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Machine Learning Provides a Much-Needed Solution for Marine Mammal Protection

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Sonar paired with automated data analysis helps to fill major gaps in current methods for marine mammal research.

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High-intensity sounds created by humans can cause great harm to marine mammals. Military use of high intensity sonar, pile driving for large construction projects, and air guns and explosives used by the offshore oil industry are directly responsible for the deaths of many endangered marine mammals. Environmental regulations require extensive monitoring of these animals before any potentially harmful projects can be approved. However, the current methods for monitoring populations of marine animals are inadequate and expensive. New developments in machine learning software paired with the use of sonar might provide the solution to this problem.

In their 2019 paper, Hastie et al. created the most accurate method for long-term marine mammal monitoring to date. Their method involves the use of a support vector machine (SVM), which is a type of machine learning software. Their SVM was paired with sonar and the sonar's accompanying software to automate the detection and classification of seals underwater. Their method relies on the use of a sonar system mounted to the seabed on a heavy tripod. This sonar system feeds data to a program that extracts high-intensity targets, which are then processed by the SVM to be classified as seals or non-seal objects.

The method used by these scientists solved several prior problems associated with monitoring mammals using sonar. They were able to create a stable mount for the sonar system that remained in place during a lengthy survey and they increased the range from previous sonars and acoustic cameras from 12 meters to 60 meters. However, the key solution found by Hastie et al. was their automation of data analysis using machine learning to process sonar data in conjunction with the software already on board the sonar. Their SVM was able to classify 100% of seal targets correctly and 92% of non-seal targets correctly, with a combined accuracy of 95%. Hastie et al. tested their SVM on confirmed seal data collected by two teams. One team watched as seals passed in front of a sonar while the other marked incoming sonar data as the first team called out confirmed sighting of seals. This provided a data set where there is sonar data that corresponds to the presence of a seal.

The use of machine learning with sonar is a novel strategy but the results of testing this methodology by Hastie et al. proved to be quite successful.

Marine mammal populations will remain at risk as humans continue to make noise under water through military activity, construction, and oil drilling. Marine mammal monitoring can help protect vulnerable populations of marine mammals and help scientists learn more about their behavior. The results of this study present a viable method to study marine mammals in an automated, time- and cost-effective manner.

Citation: Hastie GD, Wu G-M, Moss S, Jepp P, MacAulay J, Lee A, Sparling C.E., Evers C, Gillespie D. (2019) Automated detection and tracking of marine mammals: A novel sonar tool for monitoring effects of marine industry. *Aquatic Conserv: Mar Freshw Ecosyst*.29(S1):119–130. https://doi.org/10.1002/aqc.3103