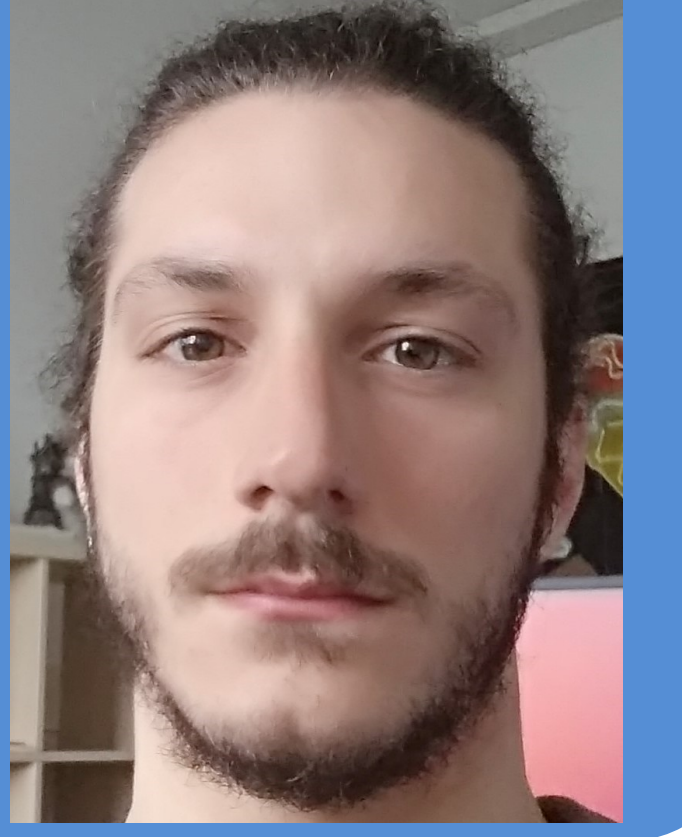


Automated identification of fishes in underwater images with Deep Learning algorithms

