Automated identification of fishes in underwater images with Deep Learning algorithms

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Coral reefs are increasingly impacted by global warming, pollution and overfishing. Monitoring of fish biodiversity can help to understand perturbation processes but need to be done over large temporal and spatial scales.

How does Convolutional neural network training works?

Training Database

Convolutional layers automatically extract feature maps Classification of the image based on the feature map

Fish images + labels Optimization of the convolutional layers of of the classification process by back-propagation on the training database

We trained a GoogleNet architecture to obtain 4 models from our 4 databases. Models are tested on images from independent videos.

We built an image database D1 composed of 44,625 thumbnails of 20 fish species from images manually cropped and identified. From this thumbnails database, we derived 4 training databases:

- 1 class "part of fish"
- 1 class "Background"
- 20 classes "part of fish", one for each species

Results

- Best results with database D4 ("Part of Fish" by species + Background)
- Mean accuracy = 94.1% on 20 species
- Processing time: 0.06 s for a thumbnail
- Compared to humans: 6% more precise (on 9 species) 100 times faster

Perspectives:

Develop a localization algorithm to count individuals of each species in videos. We also need an increase of the number of learned species.