Introduction

One of the main objectives of the EU Water Framework Directive is to preserve and restore the continuum of river networks for vertebrate migration. In this regard, fish ladders are a widely used measure. To reduce the monitoring cost and the stress for the fish of state-of-the-art monitoring methods (e.g. fish traps), we developed a video-based monitoring system, called FishCam. This system allows a continuous, all year round, contact-free monitoring of fish migration in fish ladders. One key challenge is the development of a software to automatize as much of the analysis as possible.

FishNet – The monitoring software

As only around 3% of the grabbed videos contain actually any fish, one of the main tasks for the software is to robustly filter out these videos. The entire scope of functions an automatic monitoring software should ideally have are:
- Detect all fish
- Capture the migration direction
- Measure the Length
- Determine species

The second blob is the part of the post-processing. This is, where all detected objects get classified into fish and no fish and the migration direction as well as the length get determined.

For the classification a pretrained and fine-tuned Deep Convolutional Network [1] is used. These state-of-the-art architectures recently surpassed human-level image classification accuracy [2]. The architecture of the used network is below.

Results and Future Work

FishNet – The monitoring software

The FishNet-Classifier was fine-tuned on a basis of 38870 images (70/10/20 for training/validation/testing). The test set results are shown in the table below.

<table>
<thead>
<tr>
<th>True Class</th>
<th>Predicted Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish</td>
<td>No Fish</td>
</tr>
<tr>
<td>3886</td>
<td>221</td>
</tr>
<tr>
<td>177</td>
<td>3490</td>
</tr>
<tr>
<td>Precision</td>
<td>Neg. precision value</td>
</tr>
<tr>
<td>0.95</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Sensitivity = 0.96
Specificity = 0.94
Accuracy = 0.95
F1-Score = 0.96

The FishCam-System has already been used in 14 fish passes over the last 2 years. Nearly one million videos had to be processed were only 3% contained actually any fish. The future steps consist of finishing the automatization of fish length determination. Two other open issues are the robust counting of fish in bigger schools as well as the automatization of the classification of the fish species.

Fish TV

Acknowledgement

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References: