Microsoft

AI for Earth Grantee Profile

OceanMind

Curbing illegal fishing with satellite data and AI

Summary

Illegal, unreported, and unregulated fishing have significant detrimental impacts on biodiversity and exacerbate ocean impacts of climate change. Healthy and productive ocean ecosystems are necessary for human food security, livelihoods, and health, and for helping the planet be more resilient in the face of climate change. OceanMind is working to increase the sustainability of fishing by analyzing vessel movements and identifying their behavior and regulatory compliance. This helps governments enforce existing laws more effectively and helps seafood buyers make more responsible choices. Through a Microsoft AI for Earth grant, OceanMind will move its data analytics to the Microsoft Azure cloud, allowing it to analyze more data in real time, faster and more accurately. That will greatly improve OceanMind's ability to help in the fight against illegal fishing.

Curbing illegal fishing with satellite data and AI

Fish are a crucial global resource, providing the primary source of protein in the diets of as many as 3 billion people worldwide. And as much as 12 percent of the world's population relies in some fashion upon fishing and the seafood industry for their livelihood. But this resource is seriously threatened. As reported by the UN Food and Agriculture Organization, consumption of fish as food by humans has grown on average about 1.5 percent per year since 1961. Fully a third of all fish stocks are now overfished, no longer biologically sustainable, and about 60 percent are maximally sustainably fished; as little as 7 percent remains underfished.

> One-third of all fishing stocks are now overfished and about 60 percent are maximally sustainably fished.

These problems are worsened by illegal, unreported, and unregulated (IUU) fishing. A seminal study in 2009 estimated that illegal and unreported fishing catches between 11 million and 26 million metric tons annually, costing the industry as much as $24 billion. But by definition the extent of IUU fishing is not fully known, which means the depletion of fish stocks could be even worse. And the weight of this problem tends to fall on the poorest nations with the least ability to manage their fish stocks, causing additional suffering. Illegal fishing

also sometimes uses slave labor, with the unpaid crews forced to stay working on vessels for years at a time in horrifying conditions.

Worldwide, fishing fleets collectively include more than 4 million vessels—a huge number in the even more vast environment of the oceans, where physical borders are rarely obvious. These fleets operate in a variety of jurisdictions. National governments patrol their own coastal waters, and usually form treaties to jointly manage nearby areas in between. Regional fisheries management organizations also govern some areas of international waters, while other large areas of the oceans are unregulated. With this complicated situation, it's challenging to catch IUU fishing—especially because it generally looks no different than normal legal fishing. The distinction comes in whether a vessel was licensed to catch the species it caught, with the gear used, in the amounts it caught, at the time and location where it was fishing.

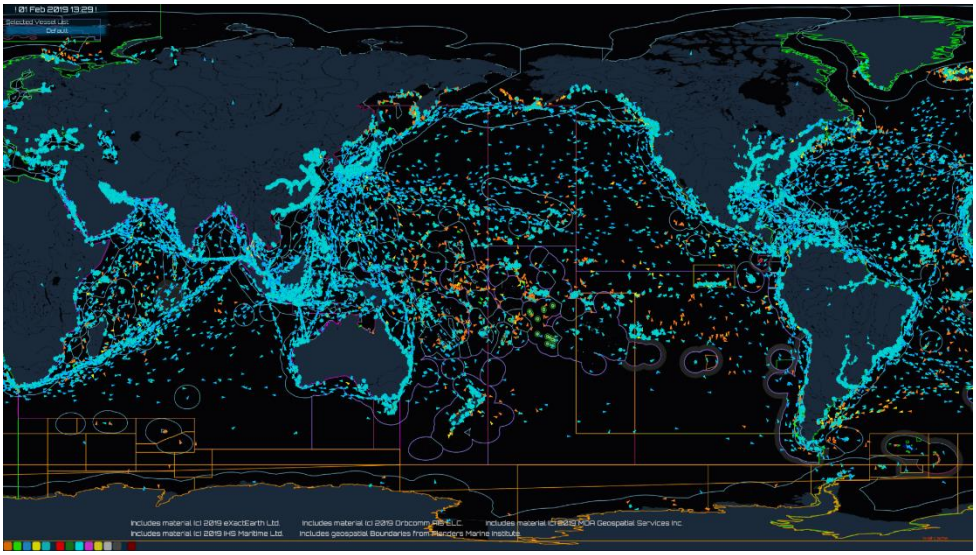
Identifying fishing activities with AI

OceanMind was founded specifically to help address this problem. Its mission is to help governments be more effective at enforcement and to help the seafood industry be more responsible with compliance, thereby improving the sustainability of fishing. The non-profit organization began as a project of the Satellite Applications Catapult, a UK government-funded research and development organization designed to help grow the UK economy through the application of satellite technologies. The Catapult, together with Pew Charitable Trusts, invested in developing a system to gather satellite data for analyzing the behavior of fishing vessels, to help curb illegal fishing.

