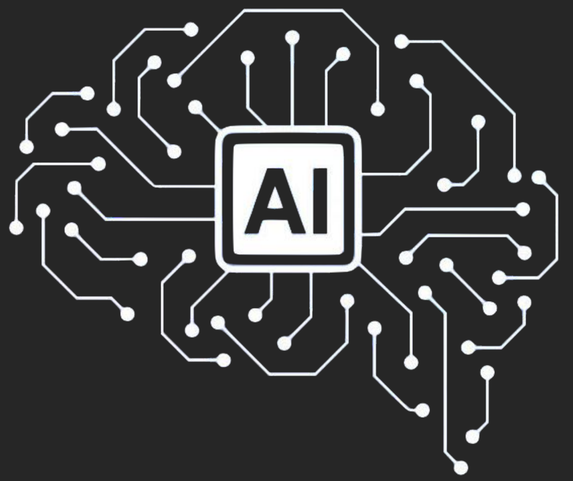
Artificial Intelligence & Machine Learning

In Deep Submergence Science



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Who is the Ocean Exploration Cooperative Institute (OECI)?

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Woods Hole Oceanographic Inst.

University of New Hampshire

University of Southern Mississippi

Ocean Exploration Trust

University of Rhode Island

What is the Ocean Exploration Cooperative Institute (OECI)?

The OECI is an integrated ocean exploration cooperative that aims to accelerate exploration through the development of new ocean technologies and operational concepts, application of new approaches to the underexplored regions of the US EEZ and ocean exploration data, and training of the next generation of ocean explorers.

oeci.org

FY22 Activities

- Shore2Abyss
- Saildrone Surveyor in Aleutians
- Cloud-based bathymetric data processing
- Bridge to Ocean Exploration (CC internships)
- Tuskegee University Internships

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- Automated Video Processing by ML
- Orpheus AUV development
- Gaussian bathymetric data processing
- Deepwater ASV sonar development
- Data management
- Advanced ML/AI data environment (BERACOUDA)
- Inner Space Center Education

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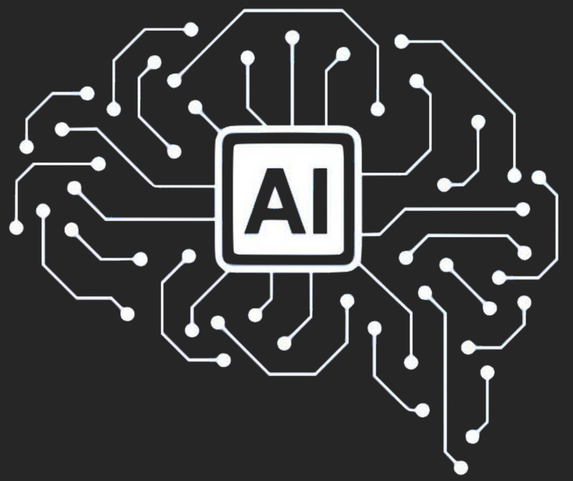

