

Oceans and AI: Path towards a sustainable earth

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“We are living on this planet as if we have another one to go to.” - Terri Swearingen

Life on Earth would not be sustainable if it weren't for the major contribution of the oceans. They cover over 70% of the planet's surface and are home to countless marine species, many of which are undiscovered. The oceans play a critical role in our lives, providing us with food and resources, regulating our climate, producing oxygen, and absorbing carbon dioxide. Protecting them from their slow deaths should be our foremost concern.

Focusing on a few of the challenges that have been slowly costing the lives of marine species and the slow but steady disintegration of the oceans' ecosystem would help us traverse through the process of leaving behind a sustainable earth. The challenges primarily include Marine Spatial Planning (MSP), which deals with the sustainable management of ocean resources; ocean carbon capture planning, which involves removing carbon dioxide from seawater and making space for it to absorb more to tackle climate change; and Ocean pollution, which involves littering the ocean's surface with plastics, events of oil spills, industrial runoff, untreated sewage, etc.

This is where AI comes into the picture by helping combat the aforementioned challenges to preserve the ocean's economy as there are roughly three billion people depending on it for their livelihood. There are other primary methods that mankind has

been using to save the oceans. However, manually picking up litter from the oceans is not feasible and is highly time-consuming, along with other measures that are needed to conserve them. As long as the disintegration moves at a faster pace, the sustainability plans need to move at an even faster pace. AI helps in designing these much-demanded solutions by using image processing algorithms, machine learning, sensors, drones, satellite data, etc.

AI applications can be developed and explored for planning and optimizing ocean-based carbon capture initiatives. It involves processes of analyzing ocean currents, economic feasibility, and carbon sequestration potential. Using AI for marine spatial planning includes optimizing MSP, and considering factors like shipping routes, offshore energy installations, and conservation areas. This can help balance economic activities with the conservation of marine ecosystems. There are AI systems implemented to monitor ocean health, including water quality, temperature, and biodiversity. This data can inform economic decisions related to industries dependent on a healthy ocean ecosystem.

Marine spatial planning

As the population continues to grow, so does the demand for resources from the ocean. The Blue economy has been sustaining human life with various activities for a very long time, and it has around 40% of the population depending on it. Marine Spatial Planning is the process of managing human activities in the ocean in a way that maximizes the benefits of marine resources. MSP is a concept primarily based on scarcity. It involves efficient allocation of the resources available and minimizing conflict by extension.

Marine resources and services are difficult to measure. The properties of marine systems are complex and poorly understood (Groenevald 2020). MSP helps in tackling these issues to some extent. It often includes services for exploring areas of deep seas and offers a practical way to create and establish a more rational use of marine space and the interactions among its uses.

AI-driven marine spatial planning can also help in identifying areas suitable for renewable energy production. It might be used to check the viability of offshore wind farms from satellite imagery and oceanographic surveys. It can also help in monitoring the ocean's health by assessing the quality of coral reefs, and intensity in case of oil spills. One of the prominent tools is the Seahawk Flying Submersibles. These are drones that can go both airborne and underwater. It has the ability to survey areas from both above and below the surface. It has the ability to process data in real-time information which implies that it can collect better data, cheaper, and faster than existing tools. Another promising one with exemplary results is the drones by Apium Swarm Technologies founded by Tyler MacCready, a former engineer and scientist for AeroVironment. The company has created underlying software that enables control of multiple autonomous surface vehicles or even diving vehicles at any time. It makes data collection more effective because it can take area snapshots coordinated with other vehicles when everything is constantly moving because of tides, sea floor changes, and differences in water makeup.

Global Fishing Watch uses satellite-based monitoring to track all fishing vessels in real-time to protect fisheries around the world. It collects satellite imagery and analyzes vessel movements with special machine learning to detect whether they are

fishing or sea-fearing. It helps to keep an eye on key trends, such as frequency, and monitor if any fishing boats venture into protected waters.

MSP integrates stakeholders and scientific knowledge from marine conservation, climate change, and regional development into the planning and decision-making process on how we use our oceans. AI helps to identify the best strategies for managing marine ecosystems, identify areas of high ecological value, like habitat for endangered species, and monitor the effects of development activities on the marine environment. The tools already in action include AI-powered sensors that can detect changes in water temperature, salinity, the presence of pollutants, and oxygen levels. It also helps in making informed decisions on how to manage developmental activities in order to minimise their impacts on marine life.

Conservation of marine species

The sound of whales has been evident in calming down human beings and helping with anxiety. These could not be recorded without the help of underwater microphones and AI which has been programmed to separate the noise of these mammals. The most prominent recording of the voices of whales by Roger S. Payne titled, “Songs of the Humpback Whale”

is credited with generating a vast emotional response and one of the greatest mammal conservation movements, per The New York Times.

Underwater microphones have been used to record the sound of healthy coral reefs to restore the dying ones. These have been very helpful in restoring habitats that had been destroyed by climate change earlier. Recently, marine scientists on Goa's coral reef in India recorded a reef and plugged the sounds into an algorithm that immediately identified the species. Researchers have used AI to map the movements of pink dolphins in the Amazon River by recognizing the animal's unique clicks and whistles. Acoustic tracking technologies have helped widely in the conservation of this species.

