

Towards Automatic Hole Detection of a Net for Fish Farms by means of Robotic Intelligence

Salvador López¹, J. González¹, A. Solís¹, A. Gomez², R. Marín¹, P. J. Sanz,¹

¹ *Computer Science and Engineering Department, University of Jaume I, 12071 Castellón de la Plana, Spain*

² *Tecnologico de Monterrey, Escuela de Ingeniería y Ciencias, Av. Epigmenio González 500, Fracc. San Pablo, Queretaro 76130, Mexico*

Abstract – In the last decades fish farms became one of the most important sources of seafood. This industry is facing complex and costly problems like net holes, especially due to unexpected situations, such as depredators and storm effects. This is a complex problem because fishes can escape from the fish farms containers or a depredator can enter in the container. To solve this problem divers are needed, but this solution is difficult and sometimes can be dangerous for the diver. The main objective of this work is to present the current state of a system where an underwater robot can detect holes in the net of a fish farm. Once the robot detects the hole it will proceed to manipulate it. This task is bordered using convolutional neural networks and the BlueROV2 platform with the Newton Gripper from BlueRobotics, which will be upgraded in a second stage to perform preliminary net repairs. This work contributes in the area of aquaculture, computer vision, underwater inspection and manipulation.

Keywords - Underwater Robots, Computer Vision, Underwater Manipulation, Aquaculture

I. INTRODUCTION

In the literature there are some works that have tried to solve the net holes problem. Most of them are able to solve the inspection. One example is the article of Lee, H et. al. [1], that proposes an autonomous set point distance between the net and the ROV. Other works like the gripper of the kraken ROV from Tech Stream [2], offer a solution to fix a net hole, while following a manual teleoperation with the help of an expert operator that controls the robot in every kind of movement. In this work a human-supervised autonomous inspection is presented, to be enhanced in a second stage also for repairs.

II. NET HOLE DETECTION

At the moment of writing, the net hole detection algorithm uses transfer learning from YOLO, and is being trained using a dataset with images of the real net installed at CIRTESU, in Universitat Jaume Primer. Figure 1 shows the labeling of the image and the test scenario. This net has been selected to simplify the image recognition, while a more realistic scenario will be used in a second stage.



Fig 1. At the left the net hole labeling and at the right the BlueROV2 inspecting the net

III. NET MANIPULATION

The current results demonstrate that the robot is able to approach the newton gripper to the autonomous recognized hole, under certain conditions. For fixing the net holes the solution will be to patch them temporarily, so that the diver can perform a more robust patch in a second stage. Figure 2 shows an image of the newton gripper facing the net hole.

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Fig 2. Net manipulation using the Newton Gripper

IV. CONCLUSIONS

This work presents the current state of a supervised autonomous system to recognize fish farms net holes and approach a gripper for hooking a temporary patch. In a second stage a realistic net will be used, and a commercial patch adapted to the gripper for further experimentation.

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