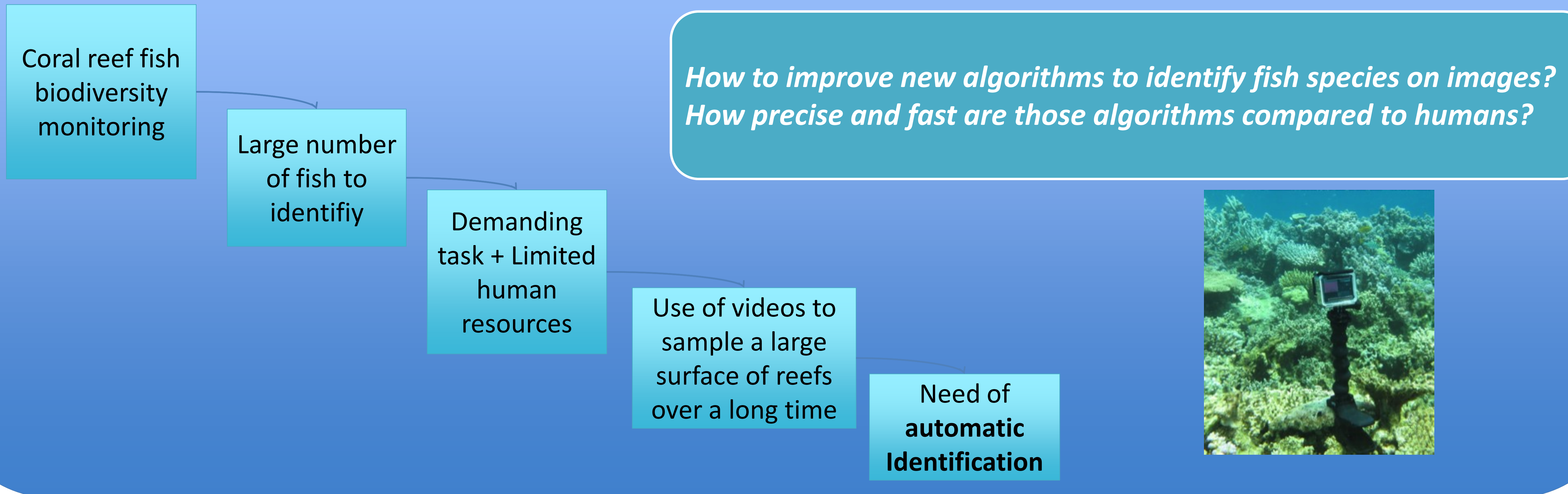


Sébastien Villon^{a,b}, David Mouillot^a, Marc Chaumont^{b,c}, Emily S. Darling^{d,e}, Gérard Subsol^b, Thomas Claverie^{a,f}, Sébastien Villéger^a

a MARBEC, University of Montpellier/CNRS, IRD, Ifremer, Montpellier, France
b LIRMM, University of Montpellier/CNRS, France
c University of Nîmes, Nîmes, France
d Department of Ecology and Evolutionary Biology, University of Toronto, Toronto, Canada
e Marine Program, Wildlife Conservation Society, Bronx, United States
f CUFR Mayotte, France



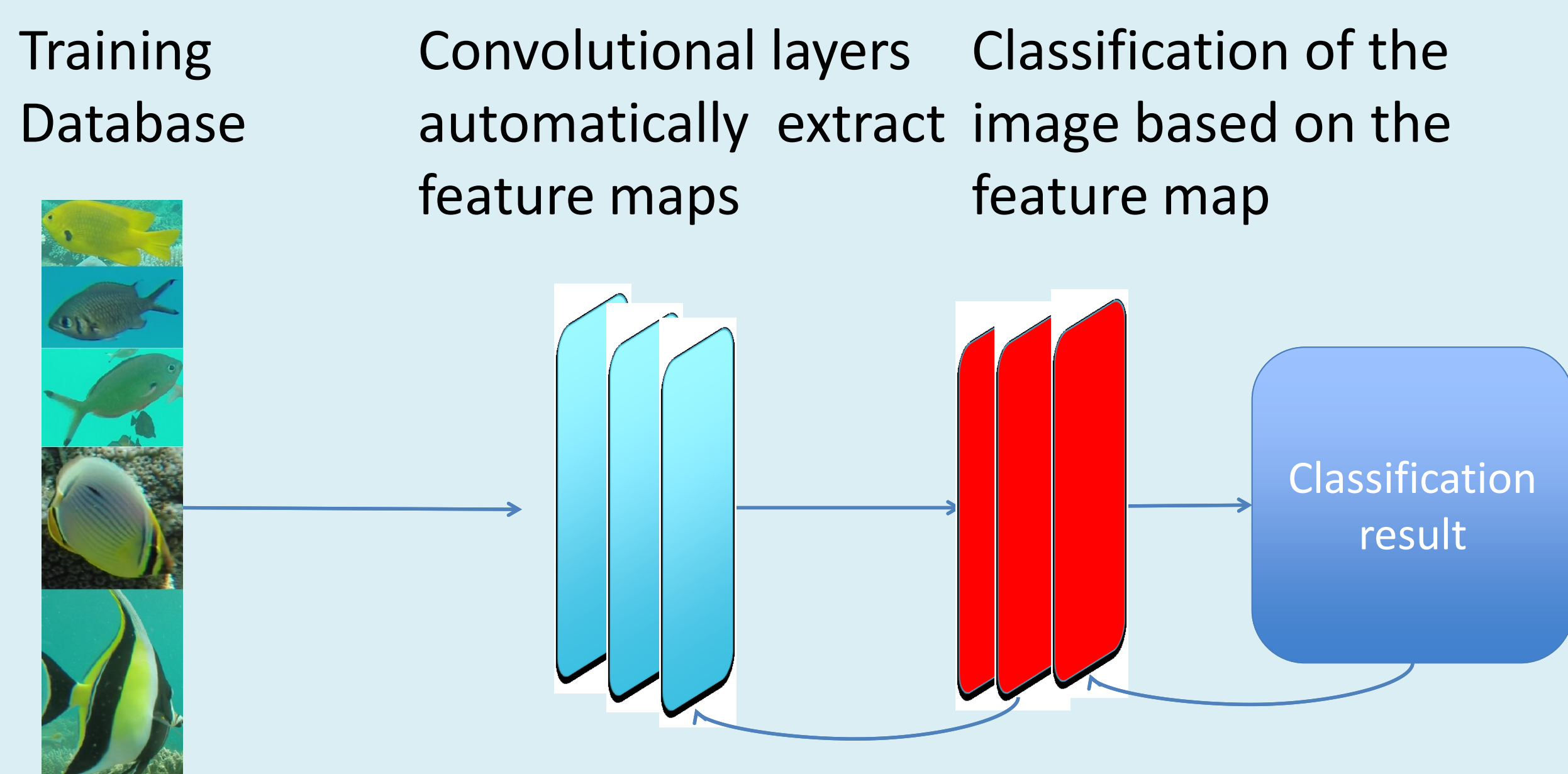
Coral reefs are increasingly impacted by global warming, pollution and overfishing. **Monitoring of fish biodiversity** can help to understand perturbation processes but need to be done over large temporal and spatial scales → **New tools are urgently needed!**



