Sustainable Commercial Fishing: Digital Inspectors to the Rescue

Johansen, Dag - Presenting author[1]; Juliussen, Bjørn Aslak - Co-author[1]; Schmidt Nordmo, Tor-Arne - Co-author[1]; Ovesen, Aril Bernhard - Co-author[1]; Halvorsen, Pål - Co-author[2]; Johansen, Håvard Dagenborg - Co-author[1]; Riegler, Michael - Co-author[2]; Rui, Jon Petter - Co-author[3]

[1]UiT The Arctic University of Norway, [2]OsloMet, [3]University of Bergen

Abstract text

A healthy ocean is core to The United Nations 2030 Agenda and their Sustainable Development Goals (SDGs). Particularly, SDG 14 is to conserve and sustainably use the oceans, seas, and marine resources. Fisheries crime is considered a global and serious problem for a healthy and sustainable development of one of mankind's important sources of food. Technological surveillance and control solutions are emerging as potential remedies to combat such criminal activities, but might also introduce unforeseen, impractical, and negative side-effects. In our inter-disciplinary research, we are investigating if and how digital technologies might contribute to a reliable, accurate, compliant, and efficient fisheries control and management regime.

Our on-going effort is to develop and evaluate algorithmic prototype systems that in the future might assist human operators monitoring and controlling remote professional fishing activities. We research fundamental components conjectured to be included in a distributed system with surveillance software running on board on fishing vessels in the Arctic Ocean, connected over satellite links with operational control centers on the mainland. We present the concepts and first prototypes of a surveillance system in lieu of current surveillance trends striking a delicate balance balance between privacy and the legitimate need to capture evidence based footage.

Our proposed novel approach is to assist human operators in the 24/7 surveillance loop of remote professional fishing activities with a privacy-preserving Artificial Intelligence (AI) surveillance system operating in the same proximity as the activities being surveyed. Consider this system as resembling an inspector on board on each fishing vessel. We are primarily investigating use of video surveillance data, but also other sensor data captured on the fishing vessels. Additionally, the system correlates with other sources such as reports from other fish catches in the approximate area and time, etc. Only upon true positive flagging of specific potentially illicit activities by the locally executing AI algorithms, can forensic evidence be accessed from this physical edge, the fishing vessel. Besides a more privacy-preserving solution, our edge-based AI system also benefits from much less data that has to be transferred over unreliable, low-bandwidth satellite-based networks.

Digital technologies properly architected might contribute to a holistic, global approach to combat fisheries crime. We are investigating and evaluating components we conjecture as key to this, which includes development and evaluation of AI analytics software, distributed systems software, communication protocols, and sensor technologies for management and control of common good resources in the Arctic Ocean.

Session

Session 1 - Pan-Arctic Infrastructure Development

Research highlight 1

It is possible to efficiently provide secure and fault-tolerant algorithmic surveillance software on weakly connected mobile edge devices (like a fishing vessel in the Arctic Ocean).

Research highlight 2

It is possible to architect such software with fundamental human rights law and ethical principles integrated.

Research highlight 3

Surveillance technologies involving human beings (fishermen) must be developed with compliance-by design and robustness-by design as guiding principles.