AISF

ARTIFICIAL INTELLIGENCE STUDENT FORUM

PRESENTS

VIT CODE APEX

CODE VERSE HACKATHON 2025

- Problem Statement Title-Marine fouling
- Team Name-BioGardians
- Team Members-Riya Kotalwar, Shreyas Jadhav and Pranav Kunjir

IDEA TITLE

Problem Statement

Marine fouling causes harmful buildup on naval structures, leading to higher fuel use and operational issues. Develop an image-based solution to classify fouling species and measure their density.

Solution

- Take High quality images of infected area
- With Powerful CNN we will classify every single pixel in the image
- With the ouput from the CNN we'll create a detailed Report of the Biofouling
- The created Report will be uploaded on a Web Platform for the user
- This Data will be used in further Training to improve the CNN

How we address the problem

Auto Mated Classification

It fully automates the slow and labor-intensive process of manual inspection, which requires expert knowledge of local fouling communities.

Accurate Density Measurement

Pixel-level classification gives precise percentage coverage for each fouling species, offering higher accuracy than traditional random-point sampling.

Standardized & Objective Analysis

The system eliminates the subjectivity and variability of human visual assessment, providing consistent and repeatable results

Innovation and Uniqueness

The key innovation is the use of semantic segmentation for this task. Unlike other methods that provide a simple fouling rating or classify the whole image, our approach provides a detailed, pixel-level map

TECHNICAL APPROACH

Tech Stack

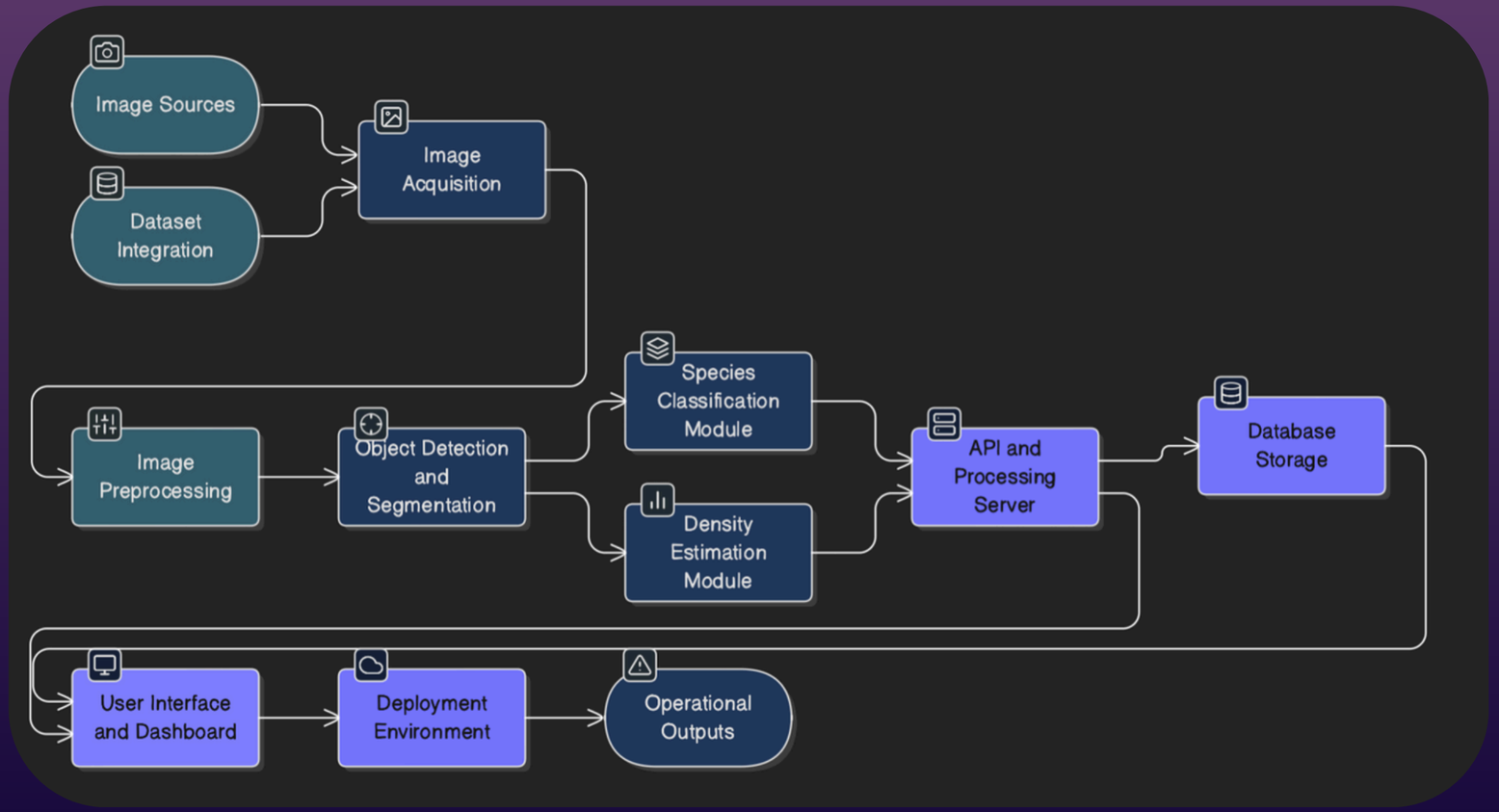
Front End
- React JS
- ShadCN UI

Back End
- Node JS
- Clerk
- Fast API

Image Processing
- Python
- Tensorflow
- Mask R-CNN

Deployment
- Vercel
- Google Cloud Run

Flow Of Application



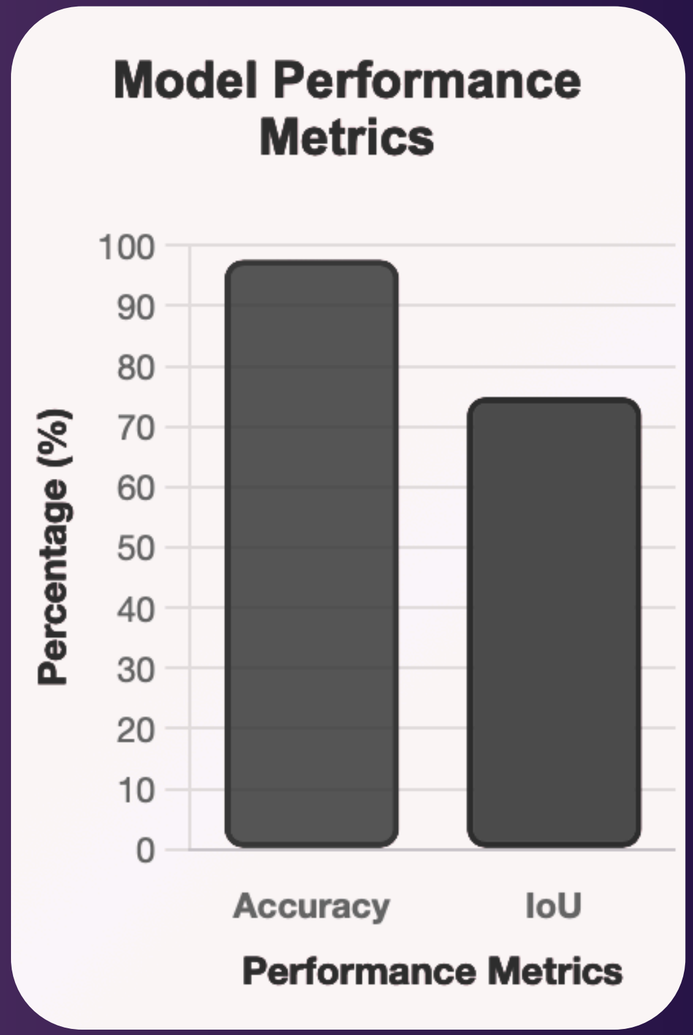
FEASIBILITY AND VIABILITY

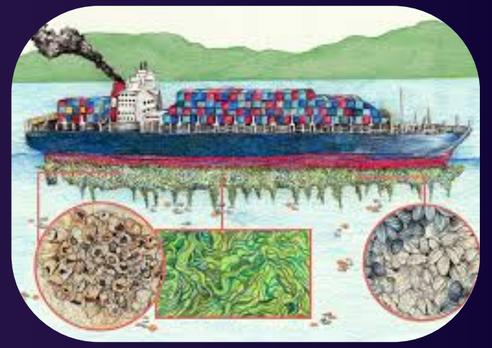
Feasibility

- Proven Technology: 97.6% accuracy, 74.9% IoU on 10-class dataset (U-Net, TensorFlow).
- Mature Tools: U-Net, TensorFlow widely adopted, well-documented.
- Scalable: Adaptable for Indian Navy ships/platforms

Challenges

- Dataset Shift: Model trained on Florida species; Indian waters differ.
- Annotation Effort: Labeling new dataset is time-intensive.
- Image Conditions: Underwater variability (turbidity, lighting).





IMPACT AND BENEFITS

Potential Impact

- Mission Readiness: Optimized hull cleaning reduces drag, ensuring peak vessel speed/efficiency
- Cost Savings: Lower fuel use (**up to 20% savings**) and maintenance costs
- Biosecurity: Early detection of invasive species protects marine ecosystems
- Data-Driven Maintenance: Historical fouling data informs antifouling coating decisions

Benefits of Solution

- Speed: Analysis in minutes vs. hours/days for manual methods
- Accuracy: Objective, precise measurements (97.6% accuracy)
- Depth of Insight: Spatial maps, novel metrics (e.g., direct surface attachment)
- Scalability: Deployable across entire Navy fleet for standardized assessments