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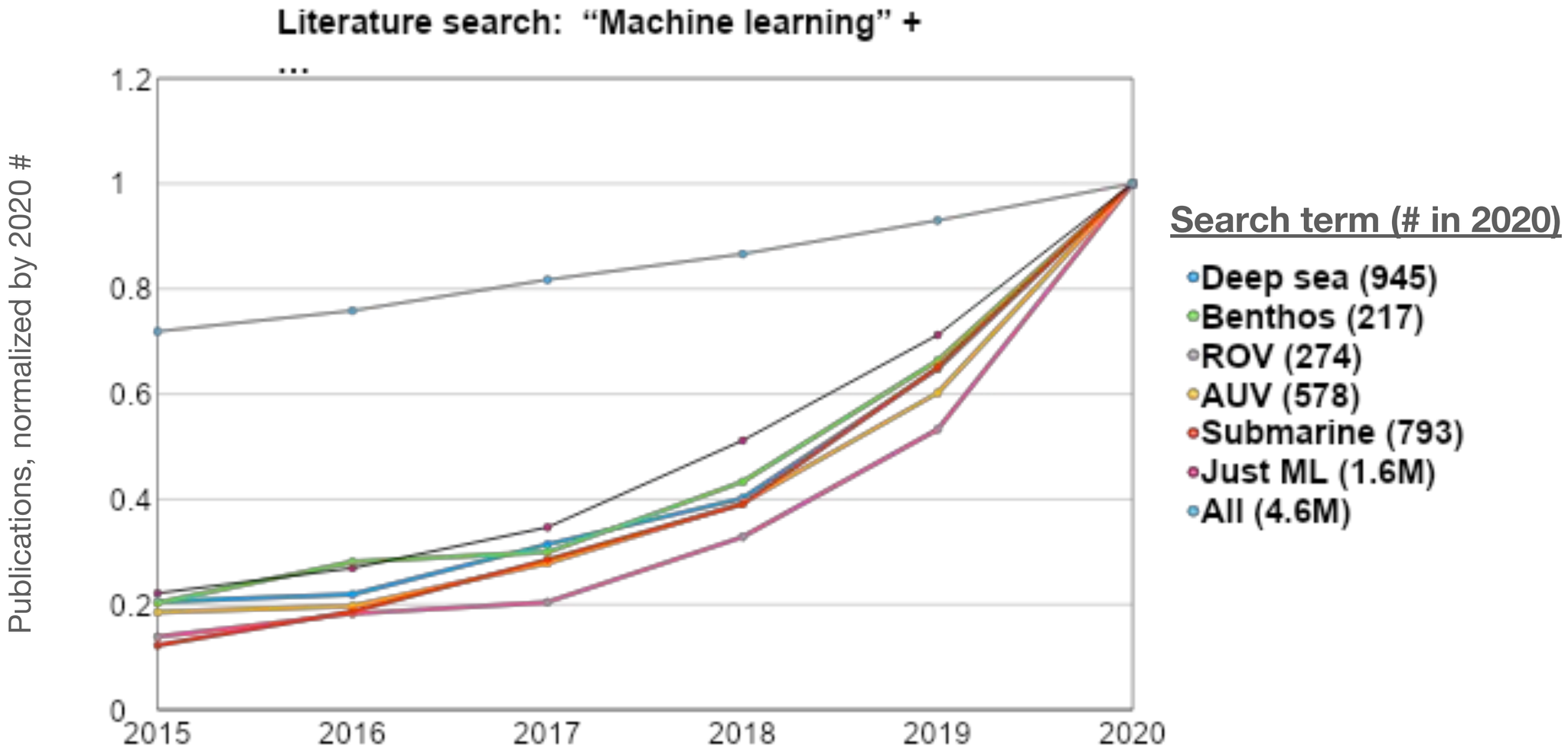
3 D’s of Robotics

Dull, Dirty, Dangerous

3 D’s of Machine Learning*

Data, Decisions, Discovery

** I pretty much made these up*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Publications, normalized by 2020 #
1.2
1
0.8
0.6
0.4
0.2
0
2015
2016
2017
2018
2019
2020
Search term (# in 2020)
Deep sea (945)
Benthos (217)
ROV (274)
AUV (578)
Submarine (793)
Just ML (1.6M)
All (4.6M)

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Environmental predictors of deep-sea polymetallic nodule occurrence in the global ocean

