Ocean Exploration Video Challenge

NOAA Ocean Exploration Background

NOAA Ocean Exploration is dedicated to exploring the unknown ocean, unlocking its potential through scientific discovery, technological advancements, partnerships, and data delivery. We are leading national efforts to fill gaps in our basic understanding of the marine environment, providing critical ocean data, information, and awareness needed to strengthen the economy, health, and security of the United States and the world. Through live video streams, online expedition coverage, training opportunities, and other education and outreach programming, we allow scientists, resource managers, students, educators, members of the general public, and others to actively experience ocean exploration, enabling broader scientific participation, cultivating the next generation of ocean explorers, and engaging the public in exploration activities.

The data and information collected during expeditions and research supported by NOAA Ocean Exploration are publicly available, giving stakeholders the information they need to identify, understand, and manage ocean resources for today and the future.

Data collection typically includes oceanographic and geophysical parameters, video, images, and other information, provided in a range of data formats. During and after missions, the office develops a variety of data products to disseminate information about expeditions to broad audiences.

Experts of all ocean science disciplines participate in NOAA Ocean Exploration expeditions from locations across the world, annotating video from a remotely operated vehicle (ROV) in real time or via recordings. Many of the organisms seen during these expeditions are being seen in their natural habitat for the first time and may be completely new to science!

Video Challenge

Problem: On average, one hour of acquired video takes four to six hours for a human to annotate and double check for accuracy. This process typically involves classifying each organism in a video clip and drawing bounding boxes around them over time. To reduce the time required for a human to annotate ROV dive video and associated quality assurance and quality control, NOAA Ocean Exploration is interested in harnessing the power of learning/artificial intelligence to assist in video annotation.

Classify and place bounding boxes around organisms in the NOAA ship *Okeanos Explorer* remotely operated vehicle video clips provided. Identify the extent of their bounding box in X and Y for each frame in which they appear and populate the template spreadsheet with these results. Students will be judged on the accuracy of their model's classifications (organism categories) localizations (bounding boxes) when it is applied test data.

Identify the organisms in one of the following broad morphological categories and draw a bounding box for each instance:
● Annelids
● Arthropods
● Cnidarians
● Echinoderms
● Mollusca
● Porifera
● Other Invertebrates
● Vertebrates: Fishes
● Unidentified Biology

Example imagery for each of these can be obtained from the **[NOAA Ocean Exploration Animal Benthic Guide.](#)**

NOAA Ocean Exploration Challenge Video Clips
For this challenge, teams will analyze the four videos below taken from the 2022 NOAA Ocean Exploration expedition to the Mid Atlantic Ridge (EX2205).   These video segments represent about 20 minutes of the ROV video from the ~ 8 hours of the dive. The video file name includes expedition number (EX2205) and start time of the video section (YYYYMMDD-**T**-hhmmss) in UTC time. Like most programming challenges, one of the primary difficulties teams will face is deciphering what makes for the best training dataset. Teams should evaluate their programs on these videos. The test clips for judging inference performance will strongly resemble the conditions and organisms within these clips. Potential training data can be found at Fathomnet (https://fathomnet.org/fathomnet/) and Seatube v3 (https://data.oceannetworks.ca/ExpeditionManagement).

ROV descent to seafloor:

https://www.ncei.noaa.gov/data/oceans/oer/video/EX2205/Video/EX2205_DIVE01_20220720/Compressed/EX2205_VID_20220720T112000Z_ROVHD_Low.mp4

ROV arrival at seafloor:

https://www.ncei.noaa.gov/data/oceans/oer/video/EX2205/Video/EX2205_DIVE01_20220720/Compressed/EX2205_VID_20220720T113000Z_ROVHD_Low.mp4

ROV exploration of the seafloor:

https://www.ncei.noaa.gov/data/oceans/oer/video/EX2205/Video/EX2205_DIVE01_20220720/Compressed/EX2205_VID_20220720T114459Z_ROVHD_Low.mp4

https://www.ncei.noaa.gov/data/oceans/oer/video/EX2205/Video/EX2205_DIVE01_20220720/Compressed/EX2205_VID_20220720T122459Z_ROVHD_Low.mp4

Annotation Data:
https://drive.google.com/file/d/1NIDtd883MkGXyBJLit8zvO4IhKvRftDV/view?usp=sharing

See the NOAA Ocean Exploration 2022 Voyage to the Ridge expedition (EX2205) for more information and additional videos.

Registration:

Teams participating in the 2023 Ocean Exploration Video Challenge should register here: 2023 MATE/NOAA Ocean Exploration Computer Coding Challenge Registration

Submission Requirements:

Teams undertaking the Ocean Exploration Video Challenge will have 10+ weeks to create their program and deliver that program, an explanation of the program including user documentation, the resulting spreadsheet, and a video showing Level 2 working in real time to MATE ROV Competition and NOAA Ocean Exploration officials. The program, explanation, spreadsheet, and video must be submitted no later than 11:59 PM, Hawaii time, June 4, 2023. The program, spreadsheet, and video link should be submitted here: 2023 MATE/NOAA Ocean Exploration Computer Coding Challenge Submission Form

Expectations for submissions:
- The following naming convention should be used for your submissions: School or organization name_company name_ document type 2023, where document type is either the program, model, explanation, or spreadsheet.
- Students' models will be tested on a video clip with the same distribution as these example clips.

- The spreadsheet must be submitted using the following .XLS template: 2023 Ocean Exploration Video Challenge Spreadsheet Template.
- The explanation of the program should include a user guide and explanation of the user interface.
- The above videos with annotations applied (bounding boxes/labels) should be uploaded to YouTube or Vimeo and a link provided to that video.
- Code for model training must be documented and include a license/royalty free copy for use and evaluation by NOAA. Training code can be structured however contestants see fit, but should be well commented.
- Model should be submitted as either .pt, .pth, TF2.x, or HDF5. If a different model format is used, instructions will need to be provided on how to replicate the inference results.
- Students may make use of pretrained models which they fine-tune, or train their models from scratch.

Questions:
Any questions should be directed to the MATE ROV Competition Technical Manager.

Announcement of Winners - and an incredible opportunity!
The winning student teams will be announced during the 2023 MATE ROV Competition World Championship Awards Ceremony. *The top winning team will receive a travel stipend of up to $7,250 to attend and present at the 2023 MTS/IEEE OES OCEANS Conference and Exhibition taking place in Biloxi, MS, USA September 25-28 (OCEANS – Gulf Coast Conference (oceansconference.org)).* Details and travel logistics support will be provided once the winning team of students is announced at the MATE World Championship.