Integrating Machine Learning and Electronic Monitoring

A Northeast Regional Workshop Report

On January 23, 2020 the Gulf of Maine Research Institute (GMRI), with its partners CVision AI and New England Marine Monitoring, hosted an electronic monitoring (EM) workshop entitled "Incorporating Machine Learning into Northeast EM programs". The goal of the workshop was to convene EM project stakeholders, AI specialists, NOAA staff, and data specialists to focus on the potential uses of machine learning in current and future programs, identify regional priorities, and begin to discuss the pathway for incorporating AI into video analysis.

Introduction

Many fisheries stakeholders in New England are actively pursuing machine learning as a solution to prohibitive human review, data transmission, and storage costs of video analysis. Pilot projects to develop algorithms which recognize fishing activity, identify species, or create a measurement continue to grow and develop in the region. To be implemented in EM programs, each of these projects will experience a similar process of building trust in pilot algorithms and approving their use in data-collection protocols. Yet as algorithms are trained and tested against the results of human-review, we have recognized uncertainties surrounding the transition from manual analysis to machine-assisted video analysis.

These uncertainties are reflected by a series of outstanding questions, including: At what point do we trust in the results of automatic analysis? What is the preferred method to evaluate algorithm performance? What is the process for incorporating machine learning into data workflows? Which points in the video review process should be prioritized for automation? What are the performance standards an algorithm must meet to be approved and trusted by fisheries managers?

Workshop Structure

To begin to resolve uncertainties listed above, the workshop was comprised of four main sessions. These sessions (1) reviewed common machine learning tasks in video analysis and the hurdles to efficient video analysis, (2) overviewed NOAA's regional priorities for automation.and identified as a group the main priorities for moving automation forward in the region (3) characterized the opportunities and challenges presented by these priorities and (4) considered an approach to implementing and evaluating machine learning protocols.

Outcomes

Overall, 42 fisheries and EM technologies stakeholders participated in the workshop. Together, these participants identified the following priorities for implementing AI into current and future EM protocols.

1. As a region, we must clearly define what "moving forward" means, and deliberately chose which EM tasks are prioritized for automation.
2. In the near term, the most promising reduction in video analysis time and cost is through developing activity recognition (AR). Developers should focus on the progression of AR and build confidence in those models.
3. Clear algorithm performance standards must be defined. As a region, we should first document and define a baseline standard, and then determine "what is good enough" for algorithm performance.
4. We must develop a process for submitting and approving new innovations in automatic analysis or processing of EM data.
5. A clear and realistic timeline needs to be developed for implementing machine learning goals.

Considering these priorities, the workshop moved into a conversation regarding what is useful and what is possible of the implementation of AI. Participants began to address the key questions of how the region could develop metrics and standards for AI, what semi-automated or machine-assisted video review might look like, and how we begin to develop trust in automation.

Conclusions

Regionally and nationally, there has been considerable time, funding and effort invested in developing automation to date. As we look towards the future of video analysis, discussions such as these will be critical to ensuring that the predicted time and cost savings provided by automation come to fruition. This workshop was designed to encourage similar conversations in other regions and programs and to catalyze the implementation of automation in EM programs. Please visit the GMRI website at https://www.gmri.org/our-work/fishing-industry-innovation/electronic-monitoring/our-progress for workshop information and a selection of presentations. For additional information, please contact Heather Cronin at hcroinin@gmri.org