

EGU2020-22594

<https://doi.org/10.5194/egusphere-egu2020-22594>

EGU General Assembly 2020

© Author(s) 2022. This work is distributed under the Creative Commons Attribution 4.0 License.



Machine learning as supporting method for UXO mapping and detection

Daniela Henkel, **Everardo González Ávalos**, Mareike Kampmeier, Patrick Michaelis, and Jens Greinert

GEOMAR Helmholtz Centre for Ocean Research, Kiel, Germany (dhenkel@geomar.de)

Marine munitions, or unexploded ordnances (UXO), were massively disposed of in coastal waters after World War II; they are still being introduced into the marine environment during war activities and military exercises. UXO detection and removal has gained great interest during the ongoing efforts to install offshore wind parks for energy generation as well as cable routing through coastal waters. Additionally, 70 years after World War II munition dumping events, more and more chemical and conventional munition is rusting away increasing the risk of toxic contamination.

The general detection methodology includes high resolution multibeam mapping, hydroacoustic sub-bottom mapping, electromagnetic surveys with gradiometers as well as visual inspections by divers or remotely operated vehicles (ROVs). Using autonomous unmanned vehicles (AUVs) for autonomous underwater inspections with multibeam, camera and EM systems is the next technological step in acquiring meaningful high resolution data independently of a mother ship. However, it would be beneficial for the use of such technology to be able to better predict potential hot spots of munition targets and distinguish them from other objects such as rocks, small artificial constructions or metallic waste (wires, barrels, etc.).

The above-mentioned predictor layers could be utilized for machine learning with different, already existing, and accessible algorithms. The structure of the data has a high similarity to image data, an area where neural networks are the benchmark. As a first approach we therefore trained convolutional neural networks in a supervised manner to detect seafloor areas contaminated with UXO. For this we manually annotated known UXO locations as well as known non-UXO locations to generate a training dataset which was later augmented by rotating and flipping each annotated tile. We achieved a high accuracy with this approach using only a subset of the data sources mentioned above as input layers. We also explored the use of further input layers and larger training datasets, and their impact in performance. This is a good example for machine learning enabling us to classify large areas in a short time and with minimal need for manual annotation.