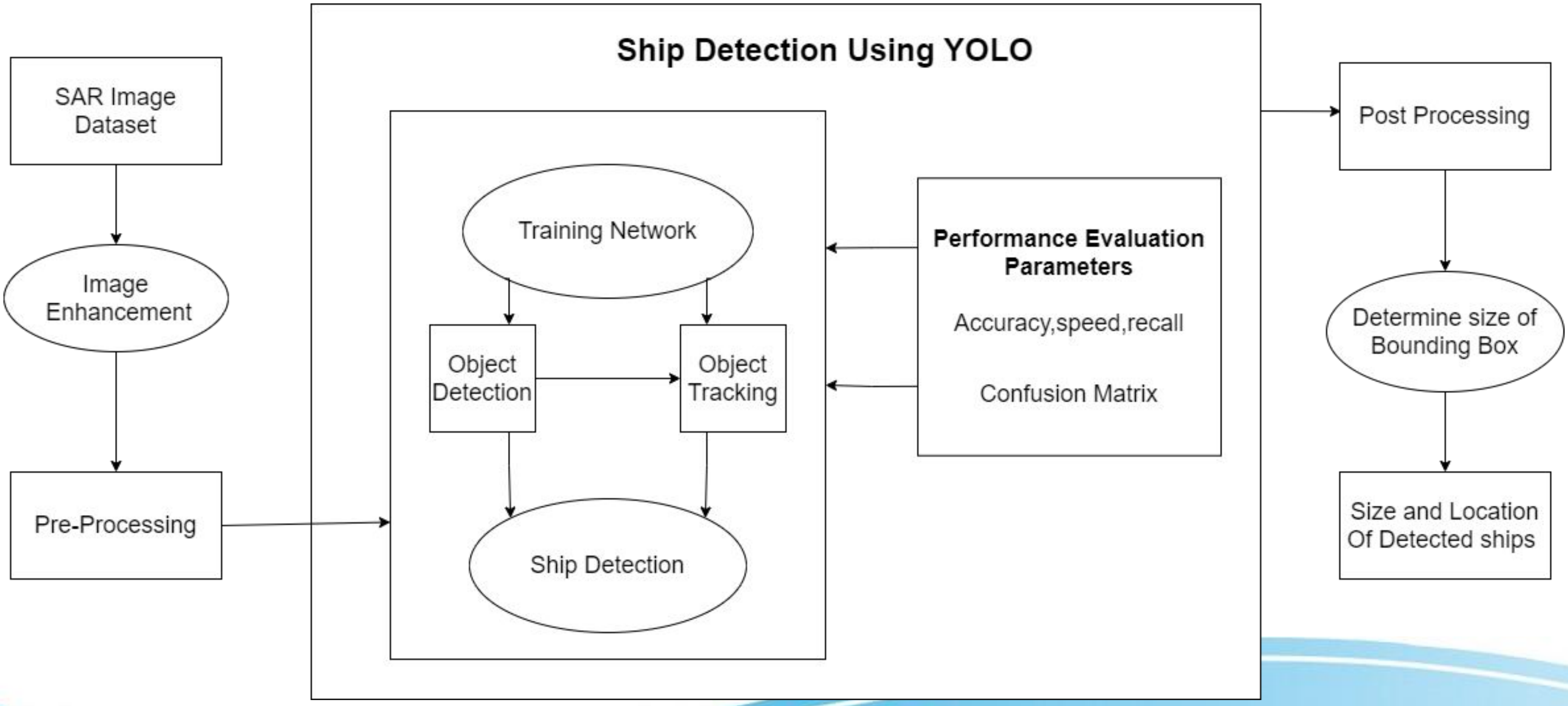
Modules

- **Data Acquisition Module**
  - SAR image dataset collection
  - Set the sample size
- **Image Enhancement Module**
  - Noise Reduction
  - Size Correction
- **Ship Detection Module**
  - Features are extracted
  - YOLO detection algorithm is used
  - Location of ships are identified

UML Diagram


Training
Provide Sample Data Inputs
Pre-Processing Procedures Executed
Features Are Extracted
Testing
Provide Sample Data Inputs
Pre-Processing Procedures Executed
Features Are Extracted
Detection
Comparing Extracted Features Of Test Data To Ground Truth
Bounding Box Is Created For Each Object
Calculate Size Of Ship With The Help Of The Bounding Box
User
YOLO Ship Custom

DFD


Ship Detection Using YOLO
SAR Image Dataset
Image Enhancement
Pre-Processing
Training Network
Object Detection
Object Tracking
Ship Detection
Performance Evaluation Parameters
Accuracy,speed,recall
Confusion Matrix
Post Processing
Determine size of Bounding Box
Size and Location Of Detected ships

