FishCam – A semi-automatic video-based monitoring system of fish migration

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One of the main objectives of the Water Framework Directive is to preserve and restore the continuum of river networks. Regarding vertebrate migration, fish passes are widely used measure to overcome anthropogenic constructions. Functionality of this measure needs to be verified by monitoring.

In this study we propose a newly developed monitoring system, named FishCam, to observe fish migration especially in fish passes without contact and without imposing stress on fish. To avoid time and cost consuming field work for fish pass monitoring, this project aims to develop a semi-automatic monitoring system that enables a continuous observation of fish migration. The system consists of a detection tunnel and a high resolution camera, which is mainly based on the technology of security cameras. If changes in the image, e.g. by migrating fish or drifting particles, are detected by a motion sensor, the camera system starts recording and continues until no further motion is detectable.

An ongoing key challenge in this project is the development of robust software, which counts, measures and classifies the passing fish. To achieve this goal, many different computer vision tasks and classification steps have to be combined. Moving objects have to be detected and separated from the static part of the image, objects have to be tracked throughout the entire video and fish have to be separated from non-fish objects (e.g. foliage and woody debris, shadows and light reflections). Subsequently, the length of all detected fish needs to be determined and fish should be classified into species.

The object classification in fish and non-fish objects is realized through ensembles of state-of-the-art classifiers on a single image per object. The choice of the best image for classification is implemented through a newly developed "fish benchmark" value. This value compares the actual shape of the object with a schematic model of side-specific fish. To enable an automatization of the length determination a mirror was installed in the upper part of the tunnel to provide an additional view angle on the fish for the positioning in depth. In its current state the program is able to detect and track moving objects and to classify these objects reasonably well (accuracy of more than 90%) into fish and non-fish objects. The determination of the fish length was tested successfully but still needs to be fully automatized. The classification of identified fish into their species is currently done manually through experts. The entire monitoring system is already in use and installed in various different rivers across Austria showing promising results to facilitate the work of fish pass monitoring.