HydroLens: A secure and Robust Underwater Scene Analyzer

Breif Background

Underwater image processing is critical for navigation and object detection but faces challenges like poor illumination, scattering, and susceptibility to tampering. Current radar systems used by small fishing vessels provide only basic presence/absence data, leading to inefficiencies and safety risks. There is a need for cost-effective, easily integrated technologies that improve accuracy, enhance adversarial robustness, and support applications such as fisheries management, environmental monitoring, and underwater operations

Application Sectors

- Rural Fishing Community of Kerala and coastal areas in India.
- Maritime Navigation
- Environmental Monitoring

TRL **3**

Tech/Prod. Summary

HydroLens is a robust, federated learning-assisted underwater scene analyzer designed for systems with limited computational power. It leverages on-site data collection and training, followed by accurate scene classification using LiDAR, ensuring efficient and secure underwater perception even under bandwidth and resource constraints

Tech/ Product Description

HydroLens is a FL-based underwater LiDAR image classification system that ensures adversarial robustness and privacy for lightweight navigation systems with limited computational resources. The system enables on-site training, reducing data transfer and bandwidth requirements, while an on-land base station aggregates results. Privacy-preserving mechanisms protect sensitive data, and adversarial simulations, such as data poisoning attacks, validate the system's resilience against noisy or corrupted underwater data.
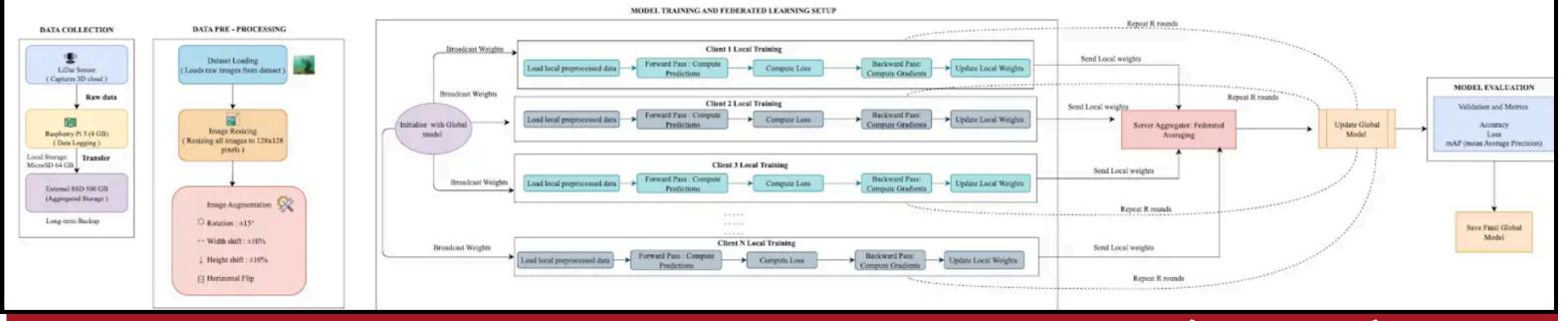
Impact - SDG:
- Safe path planning in hazardous conditions
- Locate small schools of fishes in close proximity
- Perform fish species identification so that harvest can be both sustainable and optimal

Market Potential

1. Small-scale fishing industry: USD 22.32 billion in 2024 → USD 60.4 billion by 2034

Value Proposition

1. Lightweight & Resource-Efficient
2. Adversarially Robust & Secure
3. Cost effective and Real-Time Scene Analysis