AUTOMATIC DETECTION AND RECORDING OF MOVING A SUBJECT

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Abstract

The monitoring of fish communities is of relevance in coastal areas in relation to the growing anthropic pressure. The recent development of cabled video ob¬servatory allowed the long term monitoring of fish communities with the great advantage of eliminate the inevitable disturbance of sampling activity, but hey produce a huge amount of data. Software has been developed to automatize the recognition which helps marine biologist to classify the different species and individuals shot. This project is such an attempt.

For the recognition of the fish from a 5 seconds video obtained from the OBSEA, we had developed two different methods with MATLAB R2011a. The first one using histograms and the second one using the edges of the frames.

The 100% of the total frames where the fish has at least half of its body shot were detected with both methods.

I.INTRODUCTION

The monitoring of fish communities is of relevance in coastal areas in relation to the growing anthropic pressure (Santamaria et al 2013). The traditional sampling methods: trawling, human underwater direct observation as well as photographic; present some complications. For his invasive nature it is not possible to study normal fish ethology, furthermore, some techniques causes the death of the fishes studied. Moreover, the quantity of data obtained, sometimes, is not enough to make a correct research of the community and its behaviour with the environment.

The recent development of cabled video ob¬servatory allowed the long term monitoring of fish communities (Aguzzi et al. 2011) with the great advantage of eliminate the inevitable disturbance of sampling activity. Non-invasive and long-term monitoring should be carried out at high time fre¬quency (hours) in order to link the variability in perceived community composi¬tion down to the day-night rhythms of individuals of local populations (Condal et al. 2012, Aguzzi et al. 2013). Due to this method a large number of images is generated which requires a huge amount of time to process it. For this reason, in the past few years, an increasing number of software has been developed to automatize the recognition which helps marine biologist to classify the different species and individuals shot. This project is such an attempt.

Fig 1. Fish model for both methods.

II.MATERIALS AND METHODS

For the project we used a 5 seconds video obtained from the OBSEA (Expandable Seafloor Observatory) platform.

The OBSEA is and underwater observatory managed for the SARTI group, placed at a depth of 20 meters in a trawling fishing protected area. It is connected with 4 km of optical fiber cable to their laboratories in Vilanova i la Geltrú (Barcelona, Spain).

There were developed two different methods with MATLAB R2011a (64bits).

Histograms method

This method was used in order to obtain the number of frames in which there was a presence of fish.

With this purpose, the first step was to read and extract the total of frames from the video, turn them into grayscale, make a Gaussian filter and chose a model frame, with the presence of the fish (Figure 1), for comparing. In this model frame there was cropped the part of the image where the fish was, having a smaller one but only with the animal. This operation was done by graphical software Corel Draw.

From each of the frames obtained from the original video as well as from the model frame there was done a histogram (Figure 2).

The histograms obtained were compared with the one from the model image to detect in which ones there was the fish present.

Edges method

The objective of this method was not only to determinate in which frames there were a fish, but also to search it in the image.

The first step was, again also to read and extract the total of frames from the

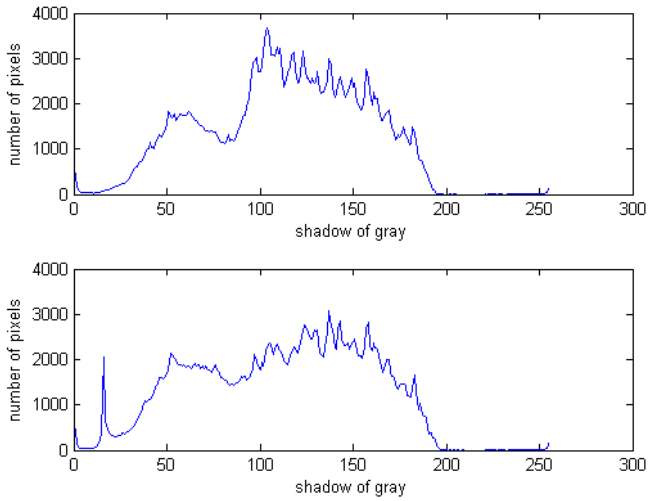

Fig 2. Final histograms obtained. Up from an image without fish, down from an image with fish. The peak marked represents the histogram form of the fish.