> Data on a vessel's movement can determine the type of fishing it's doing, and the time and positioning helps indicate whether it should be investigated.

Different types of commercial fishing—such as long-lining, purse seining, and trawling—have observable characteristic movements based upon their methods, and factors such as location, duration, and time of day can all indicate what's likely being caught. Data from satellites, from photo images to radar, automated tracking signals, and even ship lights can be used to determine a vessel's movement behavior. Running that data through an artificial intelligence algorithm then determines the type of fishing, and the time and positioning helps indicate whether it should be considered for investigation. The data can also be correlated to databases of registered vessels, which can pick out "dark targets", vessels lacking transponders that aren't readily identifiable and may be worth checking by sending out a patrol vessel.

Satellite imagery and movement behavior data can also identify when a fishing vessel meets up with a cargo carrier to transfer its catch, allowing the fishing vessel to continue working while the catch is brought in to market. This practice, called transshipment, is both legal and efficient for the industry, but does also provide an opportunity for illegal fishers to launder their catch. The carrier vessels are also sometimes involved in using slave labor, another reason they are targets of interest for monitoring and enforcement checks.



The OceanMind system visualizing vessel tracking data

OceanMind doesn't make legality determinations itself or engage in enforcement activities. Rather, through its data analysis work, it produces insights and reports that it provides to fishing authorities who have the expertise and responsibility to enforce the law. The authorities can use that information to determine what needs investigation. OceanMind also works with seafood buyers, helping them to make more responsible buying decisions by understanding the risks of illegal catches and the benefits of buying from the fishers following the regulations. That in turn creates economic incentives for fishers to operate within the law.

Processing satellite data on ocean vessels in the cloud

OceanMind's work would be impossible without modern computing resources, including AI and machine learning. With hundreds of thousands of vessels involved in any one type of fishing, across wide areas involving many different jurisdictions and thousands of regulations, monitoring couldn't be managed by humans alone. They'd never have enough time and informed analysts to manage at this scale.

Issues of scale and time also apply to the computing resources. Up to now, OceanMind has done its data analytics in an on-premises system, but that is limited in the scope and scale of data it can process. Running an analysis for a particular location requires an overnight batch process, and the system could never handle all the

data for fishing fleets worldwide all at once. To reach for real-time global monitoring, OceanMind is moving its database and data analytics to Microsoft Azure cloud computing, thanks to a Microsoft AI for Earth grant.

As part of this migration, OceanMind will redesign its solution to take full advantage of the machine learning capabilities in Azure. This redesign should enable OceanMind to analyze more data in real time, faster and more accurately—as well as cost-effectively. The goal is to deliver insights to any government anywhere, in real time, telling them of potentially illegal fishing in their waters. And that will clearly make a big difference to fighting illegal fishing.

Going forward

OceanMind will also work with AI for Earth to share their trained models of fishing behavior on the AI for Earth APIs and Applications site, to empower third parties to analyze their own data and understand vessel behavior. OceanMind is developing an API shared through Azure that will take an array of vessel positions and provide predictions on the type of behavior. Trial access to the API will be free and available upon approved request, though OceanMind will retain the rights to charge for higher usage.

About OceanMind

OceanMind began in 2014 as "Project Eyes on the Seas", a collaboration between the Satellite Applications Catapult and Pew Charitable Trusts. Initially a collaboration to develop technology fusing satellite data and artificial intelligence to detect illegal, unreported, and unregulated (IUU) fishing, it soon developed into a suite of services to help governments and the seafood supply chain to understand the compliance of fishing activities. In July 2018, OceanMind launched as a new independent non-for-profit organization with the mission to empower enforcement and compliance in the world's fisheries. Working with partners such as the UK Government, the Royal Thai Government, the Seafood Task Force, the Pew Charitable Trusts, Conservation International, and Humanity United, OceanMind is supporting enforcement and MCS professionals globally, as well as helping seafood buyers build more responsible supply chains.

Resources

Websites

OceanMind home site

Press

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Documentation

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