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AUTONOMOUS UNDERWATER MAINTENANCE AND INSPECTION USING OBJECT DETECTION AND GRASP PLANNING

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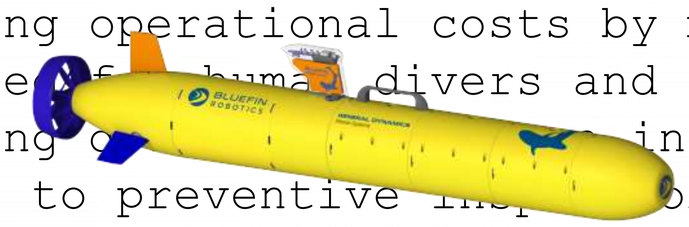
I. Introduction

- Underwater infrastructure such as oil rigs, pipelines, and subsea installations need for continuous inspection and maintenance
- These tasks are traditionally carried out by human divers or by working class remotely operated vehicles
- Advancements in Artificial Intelligence and particularly in Computer Vision makes it possible today to use Autonomous Underwater Vehicles reducing the need for human intervention

II. Motivation

- Safety
  - Reducing the risks faced by human divers
  - Enduring 24/7 ability to do inspection and maintenance tasks
- Efficiency
  - Enhancing the speed and accuracy of the tasks carried out
  - Continuous operation without need for breaks or other interruptions
- Cost reduction
  - Lowering operational costs by minimizing the need for human divers and for ROVs
  - Reducing overall installation thanks to preventive inspections and quick reparations



III. State of the art techniques

- Object detection

IV. Technical implementation

Object detection
- Input camera images and dense point clouds
- DL models detects and classifies
- Outputs bounding boxes around detected objects in the image

Point cloud segmentation
- Segments regions and extract 3D shapes of the object
- Outputs segmented point clouds for individual objects

Grasp planning
- Grasp algorithm generates potential grasp poses
- Optimal grasp pose selection based on predefined criteria
- Outputs selected grasp pose for the object

Object manipulation
- Robotics manipulator executes selected grasp pose to pick up the object
- AUV performs required maintenance or replacement
- Object is then returned to its original place

V. Conclusion and future developments

- Safer and more efficient operations
- Lower costs
- Continuous improvement of the algorithms used
- Expanding this techniques to other industries especially fish farming