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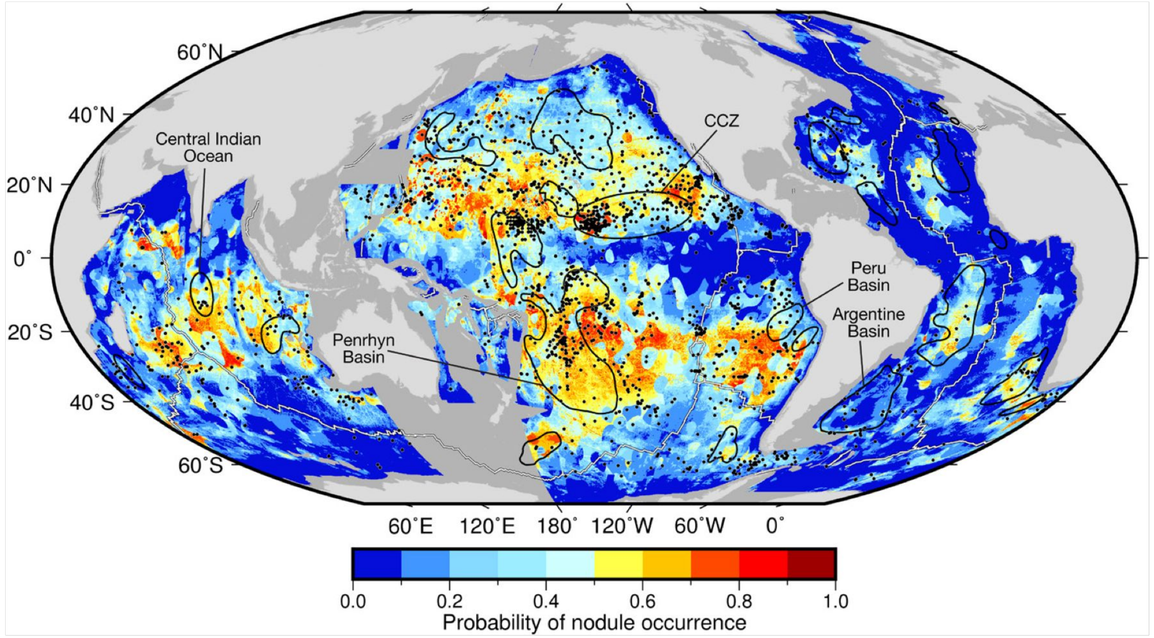
[1]EarthByte Group, School of Geosciences, The University of Sydney, Sydney, New South Wales 2006, Australia
[2]Sydney Informatics Hub, The University of Sydney, Sydney, New South Wales 2006, Australia



sensors

MDPI

Article

Video Image Enhancement and Machine Learning Pipeline for Underwater Animal Detection and Classification at Cabled Observatories

Vanesa Lopez-Vazquez [1,*], Jose Manuel Lopez-Guede [2], Simone Marini [3,4], Emanuela Fanelli [4,5], Espen Johnsen [6] and Jacopo Aguzzi [4,7]

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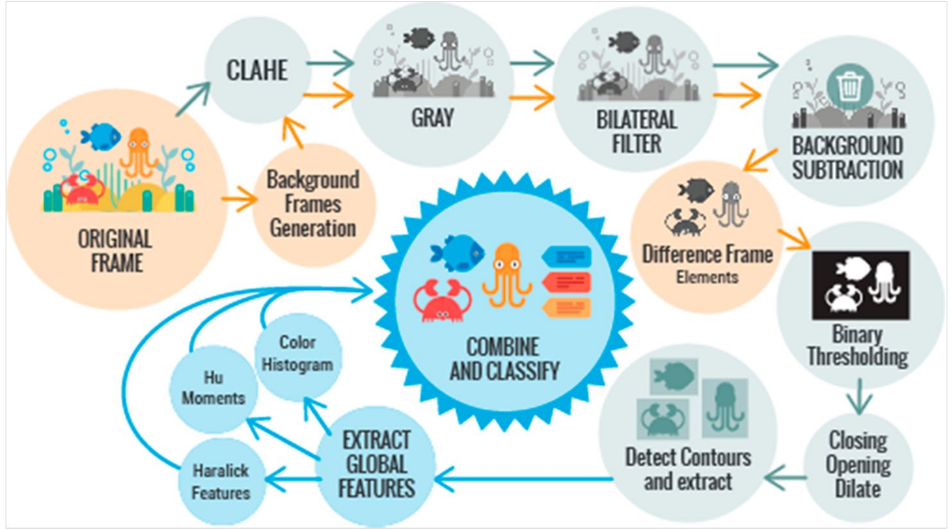

Figure 3. Image processing pipeline.