Also, Google has teamed up with Queensland University to create a detector powered by machine learning, which can automatically identify sea cows in ocean images. This detector can save time, energy, and resources to spot the animal easily instead of going through thousands of aerial photos.

These are some of the ways in which AI has been helpful in restoring the marine ecosystem. Saving these marine animals from going extinct plays an important role in the cycle of nature, and the preservation of their habitat will ensure a sustainable earth for us to live on.

Ocean carbon capture planning

Although this field is currently under development and not very prominent, it plays a chief role in the marine environment. This carbon capturing actually provides us with a way to rectify our mistakes due to the impacts caused by excessive climate change. In this particular field, AI helps by assisting in carbon tracking. Image processing algorithms are used to detect the carbon output of factories and power plants. Knowing the carbon output would help in calculating the impact of the damage caused. Satellite data is used to monitor and track these carbon emissions globally. Apart from this, it

also helps in predicting future emissions through machine learning. This helps government policymakers plan emission output targets to reduce future output. Scientifically, AI helps in carbon separation. Methods to separate the molecules are being developed. Though this seems to be in its rudimentary stage, AI has been moving at a faster pace than others and will soon result in making this a globally feasible method to combat climate change.

In partnership with Microsoft, The Nature Conservancy has combined traditional academic research with cloud and AI technologies to map, in high resolution, ocean wealth. By evaluating the economic value of ocean ecosystem services, such as carbon storage and fishing activity, it will make better conservation and planning decisions possible.

Ocean pollution

Ocean pollution is a combination of chemicals and trash, most of which comes from land resources and is washed or blown into the ocean. There are numerous incidents of whales washing up on the shores because they have died of swallowing the microplastic that litters the surface of the ocean. Apart from plastic littering and debris, marine life also faces threats due to untreated sewage, industrial runoff, and events of oil spills. Processes like offshore drilling cause severe harm to the animals due to the excessive noise it releases and also the extraction of fossil fuels. These are often fueled by urbanization and development and cannot be stopped completely. The only way to keep sustaining the shoreline community with their livelihood is to clean the debris collected everywhere and this will have a serious impact because as already mentioned, all of human life depends on the ocean in one way or the other.

Ocean Cleanup is a non-profit organization that uses AI to track and identify plastic pollution in the Great Pacific Garbage Patch. This organization has come up with machine learning and drone technology that can detect plastic waste hotspots, quantify marine litter and detect tiny plastic pieces floating in the ocean. It has powered machine learning to identify pollution in rivers and simulate how it moves in the ocean. It powers passive cleanup systems to help remove plastic.

Autonomous Surface Vehicles (AUVs) and Unmanned Surface Vehicles (USVs) are some of the mainly developed cleanup technologies with the help of AI. USVs collect commercial ocean data on the surface and map the seabed for environmental monitoring. AUVs collect data from specific parts of deep oceans while scientists conduct research on board a ship or on land. These vehicles are cost-effective to some extent and help in marine litter detection.

Sustainable Coastlines from New Zealand have created a national litter database to track the impact of cleanup efforts and generate accurate, scientifically valid data and insights for further use. Their main focus has been to identify sources, causes, and solutions to coastal pollution, along with community empowerment.

Scientists at the Plymouth Marine Laboratory used satellite data to detect patches of tiny plastic pieces down to 5 millimeters in size. They observed that materials can be distinguished using light signals based on the wavelengths of light they reflect. The algorithm was trained to detect these wavelengths along with distinguishing them from natural materials like seaweed, seafoam, and driftwood.

Similarly, at the University of Barcelona, researchers have developed an aerial imagery algorithm for detecting marine litter. The algorithm was trained to analyze 3800 aerial images of the Mediterranean Sea and used networks to improve its accuracy over time.

Marine waste cleaning startup ClearBot has designed robots that leverage AI-powered computer vision to identify marine waste and retrieve it to responsibly dispose of it. ClearBot is a marine trash-collecting drone that is solar-powered and self-navigating with AI vision that uses machine learning to optimize its capability over time.

We have a long way to go before the oceans are free from plastic and debris collection. But these AI tools can definitely help us get there faster to ensure a sustainable earth.

Conclusion

For life to continue on Earth, we must take preserving the oceans very seriously. And with the time crunch we are facing and a growing population, AI can definitely help us control the amount of damage we are inflicting on the oceans. The article has discussed various AI tools that are being used and are under development to help save the ocean.

But the main point lies in whether we are ready to be responsible for our actions and help save marine life. Oceans have always been connected to humans since the dawn of time. We have discovered continents, survived two World Wars, and now the global pandemic! Throughout all of man's inquisitiveness, the oceans have been with us. And it is only fair to leave it the same way we found it for future generations to come. We can definitely find more sophisticated AI tools in the future. But being responsible is the only way forward to a sustainable earth, because we're not sure of Planet B either. Technologically, AI will help us, but the responsibility comes from within!