frontiers | Frontiers in Marine Science

TYPE Editorial
PUBLISHED 26 April 2023
DOI 10.3389/fmars.2023.1207337

OPEN ACCESS

EDITED AND REVIEWED BY
Laura Airoldi,
University of Padova Chioggia Hydrobiological Station, Italy

*CORRESPONDENCE
Ahmad Salman
ahmad.salman@seecs.edu.pk

RECEIVED 17 April 2023
ACCEPTED 19 April 2023
PUBLISHED 26 April 2023

CITATION
Salman A (2023) Editorial: Application of machine learning in oceanography and marine sciences.
Front. Mar. Sci. 10:1207337.
doi: 10.3389/fmars.2023.1207337

Editorial: Application of machine learning in oceanography and marine sciences

Ahmad Salman*

School of Electrical Engineering and Computer Science, National University of Sciences and Technology, Islamabad, Pakistan

KEYWORDS

machine learning, marine science, deep learning, artificial intelligence, computer vision

Editorial on the Research Topic
Application of machine learning in oceanography and marine sciences

Marine scientists and conservationists are increasingly interested in machine learning, deep learning, and computer vision due to their promising outcomes in oceanography and marine sciences. These technologies offer significant advantages, including faster and more reliable results compared to manual monitoring, and they can be applied to a variety of tasks, such as fish detection and classification, coral classification, coastal morphological and morphodynamic modeling, sediment analysis, wind and wave modeling, weather prediction, ocean pollution, and resource management. However, challenges exist, such as environmental variability, limited data availability, and noise, which can affect the performance of machine learning models. The effectiveness of any algorithm is evaluated based on how it performs under such challenges. Therefore, it is crucial to adopt modern computer intelligent techniques to process large amounts of data collected from various marine sites globally and monitor changes in the marine environment to help conservationists and government agencies take necessary actions. The automated systems must be efficient and robust enough to handle environmental variations for the various data types encountered in marine sciences, i.e., imagery, videos, time sequences, and chemical and morphological features.

This special issue of *Frontiers in Marine Science* comprises articles encompassing a broader spectrum of the application of machine learning and computer vision in various fields of oceanography and marine sciences. Therefore, scientists were invited to submit their research findings under the relevant areas.

We received ten articles, and out of those, six were selected and found to be suitable for publication after a careful review process. Three articles were published under *Original Research*, one under *Review*, one under *Methods*, and one in the *Opinion* category.

Yang et al. worked on analyzing the spatial pattern of human fishing activity. They picked AIS data acquired from the western and central Pacific Ocean for tuna purse seiners covering a time span of five years (2015 to 2020). Using boosted regression trees (BRT) and a general additive model (GAM), they showed promising results in terms of accuracies. With BRT, they achieved an average accuracy of 0.84, while GAM resulted in 0.77. They also evaluated the most prominent factors affecting fishing activity, i.e., sea depth and longitudinal position. Human fishing activity detection is crucial, and therefore, this work

will contribute to suggesting an approach for fishery resource management and monitoring authorities.

In another *Original Research* article, Connolly et al. applied deep learning and computer vision for automatic fish detection through videos in shallow marine waters. This is a good contribution that facilitates marine scientists to conduct automatic fish sampling *via* rapid video-based detection. They used R-CNN, Faster R-CNN, and YOLOv5 models for fish detection, with F1-scores ranging from 81.4 to 87.3% on their dataset, which was challenging due to the environmental variation, including background confusion, water murkiness, and luminosity change.

Guan et al., in another *Original Research* article, presented a modified generative adversarial network (GAN) called FSpiral-GAN for underwater image enhancement. They claimed to overcome computational cost over the conventional GAN architecture by using a specific style of upsampling, downsampling, and residual connections. Their approach showed favorable performance in four different datasets in terms of computational efficiency metrics (e.g., GFLOPS and FPS) and quality metrics (e.g., PCQI, SSIM, UIQM, and UCIQE). With adequate visual representation, their algorithm is an addition to the current and trending hot topic of image enhancement.

Under the *Methods* article section, Marrable et al. presented their methodology and a system for fish species classification and labeling using deep learning. For species classification and labeling, they used a dataset comprising 12 fish species and presented an F1-score of 0.79. YOLOv5 pre-trained on the COCO dataset was employed as a transfer learning module. It was fine-tuned on a subset of the OzFish dataset.

Under the *Opinion* article category, Jiang and Zhu presented their view on the prospects of applying AI in scientific methods of monitoring marine biodiversity, deep-sea resource modeling, and predicting SST, tide level, sea ice, and climate. In a way, this article covers nearly all the scopes of this special edition and summarizes the latest trends and their efficacy while using AI modules to solve the challenges in marine sciences.

Similarly, in a *Review* article, Ditria et al. presented the latest trends and the role of AI in handling marine ecosystem conservation efforts. Starting with reviews on non-invasive data collection, data processing, handling, and storage, they moved towards presenting the latest interests in machine learning adoptability, predictive modeling, and data analytics for modern decision support systems, which can supplement research and development in the marine sciences. This is a good article that summarizes literature in the time span of the last two decades, mentioning their pros and cons with challenges in hand.

In conclusion, this special edition of *Frontiers in Marine Science* attracted articles of different flavors addressing various research problems related to the marine sciences, and it presented a way forward on how the related scientific community can benefit from modern and state-of-the-art AI and machine learning techniques. The most beneficial outcome of this issue is that it offers a presentation of novel approaches to address the most critical challenges faced by the marine science community. These include underwater image enhancement, automatic fish fauna detection and classification with a specially crafted machine, and deep learning architectures. Moreover, reviews and opinions are provided for data processing, conservation, the effect of climate change on marine life, and how to effectively tackle those adverse effects using modern approaches. This issue is an encouraging example for interdisciplinary research work and an inspiration for machine learning-based pragmatic solutions for marine sciences.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note