Visual tracking of deepwater animals using machine learning-controlled robotic underwater vehicles

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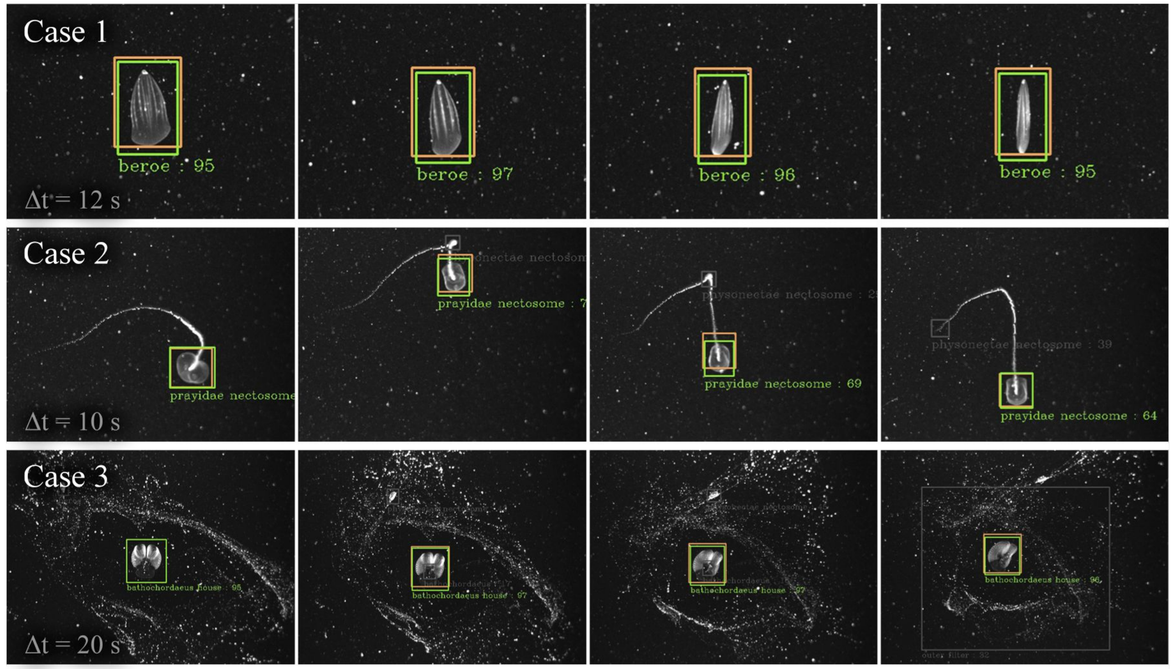


