GEOMAR
Helmholtz-Zentrum für Ozeanforschung Kiel

Masterthesis: Rotation invariance in deep learning for underwater visual recognition

When photographing the seafloor from an underwater robot, objects can appear variously rotated in the images. Finding back the same spot on the seafloor requires more careful handling of camera geometry than in air, where most images are aligned to gravity direction. Therefore, neural networks that are pretrained on gravity-aligned datasets struggle in seafloor mapping applications. A potential solution could be to equip convolutional neural networks with rotation invariance properties.

To adress this challenge, we offer a master thesis topic about different variants to include rotation and scale invariance into common architectures of convolutional neural networks in order to increase robustness of learned feature matching methods.

The task can include (but is not limited to):

- trimming existing CNN architectures with rotation invariant pooling or filters
- transfer learning strategies that allow learning rotation invariance
- generating ground-truth data with our physically based rendering tools
- comparison with classical rotation invariant feature matching methods
- using deep learning debugging methods for educated architecture decisions

Your experiences:

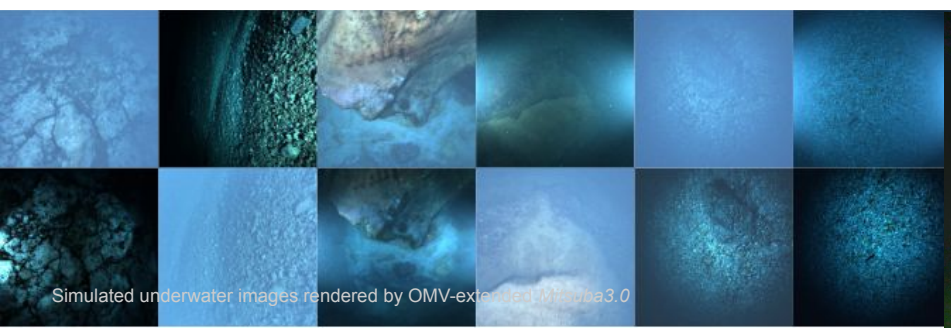
- Studies in computer science, data science, information engineering or similar
- Knowledge in deep learning, computer vision or image processing
- Programming skills (e.g. python, c++)

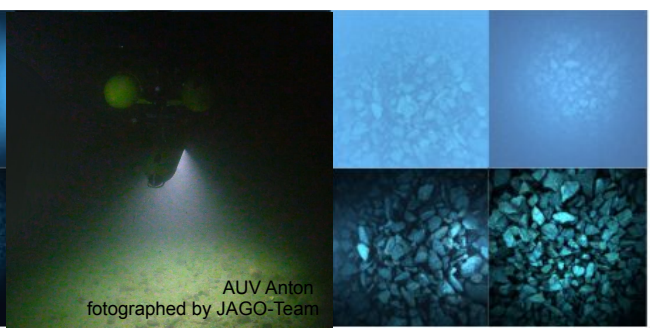
What to expect:

- work on real world challenges at the interface to marine sciences
- in an international, flexible and young research group

Interested?

Get in contact with Patricia Schöntag (paschoentag@geomar.de) for further information or check out Geomar's Data Science Unit https://www.geomar.de/forschen/digital-science/data-science-unit and the Marine Data Science Group at CAU https://www.geomar.de/en/omv.


Simulated underwater images rendered by OMV-extended Mitsuba3.0


AUV Anton
fotographed by JAGO-Team