video turn them into grayscale, make a Gaussian filter. Next is used conversion picture to black and white images and chose two model frames, one with the presence of the fish and the other one without it. The method used "edge" function implemented in Matlab environment. Results of this function are edges and their position (Figure 3).
With the no-fish model frame that is showed the environment edges present on the image were searched and deleted in order to obtain a smaller picture without those edges. For doing this we divided each image in a 10x10 sub-image. From the every sub-image is computed histogram that has only two colours (black and white). By summing of every histogram we can recognise of white edges. Results of summing represent a number (0 or 1) where '0' represent edge and '1' represent no edge. By simple method of selection there is obtained matrix with only '1'. Results of this process are boundary points in picture. From the points is possible to get area without environment.
Meanwhile, for getting the frames where the animal was present, a correlation (threshold = 0.95) was done with the fish model frame and the total frames acquired from the original video.
With the purpose of finding the position of the fish on the images, we focused on a specific characteristic of this specie, the two black bands near the head and the tail. We searched for those marks only on the part without environment. For doing this we searched for the fish black brands edges on the area without environment, mentioned before, on the fish presence images (Figure 4).
Finally, for knowing the orientation of the fish, a histogram is done in these marked areas in order to obtain the contribution of black and white pixels. The number of white pixels would represent the position of the fish in front of the camera.

III.RESULTS

Histograms

We get a total of 51 pictures from the video recorded.
The histogram obtained from the model image present a remarkable peak near to black colour. This peak is used in the comparison, with the result of 28 pictures identified where the fish is present, the 100% of the total frames where the fish has, at least, half of its body shot.

Edges

Again, we get a total of 51 frames from the video recorded.
With the correlation done, 28 pictures with the presence of the fish were detected, again, the 100% of the total frames where the fish has, at least, half of its body shot.
With the final histograms we achieved to estimate the position of the fish in front of the camera. A higher number of white pixels shows that the image present a lateral view of the fish, when the two black marks are more visible

IV.CONCLUSIONS

Both methods were able to detect the pictures with the presence of the fish.
The edge method could also estimate the position of the fish and its location on the picture.
We can finally say that the edge method is more complete and, also, uses some functions of the histogram method.
Meanwhile this two methods was developed only for this video, it can be easily adapted to another one, but not to a video with a movement of the camera, because it needs a model fixed picture to compare.

V.NEXT MOVE

The future of this project goes through making it universal, able to adapt itself to other videos and images. Also the implementations of different functions, such as identifying different species and counting the number of individuals from each one.

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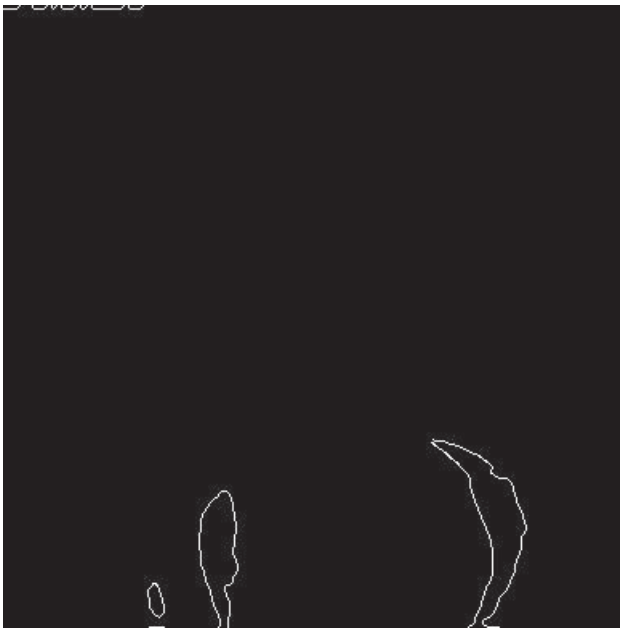
(above) Fig 3. Model fish image after the Gaussian filter and the black and white transformation.



(right) Fig 4. Edges of the black marks of the fish used for the fish localization.