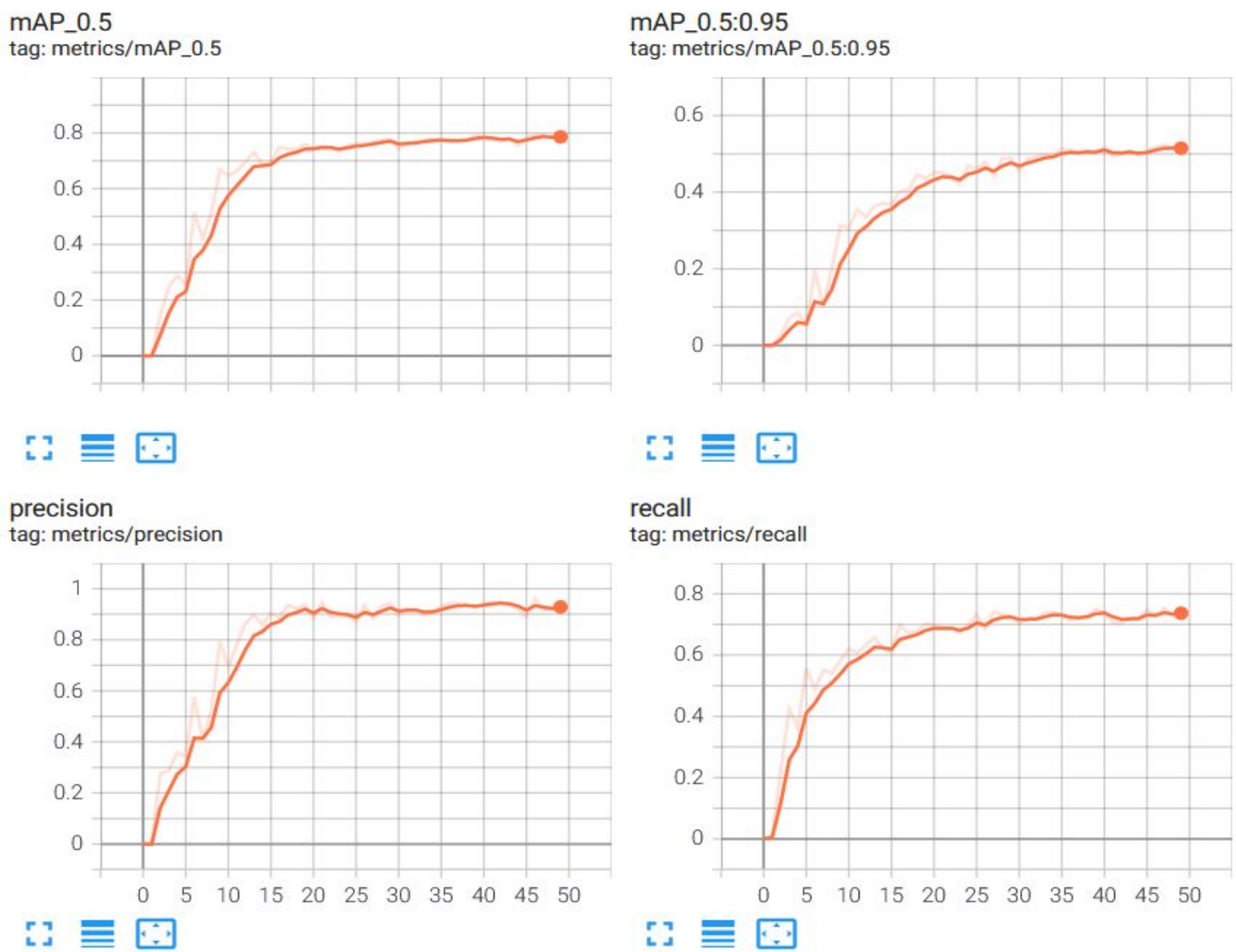
50% Implementation

- We use the HRSID database for our project
- The database was initially used in the MS COCO format which was then converted into the required YOLO format.
- All the images in the database were resized to 416x416px
- Image augmentation steps were added to vary the images in the database.
- The set of images were then divided into training, validation, and test sets with a 70:20:10 ratio