Proposed methods

Development of a Deep Learning based method [1]

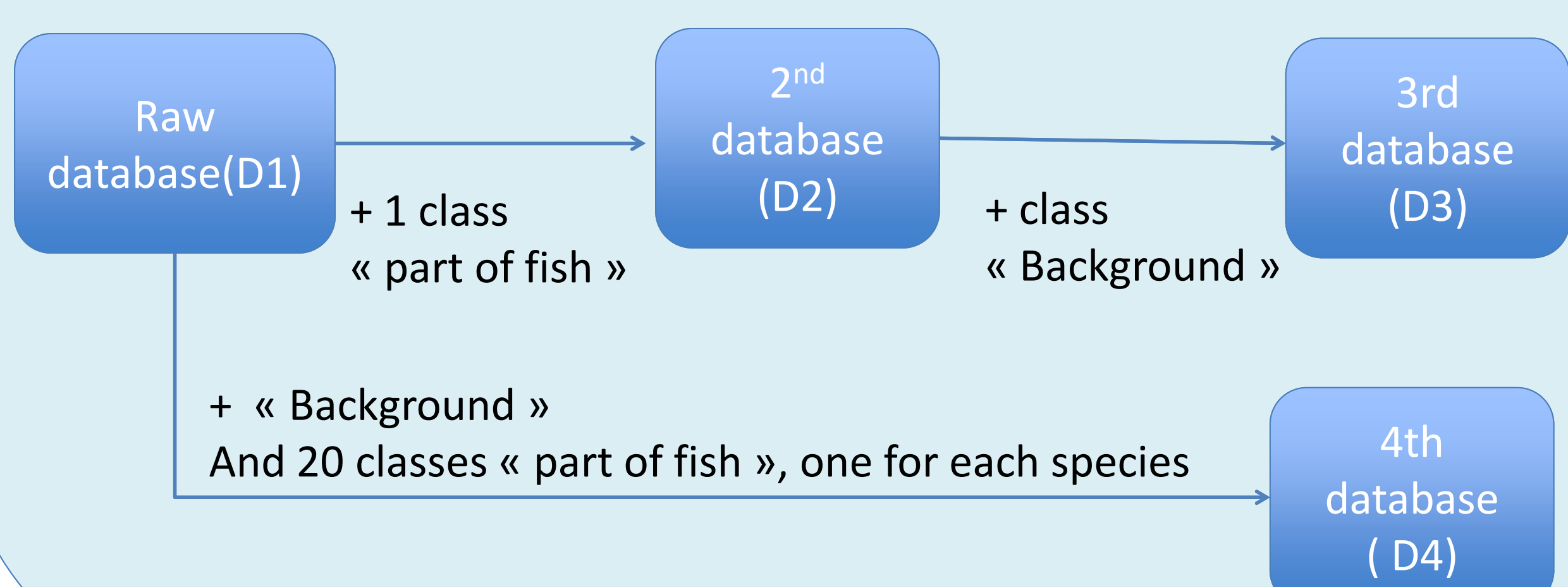
How does Convolutional neural network training works?



