Developing a Fishing Risk Framework from Satellites and Ocean Data

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The World Economic Forum (WEF) is a Swiss nonprofit foundation, it's mission is cited as "committed to improving the state of the world by engaging business, political, academic, and other leaders of society to shape global, regional, and industry agendas". The Forum is best known for its annual meeting at the end of January in Davos, a mountain resort in Graubünden, in the eastern Alps region of Switzerland. The meeting brings together some 2,500 top business leaders, international political leaders, economists, and journalists for up to four days to discuss the most pressing issues facing the world.

Problem background:

Illegal and overfishing are devastating our oceans. It is estimated that 70% of global fisheries are overexploited and many are now on the brink of collapse. Tuna populations, which are a critical apex predator in many marine ecosystems, have declined by over 90% in the past 40 years. Unless serious action is taken, we may be on the brink of large scale fisheries collapse, which could devastate the environment and the livelihoods of millions around the world that depend on such fisheries.

Given concern about the challenges facing our oceans, the United Nations convened a High Level Summit in June 2017 at the UN Headquarters in New York to review progress on the Ocean SDG (Goal 14). At this summit, the World Economic Forum helped convene major retailers, fishery firms, Governments and Civil Society around a Declaration to fully trace our most precarious fisheries by 2020, starting with Tuna fisheries. DSSG also made a commitment to help develop Data Science and Machine Learning Talent to support such efforts on our oceans.

In just the last 5 years, new data tracking technologies have come online, triggered by low cost satellites and sensors and rapid advances in data processing and machine learning. This has given fisheries managers powerful new resources to track fishing activity globally, and identify risky or illegal activity.

One particularly challenging problem historically had been to identify and end Illegal, Unreported and Unregulated fishing (IUU). These IUU fishing techniques include illegally extracting fish from waters of other nations, removing fish from designated Marine Protected Areas, catching fish using illegal and ecologically damaging techniques, and under-declaring

fish by transshipment at sea. Such practices are especially rife in the rich tropical waters of Southeast Asia due to the burgeoning demand in the region, and challenges of enforcement.

Objective:
Our goal is to create an Open-Source Risk Tool by combining multiple satellite data sources (including combining AIS with satellite imagery and machine learning) to help combat IUU fishing, and creating a 'DSSG Fishing Risk Score'. This data science approach to detecting IUU fishing could ultimately guide governance, inform policy making and improve enforcement. In this effort we are advised by a global network of experts. The DSSG Fishing Risk Framework, Vessel Scoring, and project results will be public, and all code will be made available as open source to contribute to the ongoing efforts of NGOs, Universities and International Organizations to end IUU fishing globally.

Approach:
We use labelled training data from fishing vessels to identify in automatic identification system (AIS) data vessels that are fishing. For each of these vessels, component features are measured such as predicted fishing in exclusive economic areas, or marine protected areas. In addition we can monitor encounters with other vessels to generate a component of transshipment, where a fishing vessel may offload its cargo to a larger refrigerated vessel. In addition to this where available we will correlate these components with visual evidence of such behaviours by satellite imagery.

Deliverable by the end of the summer:
The key deliverable from this project is an aggregated risk score per vessel that will be displayed on a graphical interface in which the user can interact with each component. The user may be for example an individual, a non-profit organisation, a government, or an enforcement agency. The user might be interested in a certain vessel, geography or vessel type, and can subset accordingly. Where available satellite imagery of the vessels will also be displayed.

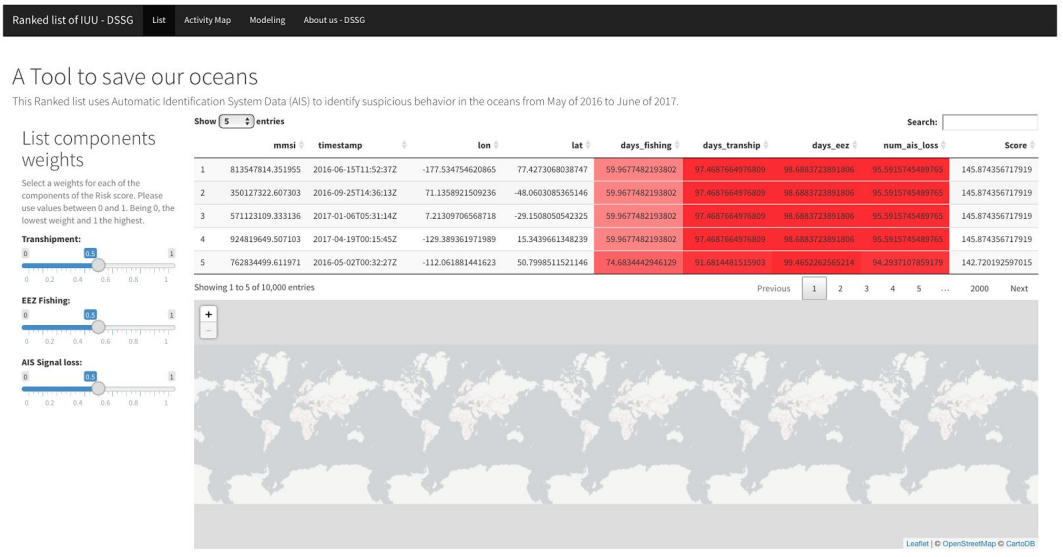

Figure: *mock-up of graphical application interface to interact with component risk score, for vessels. Red shading indicates severity of components for each vessel.*