

WHO

**SYSCOM:** NAVSEA

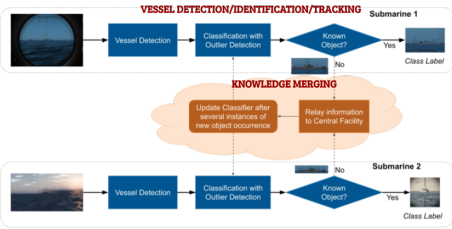
**Sponsoring Program:** PEO IWS 5.0

**Transition Target:** Integrated Submarine Imaging System (ISIS), AN/BVY-1

**TPOC:** (760) 939-1440

**Other Transition Opportunities:** Department of Defense (DoD) agencies, prime contractors and private commercial entities.

**Notes:** The proposed solution has algorithms that are applicable to a large number of machine learning and/or computer vision tasks that are of interest to the defense customers.



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WHAT

**Operational Need and Improvement:** As machine learning (ML) and artificial intelligence (AI) become more prevalent in deployed systems, an approach will be needed to update systems with knowledge learned from past missions, sharing knowledge and data across platforms and systems. Innovation is needed to develop effective ML algorithms to process complex video data, as in the case of submarine periscope imagery. From the program office perspective, this is a want to allow learning regarding periscope images on individual submarines so that the data can be shared with other submarines and with periscope imagery software developers, and represents a new capability.

**Specifications Required:** Develop ML-based methods to process periscope imagery for timely vessel detection, identification and re-acquisition. Develop update strategies to combine the knowledge learned across the fleet for improved decision making.

**Technology Developed:** Mayachitra has developed technology to automatically detect and recognize objects of potential interest from both ground-level and overhead video imagery which provides object recognition decisions with a high level of confidence. Mayachitra's technology employs state-of-art deep learning and computer vision methods to efficiently and effectively detect such objects, and uses transfer learning-based strategies to address different data modalities such as periscope imagery. In addition, the update strategies are also developed to collaboratively combine the knowledge learned from the different ML models for a distributed learning environment. The software system integrates a suite of support modules that addresses the concerns of catastrophic forgetting and annotator noise, and shows how continual learning can be used across multiple distributed systems.

**Warfighter Value:** The development of a robust reasoning AI system that handles periscope imagery decreases the overall workload of intelligence officers and their staff looking at such complex data for situational awareness and improved decision making.

WHEN

**Contract Number:** N68335-22-C-0090

**Ending on:** Nov 09, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Accurate vessel detection	Low	Low rate of false positives (precision > 90%)	7	1st QTR FY24
Accurate vessel class(es) identification using continual learning	Medium	Low rate of missed identifications (recall > 90%)	6	1st QTR FY24
Timely vessel detection, identification, tracking and re-identification	Medium	Low latency of vessel detection, identification and re-acquisition (real-time processing: 30-60 fps)	7	1st QTR FY24

HOW

**Projected Business Model:** Mayachitra, Inc. is initially focused on the Department of Defense (DoD) U.S. Navy, and other related markets to support technology transfer through sales, support contracts, and licensing agreements. Transitioning the technology is part of the growth strategy and is intended to lead the market in AI/ML technologies.

**Company Objectives:** Mayachitra's proposed technology uses ML-based methods to process complex image/video data such as periscope imagery for timely vessel detection, identification and re-acquisition. In addition, the model update strategies are also designed to combine the knowledge learned across the fleet for improved decision-making. Currently, no alternative (both ML and non-ML) solutions exist for processing complex periscope imagery and for knowledge update strategies. Mayachitra's proposed solution decreases the overall workload of an analyst looking at such data for situational awareness and decision making. Mayachitra's primary objective is to connect its technology with interested PMAs, NAVSEA Labs, Research Facilities and Ranges to mature capabilities under technology insertion initiatives, adapt the capability to meet the needs of the greater Undersea Warfare (USW) community, and deploy the capability through Navy program of record to support theater operations.

**Potential Commercial Applications:** The technology would be useful for the United States Coast Guard (USCG), Department of Homeland Security (DHS), Department of Energy (DOE), and other federal agencies for which automation in regards to learning information about the vehicles/objects of interest is important. Commercial security entities could likewise benefit from the automated processing of complex data. Federal, state and commercial rescue organizations could also benefit from the ability to learn and track objects. All organizations, for which merging knowledge from different ML models is valuable, could potentially benefit from this technology.

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