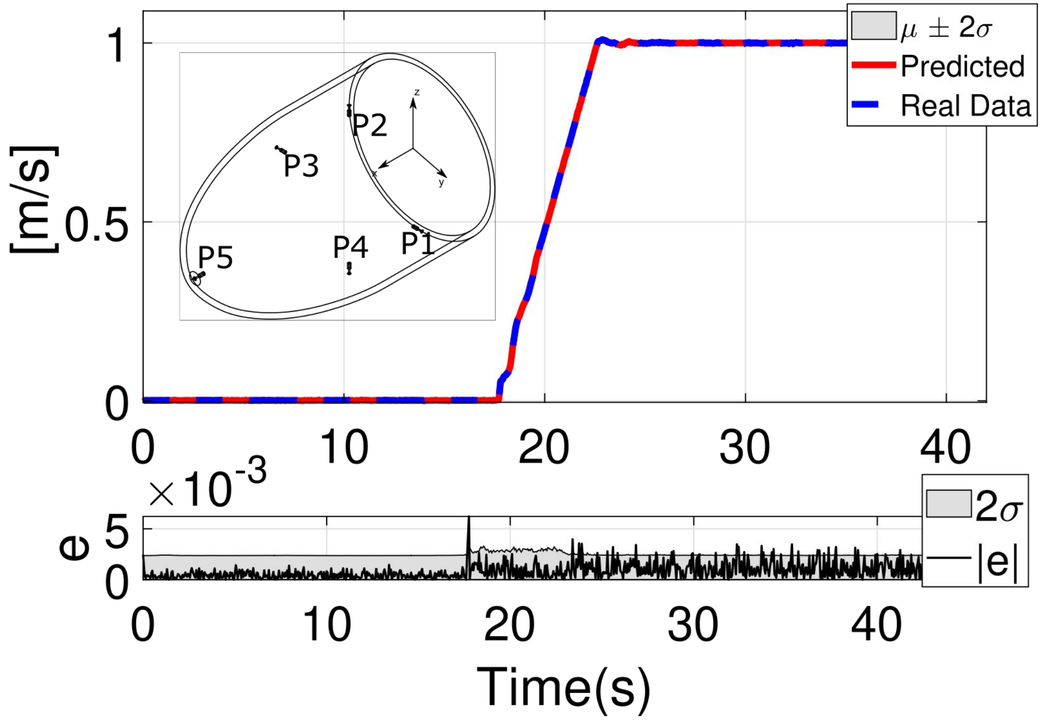
Contents lists available at ScienceDirect

Ocean Engineering

journal homepage: www.elsevier.com/locate/oceaneng

Machine learning post processing of underwater vehicle pressure sensor array for speed measurement

Wilmer Ariza Ramirez *, Zhi Quan Leong, Hung Duc Nguyen, Shantha Gamini Jayasinghe
Australian Maritime College, University of Tasmania, Newnham TAS 7248, Australia



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EXPLORING THE NATION'S BLUE FRONTIER

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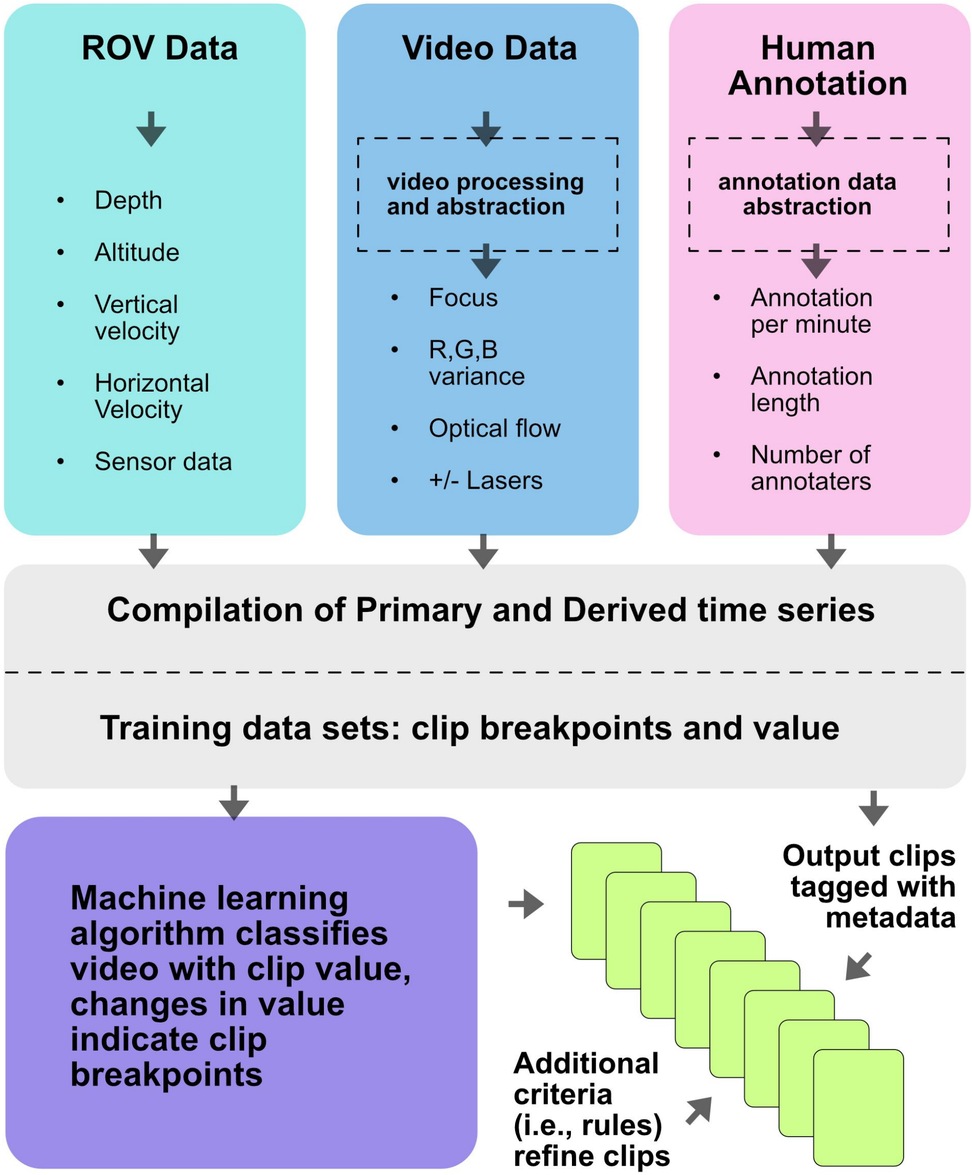
Machine Learning Automated Video Processing