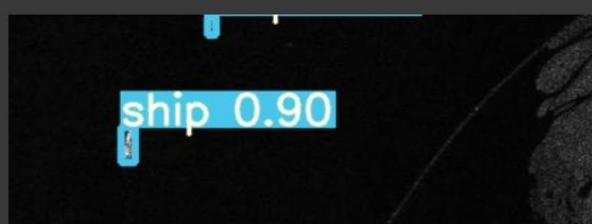
- For 50% implementation we trained our model with 1000 images from the dataset which after augmentation came to a total of 3000 images.
- We are training our model on YOLOv5 which is made using Pytorch
- For our initial training we used the smallest variation of YOLOv5 called YOLOv5s
- Training was done only for 50 epochs
- After initial training we were able to get a precision value 0.936, recall value 0.741 and map value 0.788.

```
     Epoch   gpu_mem       box       obj       cls     total   targets  img_size
     44/49     1.46G   0.03419  0.007252         0   0.04144        12       416: 100% 132/132 [00:17<00:00,  7.76it/s]
               Class    Images   Targets         P         R    mAP@.5  mAP@.5:.95: 100% 7/7 [00:00<00:00,  7.18it/s]
                 all       199       436     0.919      0.72     0.756       0.497

     Epoch   gpu_mem       box       obj       cls     total   targets  img_size
     45/49     1.46G   0.03435  0.007239         0   0.04159        14       416: 100% 132/132 [00:16<00:00,  7.77it/s]
               Class    Images   Targets         P         R    mAP@.5  mAP@.5:.95: 100% 7/7 [00:00<00:00,  7.55it/s]
                 all       199       436     0.891      0.75     0.783       0.507

     Epoch   gpu_mem       box       obj       cls     total   targets  img_size
     46/49     1.46G   0.03243  0.007042         0   0.03947        11       416: 100% 132/132 [00:17<00:00,  7.76it/s]
               Class    Images   Targets         P         R    mAP@.5  mAP@.5:.95: 100% 7/7 [00:01<00:00,  6.79it/s]
                 all       199       436     0.961     0.727     0.793       0.518

     Epoch   gpu_mem       box       obj       cls     total   targets  img_size
     47/49     1.46G   0.03148  0.006703         0   0.03818         6       416: 100% 132/132 [00:17<00:00,  7.66it/s]
               Class    Images   Targets         P         R    mAP@.5  mAP@.5:.95: 100% 7/7 [00:00<00:00,  7.16it/s]
                 all       199       436     0.919     0.752     0.794       0.523

     Epoch   gpu_mem       box       obj       cls     total   targets  img_size
     48/49     1.46G   0.03408  0.006966         0   0.04105        11       416: 100% 132/132 [00:17<00:00,  7.69it/s]
               Class    Images   Targets         P         R    mAP@.5  mAP@.5:.95: 100% 7/7 [00:00<00:00,  7.33it/s]
                 all       199       436     0.916     0.727     0.781       0.516

     Epoch   gpu_mem       box       obj       cls     total   targets  img_size
     49/49     1.46G   0.03237  0.006919         0   0.03928         9       416: 100% 132/132 [00:17<00:00,  7.72it/s]
               Class    Images   Targets         P         R    mAP@.5  mAP@.5:.95: 100% 7/7 [00:02<00:00,  3.38it/s]
                 all       199       436     0.936     0.741     0.788       0.514
Optimizer stripped from runs/train/yolov5s_results/weights/last.pt, 14.8MB
Optimizer stripped from runs/train/yolov5s_results/weights/best.pt, 14.8MB
50 epochs completed in 0.261 hours.
```

metrics


mAP_0.5
tag: metrics/mAP_0.5
mAP_0.5:0.95
tag: metrics/mAP_0.5:0.95
precision
tag: metrics/precision
recall
tag: metrics/recall
0 5 10 15 20 25 30 35 40 45 50

```python
import glob
from IPython.display import Image, display

for imageName in glob.glob('/content/yolov5/runs/detect/exp/*.jpg'): #assuming JPG
    display(Image(filename=imageName))
    print("\n")
```



Pending Works

- Ship Detection Module
- Testing

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- B. Bhadran and J. J. Nair, "**Classification of patterns on high resolution SAR images,**" *2015 International Conference on Computing and Network Communications (CoCoNet)*, Trivandrum, 2015, pp. 784-792, doi: 10.1109/CoCoNet.2015.7411279.
- H. Cui, Y. Yang, M. Liu, T. Shi and Q. Qi, "**Ship Detection: An Improved YOLOv3 Method,**" OCEANS 2019 - Marseille, Marseille, France, 2019, pp. 1-4, doi: 10.1109/OCEANSE.2019.8867209.
- T. ZHANG, X. ZHANG, J. SHI and S. WEI, "**High-Speed Ship Detection in SAR Images by Improved Yolov3**," 2019 16th International Computer Conference on Wavelet Active Media Technology and Information Processing, Chengdu, China, 2019, pp. 149-152, doi: 10.1109/ICCWAMTIP47768.2019.9067695.

Thank You