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

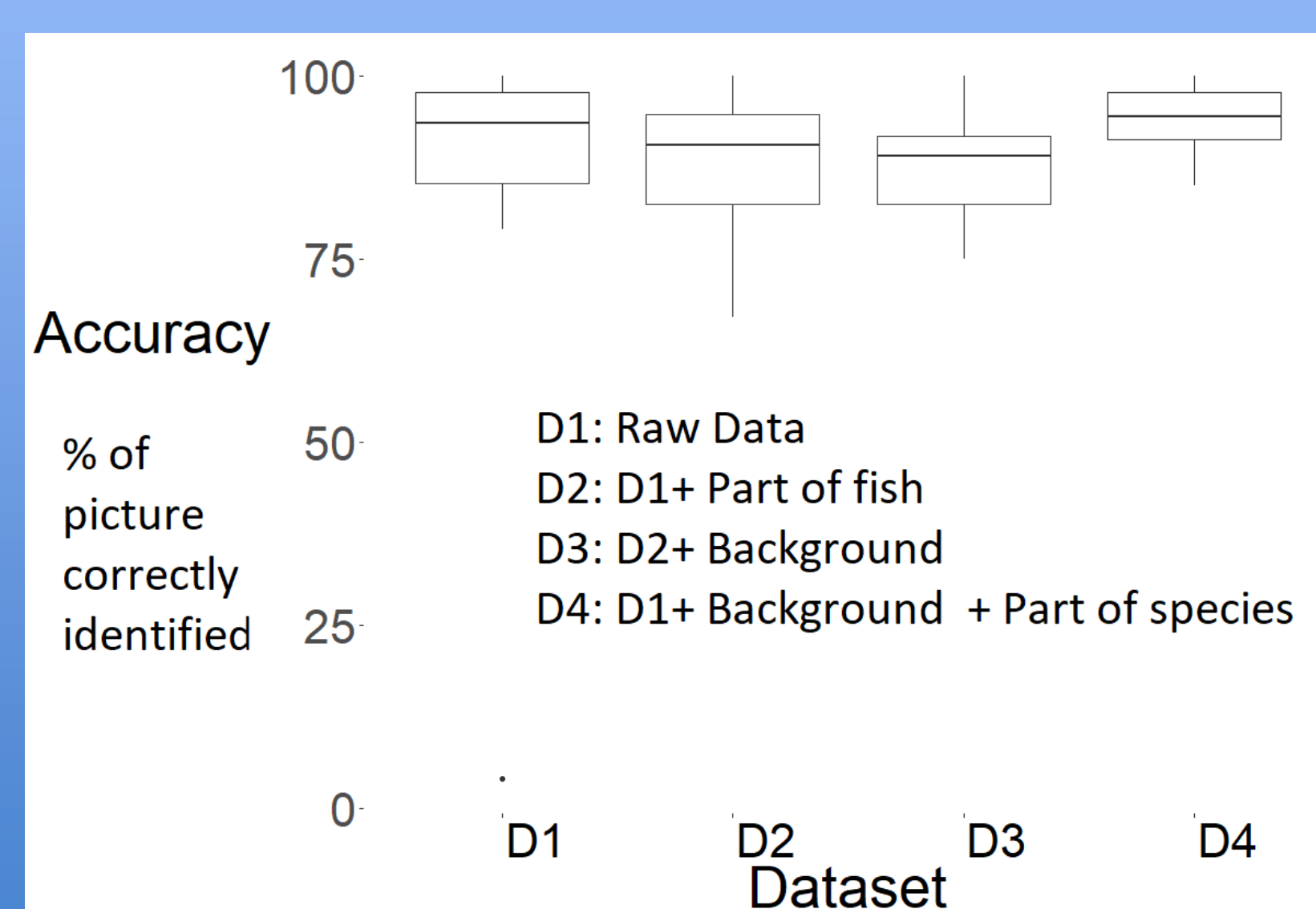
We trained a GoogLeNet architecture to obtain 4 models from our 4 databases. Models are tested on images from independent videos.