A. Soule, Y. Shen, M. Wei - URI-GSO

A large portion of the subsea video collected is only of use to a small subset of researchers, whereas a small portion is of high demand. Separating subsea video into clips is either done at arbitrary time intervals (e.g., 5 min) or by significant effort.

We propose a machine-learning algorithm to autonomously break video into clips based on ROV data, derived video data, and human annotation and trained, in part, by existing 'highlight' selections.



NSF-wide

National Artificial Intelligence (AI) Research Institutes N

Important Notice – Change in individual eligibility restrictions

Both the FAQ and the script from the September 21 Webinar have been revised to reflect a change in restrictions for individuals holding active relationships with partner companies. Eligibility restrictions are limited to the themes associated with those partners. Please consult the FAQ for full details.

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NSF 21-022

Dear Colleague Letter: Research Coordination and Planning Opportunities for the Directorate for Geosciences (GEO) in Artificial Intelligence (AI)

November 19, 2020

Dear Colleagues:

The National Science Foundation's (NSF) Directorate for Geosciences (GEO) encourages the submission of proposals for workshops, Research Coordination Networks (RCN), and other planning activities, including Early-concept Grants for Exploratory Research (EAGER) proposals, in Geosciences-themed research in Artificial Intelligence (AI). (Workshops associated with this DCL are identified as Conference proposals in the *NSF Proposal & Award Policies & Procedures Guide <https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf20001>* (PAPPG) and will hereafter be referred to as conferences.) Recent ground-breaking advances in AI have been enabled by increased computing power, algorithmic improvements in machine-learning, and the availability of large data sets. Synergies between research frontiers in AI and the Geosciences have the potential to stimulate further transformative progress in both fields.

Suggestion

- Deep submergence is data rich and heavily invested in autonomy so has tremendous opportunities to benefit from ML/AI both for science and operations.

- ML/AI activities are developed and developing, but coordination is limited and necessary to enhance broad application of these techniques.

- DeSSC or an interested set of community members could evaluate current ML/AI efforts, coordination in other fields, and contribute to an ocean-based ML/AI workshop (cf. NSF DCL).