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First Results of a **Low-Cost Visual Odometry** Approach for **Autonomous Underwater Localization** and **Fish Habitat Mapping**

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Project AuTag BeoFisch

The AuTag BeoFisch project studies non-invasive fish monitoring in hard-to-access habitats using autonomous underwater vehicles and machine learning. Scientific monitoring is one of the key elements in the sustainable management of exploited fish populations.

Partners in this cooperative research project are the University of Hamburg (focus: marine biology) and the Technical University of Hamburg (focus: localization and communication).(*)

Approach

To solve the problem of fish detection in shallow turbid water, a deep visual odometry algorithm (“deepVO”) is developed to estimate distances (depth) and motion. This is planned to be used as visual odometry to estimate the vehicle’s current position in the habitat and enable autonomous habitat mapping. Furthermore, the current sensor set-up will be extended to a stereo camera (optimized for low light conditions) and an Nvidia Jetson Orin Nano is used to deploy a deep visual odometry algorithm. The deepVO algorithm is trained in a self supervised fashion (without manual labeling!), on the autonomous driving KITTI dataset.

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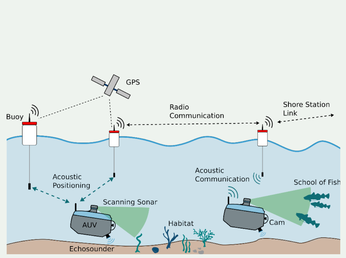
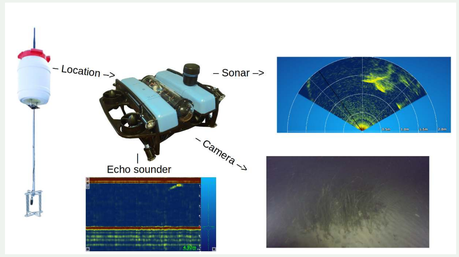
To Summarize



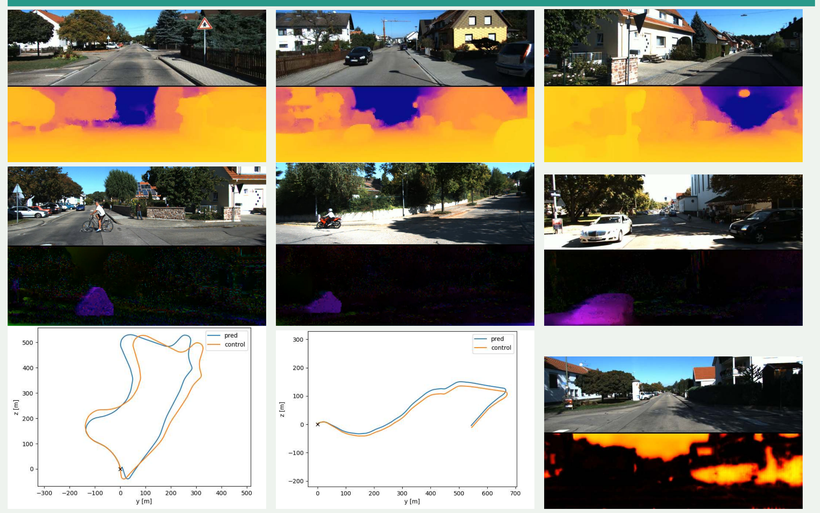


→ Presented: first results of a collaborative research project for autonomous fish detection in the western baltic sea.

→ These include first difficulties and a self-supervised low-cost solution approach for shallow or medium-deep water.

→ The proposed solution uses vision sensors only, realizing visual odometry – which could be helpful in long-term AUV missions.

First Results



The **depth prediction performance** of the deepVO algorithm can be seen in the top row. The middle row shows the predicted optical flow of self moving objects. This could be used to **detect non-stationary objects**. The **localization performance** can be seen on the left in the bottom row. It is not possible to test an algorithm for **robustness to turbid water** on a dataset for autonomous driving. However, the bottom right image shows that the deepVO algorithm is able to mask monotonous areas.

References

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