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**:

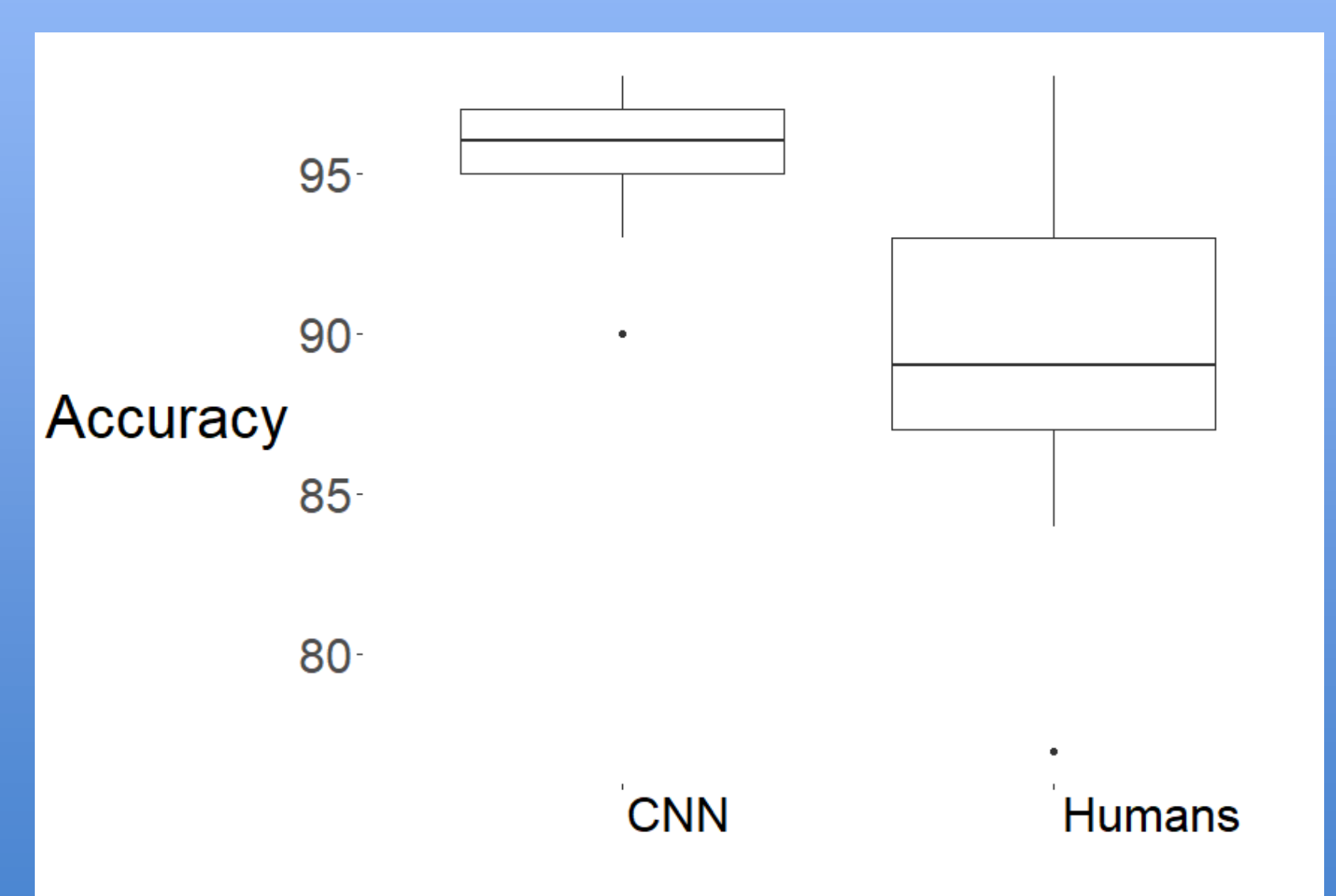


Results

- 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



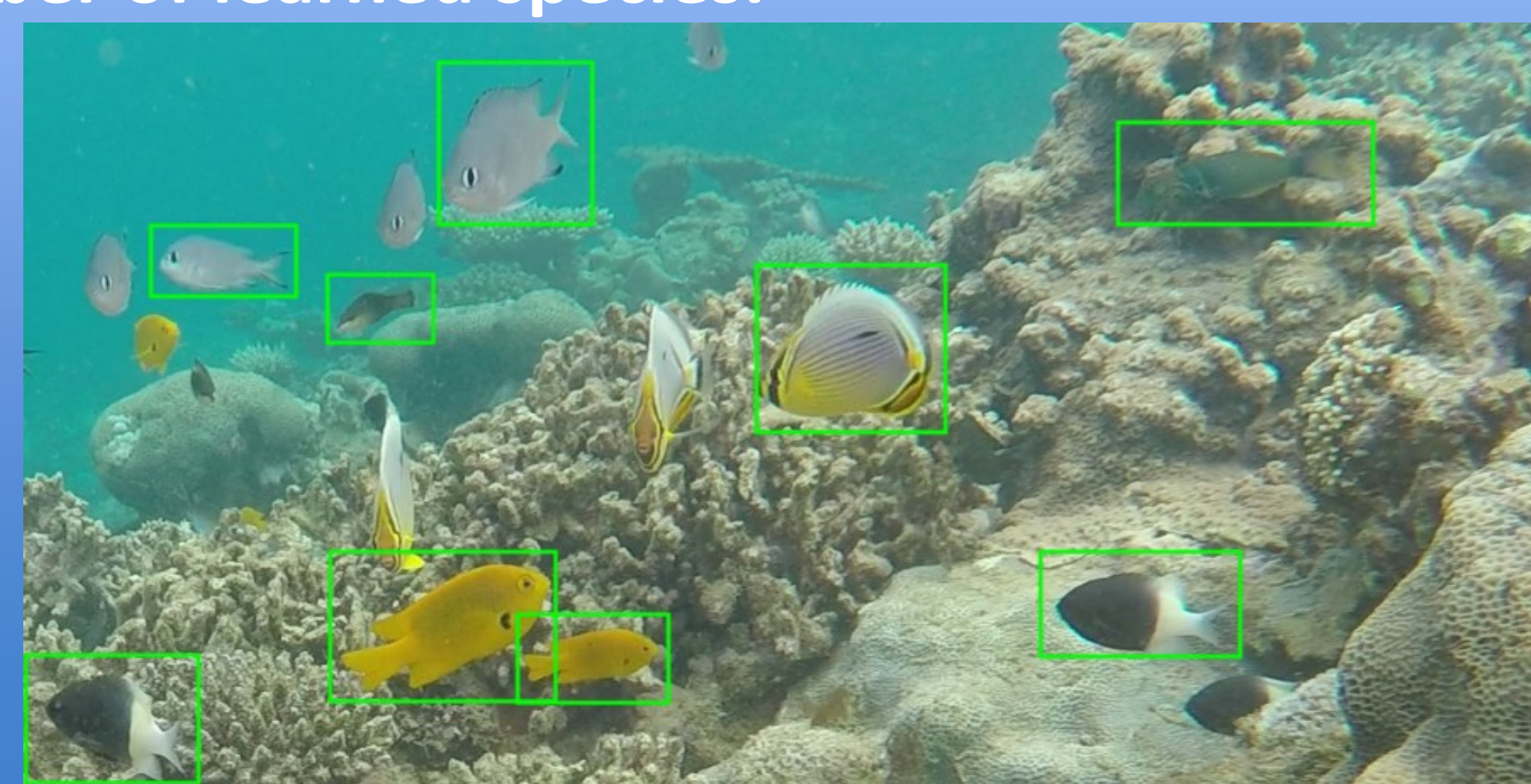
Results of the 4 models on 20 species



Results of human vs CNN comparison on 9 species

Perspectives:

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



[1] Sébastien Villon, Marc Chaumont, Gérard Subsol, Sébastien Villéger, Thomas Claverie, David Mouillot, "Coral reef fish detection and recognition in underwater videos by supervised machine learning, ACIVS'2016"